### Scheme of Teaching and Examination (2016-2017)

<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>
<td>SEVENTH SEMESTER</td>
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<tr>
<td>FT 701</td>
<td>Food Regulation &amp; Quality Control</td>
<td>3</td>
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<td>FT 702</td>
<td>Process Engineering Economics</td>
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<td>FT 703</td>
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<tr>
<td>FT 704</td>
<td>Process Dynamics &amp; Control</td>
<td>3</td>
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<td>Practices</td>
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<tr>
<td>FT 751</td>
<td>Food Quality Control &amp; Packaging Lab.</td>
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<td>FT 752</td>
<td>Engineering Computation Lab.</td>
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<td>FT 753</td>
<td>Literature Survey, Report Writing and Seminar Lab.</td>
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<td>FT 754</td>
<td>Industrial Training</td>
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<tr>
<td>FT 851</td>
<td>Project Work</td>
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<tr>
<td><strong>EIGHTH SEMESTER</strong></td>
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<td>Industrial Management</td>
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<td><em>Elective (Any one of following)</em>:</td>
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<tr>
<td>FT 803</td>
<td>Processing of Meat, Fish &amp; Poultry</td>
<td>3</td>
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<td>FT 804</td>
<td>Membrane Separation Processes</td>
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**Practicals**

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<tr>
<td>FT 851</td>
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<td>Process Instrumentation &amp; Control Lab.</td>
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<tr>
<td>FT 854</td>
<td>Process Modeling &amp; Simulation Lab.</td>
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<td>FT 855</td>
<td>Viva Voce-II (Comprehensive)</td>
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**Total**

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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)
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**
Interest and Investment Costs: Simple and compound interest. Nominal and effective rates of interest. Continuous interest ordinary annuity. Perpetuities and capitalized costs.
Taxes and Insurance: Types of taxes and tax returns, types of insurance and legal responsibility.
Depreciation: Types of depreciation. service life salvage value, present value and methods of determining depreciation, single unit and group depreciation.
SECTION-B


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

**Preliminary Steps in Plant Design:** Plant design factors. project organization, plant location, preliminary data collection, process engineering.  

**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:**

SYLLABI FOR FOUR YEAR BACHELOR OF ENGINEERING (FOOD TECHNOLOGY) 2016-2017

Paper Title: PROCESS DYNAMICS & CONTROL (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

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 : 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 algebric 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:**

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Paper Title: **BIOCHEMICAL ENGINEERING** (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**

*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: 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:**
   Kammermeyer, K.

**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.

**Paper Title:** PROCESS MODELLING & SIMULATION LAB.
**Paper Code:** FT 854  
**Max. Marks:** 25  
**Credits:** 1

Functional design, property estimate as inputs for design. System concepts for computer aided design, computer aided flow sheet design. Process analysis. Process variables selection, equipment design through the selection of free parameters subject to constraints and other parameters, Modular design. Simulation optimality. Dynamic design including control stability. Typical equipments to be considered heat exchanges, distillations factor and process equipments.

**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.