### SCHEME OF TEACHING AND EXAMINATION (2015-2016)

<table>
<thead>
<tr>
<th>Paper</th>
<th>Subject</th>
<th>Teaching Hours per Week</th>
<th>End Term</th>
<th>Mid Term</th>
<th>Total Marks</th>
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<tr>
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<tr>
<td>FT 501</td>
<td>Numerical Methods in Engineering</td>
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<tr>
<td>FT 502</td>
<td>Processing of Fruits &amp; Vegetables</td>
<td>3</td>
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<tr>
<td>FT 503</td>
<td>Processing of Milk &amp; Milk Products</td>
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<td>Mass Transfer-I</td>
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<td>Processing of Oil Seeds, Oils and Fats</td>
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<td>Engineering Thermodynamics</td>
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**Practicals**

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**Total**

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**SCHEME OF TEACHING AND EXAMINATIONS (2015-2016)**

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<td>Mass Transfer Lab.</td>
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<td>Process Plant Design-II</td>
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<td>FT 653</td>
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<tr>
<td>FT 754</td>
<td>*Industrial Training</td>
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**Total**  
15  3  9  24  230  370  600

*There will be 6-8 weeks’ compulsory industrial training after 6th semester theory examination during summer vacation. Every student will submit the Industrial Training report within one month from the start of teaching of the 7th Semester. After that it will be evaluated by the team of Training & Placement Officers.*
<table>
<thead>
<tr>
<th>Paper</th>
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<td>FT 701</td>
<td>Food Regulation &amp; Quality Control</td>
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<td>Process Engineering Economics</td>
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Practicals

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<th>Subject</th>
<th>Teaching Hours per Week</th>
<th>End Term</th>
<th>Mid Term</th>
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<tr>
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<tr>
<td>FT 851</td>
<td>Project Work</td>
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## SCHEME OF TEACHING AND EXAMINATION (2015-2016)

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<td>FT 803</td>
<td>Processing of Meat, Fish &amp; Poultry</td>
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<tr>
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<td>Process Modeling &amp; Simulation Lab.</td>
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All independent/self study courses shall be graded in terms of ‘S’ (Satisfactory) or ‘X’ (Repeat).

**Requirement for the award of B.E. (Food Technology) is of 200 credits.**
SYLLABUS FOR
BACHELOR OF ENGINEERING (FOOD TECHNOLOGY)
FOURTH SEMESTER

Paper Title: MATHEMATICS-III (Theory)
Paper Code : FT 401      Max. Marks: 50  Credits : 4      Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of
8 questions. 4 questions from section A and 4 questions from section B are to be set. The students
will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Solution of differential equations in series with reference to Bessel and Legendre equations, elementary
properties of Bessel and Legendre functions.
Solution of difference equation with constant coefficients.
Formation and classification of partial differential equations, first order linear equations, standard forms
of non linear equations, Charpit’s method, homogeneous linear equations with constant coefficients.
Solution of partial differential equations of engineering interest by method of separation of variables.

SECTION-B

Laplace transform: Definition, Transforms of Elementary functions, Properties of Transforms, Inverse
Transforms, Transform of Derivative Unit. Unit Step Function, Dirac Delta Function & Unit Impulse
function. Period Functions, Application of Transform to the solution of ordinary Differential equations.
Function of complex variable, analytic functions, Cauchy’s theorem, Cauchy’s integral formula,
introduction to Tayler’s series and Laurent’s series, Residues, theorem and its simple applications.

Books Recommended:


Paper Title: FOOD MICROBIOLOGY (Theory)
Paper Code : FT 402      Max. Marks: 50  Credits : 4      Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of
8 questions. 4 questions from section A and 4 questions from section B are to be set. The students
will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Contamination of foods by microorganisms from natural sources, spoilage of different foods:
general principles, causes and spoilage and growth of microorganisms in foods.
Preservation of foods by different preservation methods, contamination, preservation and spoilage of different food products. Food poisoning and food infections – investigation of food borne disease outbreak.
Microbiology of individual food products - Dairy products, bread.

SECTION-B

Food from microbes: Fermented foods.
Microbial flavour – fragrances.
Food Allergies. Antimicrobial agents used in foods.
Rapid methods for microbiological analysis of foods.
Food processing plant, hygiene and sanitation: Importance of hygiene and sanitation.
Chemicals and methods used in sanitation of plant and equipments.

Books Recommended:
2. Stain  : General Microbiology.
5. Casida : Industrial Microbiology, John Wiley.

Paper Title: HEAT TRANSFER (Theory)
Paper Code: FT 403 Max. Marks: 50 Credits : 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Conduction: Steady state conduction in one dimensional system, general conduction equation, effect of variable thermal conductivity, steady state conduction involving internal heat generation, lagging on pipes, the critical thickness of insulation on pipes, extended surfaces of uniform thickness and fin effectiveness, fin efficiency.

Convection: Free and forced convection, concept of heat transfer co-efficient, dimensionless numbers in free and forced convection, Dimensional analysis, Determination of Heat transfer coefficient using heat and momentum transfer analogies, experimental determination of heat transfer coefficient and common working correlations.

Radiation Heat Transfer: Black Body radiation, and grey body radiation, physical mechanism, radiation properties and shape factor, heat exchange between non-black bodies, radiation shields pyrometry and effect of radiation on temperature measurement.

SECTION-B

Condensation and Boiling: Condensation heat transfer phenomenon, film condensation on vertical plates and cylinders as well as on horizontal cylinders. Effects of non-condensable gases and vapor velocity on condensation, pool boiling, forced convection boiling, working correlations for pool boiling.
Evaporation: Types of Evaporators, single and multiple effects, single and multiple effects calculations, evaporator capacity, economy, effect of liquid head and boiling point elevation, methods of feeding.

Heat Exchangers: Various types of heat exchangers, overall heat transfer coefficients, heat exchanger mean temperature differences, heat exchanger effectiveness and the number of transfer units.

Books Recommended:

Paper Title: PROCESSING OF CEREALS & PULSES (Theory)
Paper Code : FT 404 Max. Marks: 50 Credits : 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Composition, structure and quality, characteristics of cereal grains and pulses.

SECTION-B
Corn Milling: Dry and wet milling of corn, corn based ready to eat breakfast cereals. Corn oil-processing and utilization, Corn starch modification and uses, Corn sweeteners such as glucose syrup, high fructose corn syrups, dextrose, maltodextrin.

Books Recommended:
2. Pomeranz, Y. : Wheat Chemistry and Technology, CHIPS Book, USA.
3. Tanley A. Watson & Paul E. Ramstad : Corn Chemistry and Technology, ADCC, USA.
4. Julliano, B.O. : Rice Chemistry and Technology, AACC, USA.
Paper Title: **FUNDAMENTALS OF ELECTRICAL & ELECTRONICS ENGINEERING (Theory)**

Paper Code: FT 405  Max. Marks 50  Credits : 4  Time: 3 hours

Course Duration: 45 Lectures of one hour each.

Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

### SECTION-A

**DC Circuits and Single Phase A.C. Fundamentals:** General introduction to Electrical Engineering, Kirchoff’s Laws, Mesh and Node analysis, Superposition theorem, Thevenin Theorem, Norton Theorem, Maximum power transfer theorem. Generation of alternating voltages and currents, Equations for AC quantities, cycle, time period, frequency, amplitude, calculation of R.M.S values, Average values for different waveforms, solution and phasor diagram of single phase AC circuit with sinusoidal source of excitation, series and parallel combination of R-L-C circuits.

**Three Phase AC Fundamentals:** Disadvantages of single phase system, star and delta connection in three phase circuits, relation between line and phasor quantities, power in three phase system, solution of three phase balanced circuits, power and power factor measurement by two wattmeter method.

**Electrical Machines:** Introduction to magnetic circuits, Basic principle and construction of transformers, E.M.F equation, approximate equivalent circuit, phasor diagram, losses, efficiency and condition for maximum efficiency, open circuit and short circuit test on single phase transformers. Operating principle and construction of three phase induction motors, production of rotating field, concept of slip, frequency etc. Operating principle and construction of DC generators, types of DC Generators, E.M.F equations, Principle of DC Motors and their applications.

### SECTION-B

**Semiconductor Diodes and Transistors:** General introduction to Electronics. Concept of stiff Voltage and Current Source. PN Junction, Depletion layer, Barrier Potential, Forward and Reverse Bias, Breakdown voltage, V-I characteristics, Half wave and full wave rectifiers, Zener
diode. Introduction to junction transistors, Transistor amplifying action, CB, CE, CC-configuration characteristics.

**Operational Amplifiers:** Block Diagram, characteristics of an ideal OP-AMP, Application of OP-AMP as an Inverting amplifier, Non-Inverting Amplifier, Adder, Differential, Integrating amplifier.

**Digital Electronics:** Binary and Hexadecimal number system, conversion of numbers from one system to other, OR, AND, NOR, NAND, NOT Gates, Universal Gates, Exclusive OR, NOR gates, De-Morgan's Theorem, Boolean Relations: Commutative, Associative and Distributive Laws. Concept of flip-flops, RS,JK flip flops, shift register.

**Books Recommended:**


**Paper Title : PARTICLES MECHANICS LAB. (Practical)**

**Paper Code FT 451**

Max. Marks : 50

Credits : 2

1. Pressure drop and two phase flow characteristics in packed and fluidized beds.
4. Constant pressure filtration.
5. Mixing, crushing, grinding, screening and particle size analysis.

**Paper Title:** FOOD MICROBIOLOGY LAB. (Practical)

**Paper Code FT 452**  
Max. Marks : 50  
Credits : 2

- Bacteriological examination of foods: General protocol taking the examples of different foods.
- Presumptive coliform test of milk, butter, cream, ice-cream and dahi.
- Standard plate count for pasteurized milk and ice-cream.
- Yeast and mold count for butter, dahi and bread.
- To assess bacteriological quality of milk by methylene blue reduction test and resazurin reduction test.

**Paper Title:** CEREALS & PULSES PROCESSING LAB. (Practical)

**Paper Code FT 453**  
Max. Marks : 50  
Credits : 2

(PRACTICALS)

- Milling of wheat.
- Evaluation of properties of wheat and milled products - Physical, chemical and rheological.
- Baking of bread, biscuit, cake, pastries.
- Evaluation of baked bread.
- Evaluation of properties of rice (physical and chemical).
- Cooking quality of rice.
- Experiment on parboiling, evaluation of quality.
- Milling of rice, assessment of degree of polishing.
- Milling of pulses.
- Visit to flour mill, rice mill and pulse mill industries.

**Paper Title:** ELECTRICAL & ELECTRONICS ENGINEERING LAB. (Practical)

**Paper Code FT 454**  
Max. Marks : 50  
Credits : 2

1. Overview of the equipments, instruments and procedure to be used, safety precautions and report writing.
2. To study resonance in R-L-C series and parallel circuit.
3. Measurement of power and power factor by three voltmeter method.
4. Measurement of power and power factor by three ammeter method.
5. To measure power and power factor using a single wattmeter in a single phase circuit.
6. Measurement of power and power factor of three phase balanced load by two wattmeter method.
7. To perform open circuit test and short circuit test on a single phase transformer and draw equivalent circuit.
8. To obtain magnetization characteristics of DC Machine.
9. Study the forward and reverse biased diode characteristics.
10. Study the CB, CE, CC transistor characteristics.
11. To obtain the waveforms of half wave rectifier circuit on CRO.
12. To obtain the waveforms of full wave rectifier circuit on CRO.
13. To study the OP-AMP as an Inverting amplifier, Phase Shifter, Integrator, Differentiator.
14. Verification of basic and universal gates.

**Paper Title:** COMPREHENSIVE VIVA-VOCE-I (Practical)

**Paper Code FT 455**  
Max. Marks : 50  
Credits : 2
The viva-voce examination will be comprehensive and covering mainly subjects covered during
the first four semesters.

**Paper Title:** BASIC WORKSHOP TECHNIQUES (PRACTICALS)
**Paper Code:** FT 456  Qualifying  Credits : NC

*Carpentry Shop:* Introduction to various types of timber and particle, boards defects in timber, seasoning of wood. Description and use of carpenter’s tools, i.e. saws, planes, chisels, adze, etc. Different types of timber in common use, making of lap joint, Bridle joint, dovetail joint and Mitre joint.

*Electric Tools:* Exercise of wiring in link clip and casting and causing wiring of lights with switches in parallels, series and with 2 ways switches. Connecting energy meter, main switch and distribution board, testing a wiring installation for insulation resistance. Relevant Indian Electricity Rules.

*Machine Shop:* Classification of fabrication processes, machine tools and materials, introduction to working of lathe, shapper, milling and drilling machines, power hacksaw, shearing machine and grinding wheel. Simple turning, threading, drilling board and knurling operations on a lathe.

*Welding:* Use of arc welding and gas welding in making different types of joints.
SYLLABUS FOR
BACHELOR OF ENGINEERING (FOOD TECHNOLOGY)
FIFTH SEMESTER

Paper Title: NUMERICAL METHODS IN ENGINEERING
Paper Code : FT 501  Max. Marks 50  Credits : 4  Time: 3 hours

Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

SECTION-B
Numerical Solution of Partial Differential Equations: Finite-Difference Approximation to Laplace’s Equation, Parabolic Equations and Hyperbolic Equations

Books Recommended:

Paper Title: PROCESSING OF FRUITS & VEGETABLES (Theory)
Paper Code : FT 502  Max. Marks: 40  Credits : 3  Time: 3 hours

Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Physiology of ripening. Effect of physical and chemical treatments on post harvest life of fruits and vegetables. Role of plant growth regulators in post harvest storage. Storage and handling of fresh fruits and vegetables. Preservation of fruits and vegetables by heat treatment, Canning Processing and preservation of fruits and vegetable juices. Preparation of jams, jelly, marmalade, preserves, pickles and vegetable products.

**SECTION-B**
Design of cleaning, cutting, blanching, and thermal processing equipments. Plant layout.

Books Recommended:
3. Luh & Woodroof : Commercial Vegetable Processing, AVI Publishing, USA.
4. Woodroof & Luh : Commercial Fruit Processing, AVI Publishing, USA

Paper Title: PROCESSING OF MILK & MILK PRODUCTS (Theory)
Paper Code : FT 503  Max. Marks: 50  Credits : 4  Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Chemical composition, nutritive value and physical characteristics of milk and milk products.
Production, processing, distribution and storage of liquid milk.
Technology of manufacture of cream, butter, ghee and ice-cream.
Technology of manufacture of evaporated milk and condensed milk.
Technology of manufacture of cheese and other fermented milk products.

SECTION-B
Fortification of milk products with nutrients, quality standards.
Production of infant milk food.
Utilization of dairy byproducts such as whey, butter-milk etc.
Quality control in milk and milk products including various analytical techniques of determination of milk quality. Milk plant hygiene, sanitation
Design of storage tank, pasteurizer, cream separator, milk evaporator, ice-cream mixer and freezer. Plant layout.

Books Recommended:
1. De, S. : Outlines of Dairy Technology, OUP, India..
3. Eckles : Chemistry & Technology of Milk, CBS Publisher, India.
Paper Title: **MASS TRANSFER-I** (Theory)  
**Paper Code:** FT 504  
**Max. Marks:** 50  
**Credits:** 4  
**Time:** 3 hours  
**Course Duration:** 45 Lectures of one hour each.  

Note for the Paper setter: The question paper should be divided into Section A and Section B. Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.  

**SECTION-A**  
Mass transfer operations, classification of mass transfer operations, choice of separation methods, methods of conducting mass transfer operations, design principles.  
Introduction to mass transfer and diffusion, molecular diffusion in gases and liquids, diffusion coefficients for gases and liquids, diffusion in solids, types of solid diffusion.  
Mass transfer coefficients, types of mass transfer coefficients, mass transfer coefficients in laminar flow, theories of mass transfer.  
Interphase mass transfer, concept of overall mass transfer coefficient.  

**SECTION-B**  
Working principle, construction and industrial applications of various gas liquid contacting equipments like sparged vessels, mechanically agitated vessels, tray towers, packed towers, spray chambers, venturi scrubbers.  
Humidification operations, psychrometric chart, adiabatic saturation temperatures, wet bulb temperature, adiabatic operations, types of cooling towers.  
Principle of drying, batch drying, drying curve, constructional details and working of different dryers.  

**Books Recommended:**  

Paper Title: **PROCESSING OF OIL SEEDS, OILS & FATS** (Theory)  
**Paper Code:** FT 505  
**Max. Marks:** 50  
**Credits:** 4  
**Time:** 3 hours  
**Course Duration:** 45 Lectures of one hour each.  

Note for the Paper setter: The question paper should be divided into Section A and Section B. Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.  

**SECTION-A**  
Oil milling methods: Ghani, mechanical expeller, hydraulic press, solvent extraction. Refining of edible oils & fats.
SECTION-B

Books Recommended:
1. Bailey : Fats and Oil, Wiley, USA.

Paper Title: ENGINEERING THERMODYNAMICS (Theory)
Paper Code : FT 605 Max. Marks: 50 Credits : 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.

Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A


SECTION-B
Phase Equilibria:
Partial molar properties, partial molar Gibbs free energy, Chemical potential and its dependence on temperature and pressure Ideal solutions (Lewis-Randel Rule).
Fugacity and its calculations. Dependence of fugacity of temperatures and pressure

Chemical Equilibria:
Equilibrium constant in terms of measurable properties variations of equilibrium constant with temperature and pressure.
Adiabatic reactions, Gibbs phase rule, equilibria in heterogeneous reactions.
Books Recommended:


Paper Title : PROCESS PLANT DESIGN -I (Practical)
Paper Code FT 551 Max. Marks : 50 Credits : 2

2. Selection, specification & power requirements of process pumps, fans and blowers.
3. Design of settling equipment like Dor thickeners, dust chambers, cyclone separator & centrifuges.
4. Design of agitated vessels using various types of impellers.
5. Design of conveyor system for solids.

Books Recommended:


Paper Title : FRUITS & VEGETABLES PROCESSING LAB (Practical)
Paper Code FT 552 Max. Marks : 50 Credits : 2

1. Blanching of fruits and vegetables: Effect of temperature, time and selected compounds on blanching.
3. Preparation of jam, marmalade preserve, candy.
4. Preparation of fruit juice concentrate and powder.
5. Preparation of tomato products.
6. Preparation of pickles, chutneys, sauces.
7. Drying of fruits & vegetables.
8. Freezing of fruits & vegetables.
10. Can seaming operation and canning of fruits and vegetables.
11. Visit to a fruit and vegetable processing plant.
Paper Title: MILK & MILK PRODUCTS PROCESSING LAB (Practical)
Paper Code FT 553      Max. Marks : 50      Credits : 2

1. Physical and chemical analysis of milk & milk products.
2. Testing the adulteration in milk & milk products.
3. Preparation of cream, butter, ghee, ice-cream, milk powder and condensed milk.
5. Visit to a milk processing plant.

Paper Title: OILS & FATS PROCESSING LAB. (Practical)
Paper Code FT 554      Max. Marks : 25      Credits : 1

1. Determination of oil content of foods by Soxhlet method.
2. Determination of specific gravity of oils and fats.
4. Determination of free fatty acids and acid value of fats and oils.
5. Determination of peroxide value of fats and oils.
7. Determination of melting point and smoke point of fats and oils.
10. Determination of Reichert Neisl number and Polenske value of fats and oils.
11. Determination of oil absorption during deep-oil frying of foods.
SYLLABUS FOR
BACHELOR OF ENGINEERING (FOOD TECHNOLOGY)
SIXTH SEMESTER

Paper Title: REACTION ENGINEERING (Theory)
Paper Code: FT 601      Max. Marks: 50      Credits: 4      Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Introduction and a brief review of the kinetics of homogeneous reactions.
Interpretation of rate data from constant volume and constant pressure systems.
Single Ideal reactors.
Design for single reactions.

SECTION-B

Design for multiple reactions.
Thermal characteristics of reactors: temperature and pressure effects.
Non-ideality in reactors and its effects on chemical conversion. One parameter models to represent the behaviour of chemical reactors.

Books Recommended:


Paper Title: PROCESS INSTRUMENTATION (Theory)
Paper Code: FT 602      Max. Marks: 50      Credits: 4      Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

General Concept: Need and classification of measurements and instruments, Basic and auxiliary functional elements of a measurement system.
Static and Dynamic Characteristics of Instruments:
Static Characteristics: Range and span, accuracy and static error, reproducibility and drift, sensitivity and dead zone.
Dynamic Characteristics: Speed of response and lag, fidelity and dynamic error, dead time.
Temperature measurement:
Thermocouples, metal resistance thermometers and thermistors, optical and radiation pyrometers, radiation receiving elements.
Pressure measurement:
Use of manometers, Bourdon gauge, bellows type gauge. Vacuum measurement–Mcleod gauge, thermoionic type ionization gauge, pirani vacuum gauge. Measurement of pressure in corrosive fluids: Diaphragm seal, liquid seal and purge system.

SECTION-B

Liquid level measurement:
Direct measurement of liquid level –Float & tape liquid level gauge, float and shaft liquid level unit, hydraulic remote transmission of liquid level.
Level measurement in open vessels: Bubbler system, diaphragm box system, air trap system. Level measurement in pressure vessels – Differential pressure manometer, use of liquid seals with a manometer, displacement float liquid level gauge. (6 Hrs.)
Measurement of viscosity, conductivity, humidity and pH.
Density measurement – liquid level method, displacement meter and hydrometer.
Measurement of weight – spring scale, pneumatic force meter and hydrostatic force meter.
Process Instrumentation–Recording instruments, indicating and signaling instruments, control centre, transmission of instrument reading, instrumentation diagrams.

Books Recommended:
1. Eckman, Donald P. : Industrial Instrumentation, CBS Publisher and Distributors, Indian Reprint 2004.

Paper Title: CONFECTIONARY TECHNOLOGY (Theory)
Paper Code : FT 603 Max. Marks: 40 Credits : 3 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.
SECTION-A

Types of confectionary goods.
Characteristics and processing of raw materials.
Technology of manufacture of toffee, chocolate, fruit drops, hard-boiled candies, bars, chewing gums, bubble gums and special confectionary goods.

SECTION-B

Color, flavor and texture of confectionery. Standards and regulations.
Economics and marketing of confectionery goods.
Design of equipments used in confectionary. Plant layout.

Books Recommended:

Paper Title: MASS TRANSFER-II (Theory)
Paper Code : FT 604 Max. Marks: 50 Credits : 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A


SECTION-B

Liquid-Liquid Extraction: Ternary Equilibria and its representation on various plots. Selection criteria for solvent, Multistage extraction using partially miscible & immiscible solvents. Stagewise contact for countercurrent and crosscurrent extraction. Constructional details of equipment like mixer-settler, packed columns, pulsed extractor, sieve-tray extractor and centrifugal extractor.
Leaching: Preparation of solid, countercurrent and crosscurrent multistage contact Shank’s system. Constructional details of equipment like Rotocel extractor, Hildebrandt extractor, Bollman extractor, Kennedy Extractor & Beet-Sugar Diffusion battery extractor.
Adsorption: Types of adsorption, nature of adsorbents, equilibria for adsorption systems. Brief manufacture and commercial applications and characteristics for common adsorbents. Stagewise & continuous contacting
of fluid and solid phase. Description of contact filtration adsorption system. Hypersorber Ion-exchange
system.

Crystallization: Growth and properties of crystals saturation, nucleation, growth of crystals, effect of
impurities on crystal formation, effect of temperature on solubility, fractional crystallization, yield of
crystals, crystal purity, yield calculation using phase diagram, energy requirements using enthalpy-
concentration diagram. Methods of creating super saturation-Meirs supersolubility curve. Mechanism
Swanson-Walker and various vacuum crystallizers.

Books Recommended:

1975.
2005.
New Delhi, 1982.
2. To determine drying rate curves for different wet solids in a batch drier under constant drying conditions.
3. Fractional approach to equilibrium for liquid-liquid extraction from single drop.
4. Verification of Rayleigh’s equation for differential distillation.
5. Determination of flooding velocities in packed columns.
6. Determination of HETP for packed distillation columns.
7. Study and operation of a pilot sized distillation column under total reflux.
8. Study of different mass transfer equipments.

**Paper Title:** PROCESS PLANT DESIGN –II (Practical)

**Paper Code FT 652**

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1. Process design and specifications of double pipe heat exchanger, shell and tube heat exchanger, plate type heat exchanger, condenser and reboiler.
2. Equilibrium procurement techniques – experimental and use of thermodynamics for its evaluation and then use in design height of distillation column. Calculations using McCabe Thiele, Plate-to-Plate calculation methods for fractionators, design of batch fractionating columns, design of fractionators internals for sieve-tray.
3. Absorber/Stripper design of stage-wise and continuous contact equipment (packed column), height of column and diameter calculation, design of various internals of absorber/stripper.
4. Process flow sheets, material and energy balance flow sheeting analysis.

**Books Recommended:**

   Instt., IS: 43-197.

**Paper Title:** BEVERAGE & CONFECTIONARY PROCESSING LAB. (Practical)

**Paper Code FT 653**

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1. Water hardness, acidity, basicity, chlorination, total dissolved solids, chlorides, iron, phosphorus in water.
2. Determination of alcoholic content in beer and wine using the distillation method.
3. Sulphur dioxide content in juices, squash, wine etc.
4. Acidity and total soluble solids determination in different beverages.
5. Manufacture of whey.
7. Determination of extract in tea leaves.
8. Sensory evaluation techniques and their uses.
SYLLABUS FOR BACHELOR OF ENGINEERING (FOOD TECHNOLOGY) SEVENTH SEMESTER

Paper Title: FOOD REGULATION & QUALITY CONTROL (Theory)
Paper Code : FT 701      Max. Marks: 50  Credits: 4  Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

General Principles of Quality Control, Quality Attributes: Colour, gloss, viscosity and consistency, size, shape and texture, flavour, taste, sensory evaluation techniques. Microbiological methods of quality evaluation. Application of Biosensors to check the quality of packaged food products.

SECTION-B

Government and trade standards for quality. Food Laws and Regulations: PFA, FPO, BIS, AGMARK, ISO, etc. Quality of Different Food Products: Cereals, fruits, vegetables, milk, egg, meat, fish etc.

Books Recommended:


Paper Title: PROCESS ENGINEERING ECONOMICS (Theory)
Paper Code : FT 702      Max. Marks: 50  Credits: 4  Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

SECTION-B


Optimum Design: Procedure with one variable, optimum reflux ratio in distillation and other examples.


Books Recommended:


Paper Title: PACKAGING TECHNOLOGY (Theory)

Paper Code: FT 703 Max. Marks: 50 Credits: 4 Time: 3 hours

Course Duration: 45 Lectures of one hour each.

Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Basic concepts, function of food package, packaging materials, cellulosic, glass, metal, polymeric composite, rigid, semi-rigid and flexible package forms, adhesive, band and closure, coatings and labels, packaging, product characteristics and packaging requirements, selection of material, form, machinery and method of packaging, package printing, standards and regulations. Active Smart packaging and Edible packaging.

SECTION-B

Special problems in packaging of foodstuffs. Biodegradable packaging.
Design of packaging equipments.
Evaluation of packaging materials for different food products and package performance.
Use of Nanocomposites in food packaging.

Books Recommended:

Paper Title: BIOCHEMICAL ENGINEERING (Theory)
Paper Code: FT 704      Max. Marks: 50      Credits: 4      Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Isolation and Utilization of Enzymes: Purification, immobilization, application of enzyme technology.
Kinetics of Enzyme-Catalyzed Reactions: The substrate, enzyme kinetics, factors affecting enzymatic activity and enzymatic reactions in heterogeneous reactions.
Metabolic Pathways and Energetics of the Cell: The concept of energy coupling, aerobic and anaerobic metabolism, photosynthesis and biosynthesis, transport across cell membranes.
Cellular Genetics and Control: Growth and reproduction of a single cell, alteration of cellular DNA, commercial applications.

SECTION-B
Transport Phenomena in Microbial Systems: Gas-liquid mass transfer, determination of oxygen transfer rates, mass transfer, surface-area correlations for mechanically agitated vessels, scaling of mass transfer equipment, particulate mass transfer, heat transfer.
Design and Analysis of Biological Reactors: The ideal continuous-flow stirred-tank reactor (CSTR), residence time distribution, different types of reactors, relationship between batch and continuous biological reactors. Fermentation technology, product manufacture by fermentation, reactors for biomass production.

Books Recommended:

Paper Title: FOOD QUALITY CONTROL & PACKAGING LAB. (Practical)
Paper Code FT 751      Max. Marks: 25      Credits: 1

Quality Control:
Estimation of product quality with respect to the color, size, shape. Viscosity, texture, flavour, taste, sensor evaluation, market testing of products. Evaluation of food standards.
Packaging:
1. Strength properties of packaging materials.
2. Water vapour and gas transmission rates of flexible packaging materials.
4. Pre-packaging of vegetables.
5. Shrink packaging of poultry.
7. Vacuum and gauge packaging.
Paper Title: ENGINEERING COMPUTATION LAB. (Practical)  
Paper Code FT 752  
Max. Marks: 25  
Credits: 1

Errors analysis, solution of linear and non-linear algebraic equations.  
Numerical differential & integration.  
Interpolation.  
Least squares approximation.  
Ordinary and partial differential equations.  
Development of computer programs based on the above topics using Matlab and their applications in chemical process computations.

Books Recommended:

Paper Title: LITERATURE SURVEY, REPORT WRITING AND SEMINAR  
Paper Code FT 753  
Qualifying No Credit

Selection of topic for the seminar related to food processing. Preparation of technical report on an assigned topic after survey of scientific, technical and commercial literature, using journals, popular articles and other information retrieval methods. Use of computer softwares for report writing. Presentation of the seminar.

Paper Title: INDUSTRIAL TRAINING  
Paper Code FT 754  
Max. Marks: 25  
Credits: 1

Each student will be required to submit a report after each factory visit/training programme throughout the entire course. The reports will be assessed by teachers in charge of the programme.

FT 851 PROJECT WORK

Each student is required to submit a project report on the design of a food processing plant, selecting the best process with optimum equipment size and operating conditions. The object is to test the ability of the student to apply his entire knowledge of food processing technology principles to conceptualize, analyze and solve the problems. To judge his knowledge and originality and capacity for application of laboratory data in designing food processing plants and to determine the level of his proficiency at the end of the course.
SYLLABUS FOR BACHELOR OF ENGINEERING (FOOD TECHNOLOGY)
EIGHTH SEMESTER

Paper Title: INDUSTRIAL MANAGEMENT (Theory)
Paper Code: FT 801 Max. Marks: 50 Credits: 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Process of decision making, elements in decision making nature and framework of planning short and long range planning policy formulation organisation structure and behaviour, decentralisation and delegation. line-staff relationship motivation and morale, communication, inter-personal and group behaviour, coordination and direction.

SECTION-B

Purpose, processes and areas of control; control standards, control reports, budget as control device. Economic planning and policy in India, industrial policy, industrial development in India. Position and problems of chemical industries in India.

Books Recommended:

Paper Title: PROCESS DYNAMICS & CONTROL (Theory)
Paper Code: FT 802 Max. Marks: 50 Credits: 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Incentives for chemical process control, design aspects of a process control system. Difference between feedback and feed forward control configuration. Hardware elements of a control system, Block Diagrams.

Laplace transform and transfer functions. Difference between lumped and distributed parameter systems, Dynamic behaviour of first and higher order systems, interacting and non-interacting systems, dead time.

Different modes of control actions and their basic characteristics, controllers and their characteristics, control valve.
 SECTION-B

Closed-loop transfer functions, transient response of simple control systems, Routh stability criterion, Root Locus.

Introduction to frequency response: Bode diagrams, control system design by frequency response: Ziegler-Nichols controller settings, stability using frequency response, gain margin and phase margin.

Introduction to advanced control techniques such as cascade control, feed forward control, ratio control, inferential control.

Books Recommended


Paper Title: PROCESSING OF MEAT, FISH & POULTRY (Theory)
Paper Code : FT 803 Max. Marks: 50 Credits: 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.

Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A


SECTION-B

Fish structure and composition, cold storage, freezing preservation and canning of fish. Pickling of fish, fish protein concentrates, fish meal and by-products of fish processing industry. Sanitation in meat, fish, egg and poultry processing plants.

Books Recommended:

5. Roberts, R.J.: Fish Technology.

Paper Title: MEMBRANE SEPARATION PROCESSES (Theory)
Paper Code: FT 804      Max. Marks: 50  Credits: 4   Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Fundamental, mechanism of membrane transport, gaseous diffusion, separation in liquid phase, dialysis, reverse osmosis, ultra filtration, liquid membrane.

SECTION-B
Electromembrane processes, transfer coefficient and its determination, engineering aspects of membrane separation and industrial application.

Books Recommended:

Paper Title: Project Work
Paper Code: FT 851      Max. Marks: Qualifying  Credits: 2

Paper Title: ELECTIVE LAB. (Practical)
Paper Code: FT 852      Max. Marks: 25  Credit: 1

i) PROCESSING OF MEAT, FISH & POULTRY

(a) Fish & Meat: Cutting and handling.
(b) Dressing of poultry.
(c) Evaluation of quality of meat, fish & poultry.
(d) Canning, freezing, dehydration & curing of meat & fish.
(e) Quality of egg & egg powder, egg preservation.
(f) Preparation of pettie, emulsion etc.
(g) Visit to meat, fish & poultry processing industries.

ii) MEMBRANE SEPARATION PROCESSES

(a) Preparation of membranes.
(b) Study of separation characteristics of membranes.
(c) Study of the effective life of membranes.
(d) Liquid membranes (i) emulsion type (ii) supported liquid membrane.
(e) Emulsion membrane: Design of liquid surfactant membrane system to treat industrial effluent.
(f) Concentration of liquid foods such as milk, juices using membranes.

**Paper Title: PROCESS INSTRUMENTATION & CONTROL LAB.**  
**Paper Code FT 853**  
**Max. Marks: 50**  
**Credits: 2**

Calibration of temperature, pressure, flow and composition measuring instruments. Study of process characteristics. Investigation of the operation of pneumatic and electronic controller with proportional integral, derivative action. To determine the best setting of a controller with controlling as actual process. To solve first order or higher order differential equations with the help of an analog computer and to study control problems by analog simulation. Selected experiments on isothermal, homogeneous batch and continuous reactors, stirred tank and tubular reactors. Residence time distribution.

**Books Recommended:**


**Paper Title: VIVA-VOCE-II (COMPREHENSIVE)**  
**Paper Code FT 855**  
**Max. Marks: 50**  
**Credit: 2**

The viva-voice examination will be comprehensive and covering mainly food technology subjects covered during all the semesters including the Eighth Semester.