Syllabus of Final Year

B. Tech (Food Technology)

Faculty of Science and Technology

University Institute of Chemical Technology,
North Maharashtra University, Jalgaon

B. Tech. (Food Technology) Final Year Course Structure w.e.f. 2017-18
(Overall Structure and Revised Syllabus w.e.f. 2017-18)

Course Code	Title of Course	Teaching Hours	Tutorial	Credits	Practical Hours	Credits	Total Credits
Seventh Semester							
FTP-401	Industrial Training/ Project	-	-	-	32	16	16
FTP-402	Technical Seminar & Colloquium	-	-	-	08	04	04
Total		-	-	-	40	20	20
Eighth Semester							
CHL-405	Project Engineering & Economics	03	01	04	-	-	04
CHC-406	Process Equipment Design	02	-	02	03	1.5	3.5
FTC-405	Food Quality	04	-	04	03	1.5	5.5
FTL-403	Food processing- II	04	-	04	-	-	04
FTP-404	Food processing- II	-	-	-	06	03	03
Elective	Elective-III	04	-	04	-	-	04
Total		18	-	18	12	6.0	24.0

Nomenclature of the courses:

First two letters of the course code denote the branch/ division. Thus FT stands for Food Technology Course and CH stands for Chemical Engineering Course. Similarly ES stands for Engineering Sciences and HM for Humanities and Management Sciences.
Third letter denotes the type of the course, viz lecture, practical or lecture + practical. If third letter is L, the said course is of lectures. Practical course is shown by P and C represents the course consisting of lecture + practical. First numeral of the course code denotes the level of course, and the other two are for number of course in particular branch/division.

For example course BSL-101 – mathematics-1. Here BS stands for basic science branch, L for lecture; For 101, first 1 for first year and 01 for first course of basic science.

Examination System:

For each theory paper of 04 and 03 credits, Major Examination with paper of 60 marks and duration of 03 Hours will be conducted.

For each theory paper of 02 credits, Major Examination with paper of 30 marks and duration of 02 Hours will be conducted.

For each practical Lab. of 1.5, 02 and 03 credits, the examination will be conducted for 03 hours' duration for CH, ES and BS practical. For all PT/PL/FT/OT labs.the practical examination is of 06/03 hours duration. For all these practicals, the Major examination carries 60 marks. For practical lab with 01 credit, the examination will be conducted as viva-voce (major- 30, minor - 20)

List of Electives

Paint Technology

PTL - 406 Special Purpose and Effect Coatings

PTL- 407 Nanotechnology in Paint Industry

Polymer Technology

PLL-405 Polymer Blends and Composites

PLL-406 Plastics for Packaging

PLL-407 Theory of Adhesion and Adhesives

PLL-408 Polymer Nanocomposites: Synthesis and Characterization

Oil Technology

OTL-406 Environmental Aspects of Oil and Allied Industries

OTL-407 Modern Instrumentation Techniques for Analysis of Oils and Oleochemicals

OTL-408 Non Traditional Oils and Non Triglyceride Constituents

Food Technology

FTL-406 Biochemical Engineering

FTL-407 Dairy Technology

Seventh Semester

Department	**: Department of Food Technology**
Course code	**: FTP-401**
Course Title	**:Industrial Training/ Project**
Course Type	**: Project**
Total Hrs	**: 32**
Course credit	**: 16**

Course Objective:
The objective is to create interest of graduates in research with subject knowledge they have acquired earlier. To provide exposure to graduate for recent industrial practices and technological revolutions. To provide exposure to graduate for technical report writing of their research work and its presentation.

Course Outcome:
On completion of Industrial Training, the Technocrat will develop skills and good practices related to

1. Graduates will be aware about the Food technology field.
2. Graduates will be able to identify raw materials needs/inventory, material selection, performance criteria, applicable processing method, product defects, their practical causes and remedies.
3. Graduates will be able to provide engineering solutions in a global, economic, environmental, and societal context.
4. Graduates will have Career opportunities and Choices.

Research Project at Department: The entire semester will be devoted for the detail experimental work on a research problem from the field of Food Technology selected by the student and specially approved by the faculty member/s designated as research guide/s. The student will present his/her findings in the form of neatly typed and bound thesis and will have to appear before panel of experts for defending his/her Thesis.

Or

Research Project/ Training at Industry: The student will undertake research work/ Training at selected reputed Institute / Industries for six months on a topic allotted by the concerned institute / Industry Management and approved by the Department. His/her progress will be jointly reviewed by the Department and the concerned Institute / Industry Management. The student will present his/her findings in the form of neatly typed and bound thesis, which will carry approval and attendance certificate issued by the concerned Industry Management and will have to appear before panel of experts for defending his/her Thesis.

Or

Student can opt the theory and /or practical courses of his / her branch of interest for 16 credits.

Department	**: Department of Food Technology**
Course code	**: FTP-402**
Course Title	**:Technical Seminar & Colloquium**
Course Type	**: Seminar**
Total Hrs	**: 08**
Course credit	**: 04**

Course Objective:
To develop necessary skills in understanding current technological trends in the field of Food technology. To provide the graduates, in-depth exposure of literature survey, preparing technical review report. To improve technical presentation skills of the graduates.

Course Outcome:
1. Graduates will have knowledge of recent and emerging trends in the field of Food Technology.
2. Graduates will be able to identify, formulate, and solve technical problems.
3. Graduates will have developed necessary skills for preparation and presentation of Technical Reports.
4. Recognition of the need for, and an ability to engage in life-long learning.

Student will be required to prepare a critical review of selected topics in Food Technology and allied subjects and submit the same in the form of a standard typed report under the supervision of designated Guide. The student will also be required to make an oral presentation of the review before panel of experts.

Eighth Semester

Department : Department of Food Technology

Course Code :CHL 405

Course Title :Project Engineering and Economics

Course Type : Theory

Total Hrs/Week :04 Hrs (3 Hrs Lectures+1 Hr Tutorial)/week

Course Credit : 04

Course Objective:

The objective of the course is to provide students with a firm grasp of the essential principles of Management, Project identification project feasibility and Project Scheduling Technique with Suitable Examples. This course will help student to understand the concepts and terminology that are used in Management economics and costing. Students know about pipeline design on the basis of fluid dynamics and mechanical properties. students also understand the balance sheet, store ledger account by various methods and solve various engineering problems in process optimization.

Course Content:

Unit -I
1. Project identification, project feasibility
2. Project testing based on vibality risk & Cost estimation.
3. Evaluation of project by different methods on the basis of Vibality
   i) Net Present Value method. ii) Method of Rate of Return on Initial Investment

iii) Pay out Period iv) Method of Discount Cash Flow v) Capitalized cost method vi) Internal rate of return method vii) Break Even Chart

4 Evaluation of project by different methods on the basis of Risk
i) Profitability Index ii) Demand fore casting iii) Standard Deviation Approach

5 Evaluation of project by different methods on the basis of Cost
i) Preparation of Cost sheet and statements ii) Preparation of Profit Loss Statement

(10 Hrs)

Unit -II

1. New developments in management, CPM & PERT
   Principle and Objectve of CPM and PERT
   Net work Diagram for calculation Time Duration
2. Linear Programming Problem (Numerical based on each method)

i) General simplex method ii) Primary & Dual technique method
iii)Direct simplex method Iv) Graphical Method

(10 Hrs)

Unit -III

1. Cost analysis, fixed capital, working capital, Preparation of store ledger account by pricing issue methods. LIFO, FIFO, Simple average, weighted average
2. Depreciation, significance of inadequacy and obsolescence, and depreciation methods (Numerical Based on It)

(10 Hrs)

Unit -IV

1. Layout and location, objective, principle
2. layout and Location factors.
3. Equipment layout diagram (ELD)
4. Tank firm cum utility block diagram for different processes. (TFCUBD)

(10 Hrs)

Unit -V

1. Design of process flow sheet from process information. Plant utility line diagram for including valve, IPC symbol, unit operations symbols (mass & heat transfer)
2. Utility Block diagram for Boiler House, Refrigeration Plant,Compressor House and Electricity
3. Piping design: Fluid dynamic parameter (Q, Delta, D), piping insulation, Pipe Welding, pipe Fittings, types of valves, selection of valve, P.C. and instrumentation Symbols. Numerical Based On it
4. Design of pipeline on the basis of fitting, valve, Insulation, IPC & utility panel board.

(10 Hrs)

Course Outcome:

1. To enhance knowledge of students about pipeline design on the basis of fluid dynamics and mechanical.
2. To understand the various methods of profitability evaluation and their application.
3. To enhance knowledge of students to understand the balance sheet and store ledger account by various methods.
4. To enhance knowledge of students about various scale up methods and to understand the new development in management and optimization techniques.
5. To enhance the ability of students to identify and solve various engineering problems in process optimization.

Reference Book:

1. Dawande, S. D. "Process Design of Equipments." Central Techno Publication, Nagpur (2000).
2. Pathak B.V. & Mahajan M.S. “Industrial Organization & Management”, NiraliPrakashan 1986
3. Peters, Max Stone ,Timmerhaus K.D.. “Plant Design and Economics for Chemical Engineers”. Vol. 4. New York: McGraw-Hill, 1968.
4. Austin, George T. "Shreve's Chemical Process Industries." (1984): 136-138.
5. G.V.Kumbhojkar , “Applied Mathematics Optimization –IV” , 2002
6. Dhone D.B., “ Plant Utilities” NiraliPrakashan, 2008.
7. T,S,Grewal and S.C.Gupta, “Introduction to Accountancy” S.Chand Publication 2008
8. Christopher J,S. and L.M.Weather, “Managerial and Cost Accounting” Ventus Publisher APS, 2011

Department	**: Department of Food Technology**
Course code	**: CHC 406**
Course Title	**: Process Equipment Design (Th)**
Course Type	**: Theory**
Total Hrs/ Week	**: 02**
Course credit	**: 02**

Course Objective:
To study the design procedure for chemical equipments.To study the behavior of material under stress. The student should be able to understand the designing of pressure vessels, high pressure vessels, supports, calendria evaporator, shell and tube heat exchanger, sieve tray and bubble cap tray for distillation column, agitators.

Course Content:

Unit –I
General design procedure for designing chemical equipment, protective coating, corrosion causes and prevention. Theory of failure, factor of safety. The material behavior under stresses.Unfired pressure vessel subjected to internal and external pressure. Design of shell, nozzle, different types of head. **(10hrs)**

Unit –II
Vessels for high pressure operation, constructional features, multi shell construction, determination of thickness of shell applying various theories of failures.Agitators, selection, types application, power required for agitation. **(10hrs)**

Unit-III
Types of support for vertical and horizontal vessels, Process design for short tube calendria

type of evaporator, Types of heat exchangers, shell and tube heat exchanger construction and design in details. Design for sieve tray and bubble cap tray for distillation column, Heating and cooling arrangements for reaction vessel. **(10hrs)**

Course Outcome:

1. At the end of the course the student exhibits how to design and draw in a competitive manner various process equipment with proper scale and each components with detail dimensions.
2. Learn how to design Pressure vessels, Reaction vessels, Shell and Tube Heat Exchanger, Short Tube Calendria Evaporator.
3. Understands the constructional features of high Pressure vessels, Detail arrangement of Sieve tray and bubble cap trays.
4. Understand how to read drawings to know details about process equipment, which can be utilized for fabrication, maintenance, assembling and dismantling.

Reference Book:

1. Bhattacharya, B. C. "Introduction of Chemical Equipment Design." Mechanical Aspects (2003): 201-203.
2. Sinnott, R. K. Coulson & Richardson's "Chemical Enginering: Volume 6/Chemical Engineering Design", Elsevier Butterworth Heinemann, 1999.
3. Joshi, MansukhlalVrajlal, and V. V. Mahajani. Process Equipment Design. Macmillan India, 1996.
4. Dawande, S. D. "Process design of equipments." Central Tecno Publication, Nagpur (2000).

Department	**: Department of Food Technology**
Course Code	**: CHC 406**
Course Title	**: Process Equipment Design (Pr)**
Course Type	**: Practical**
Total Hrs/ Week	**: 03**
Course Credit	**: 1.5**

Course Objective:

To study the design procedure for designing chemical equipment and selection of proper material of construction by considering different mechanical and physical properties.To study the behavior of material under stresses. The student should be able to understand the designing of pressure vessels, high pressure vessels, supports, calendria evaporator, shell and tube heat exchanger, sieve tray and bubble cap tray for distillation column, agitators.

Course Content:

Students will be required to do process design and submit drawings of at least six equipments such as pressure vessels, heat exchangers, agitators, short tube calendria type evaporator etc. Types of agitators, supports. Design of bubble cap tray, sieve tray, different types of packing

Course Outcome:

1. At the end of the course the student exhibits how to design and draw in a competitive manner various process equipments with proper scale and each component with detail dimension.
2. Learn how to draw from the design problem solved in theory the exact Drawings of Pressure vessel, Reaction vessel, Shell and Tube Heat Exchanger, Short Tube Calendria Evaporator.
3. Understands the constructional features with the help of drawings of high Pressure vessels, Detail arrangement of Sieve tray and bubble cap trays.
4. Understand how to read drawings to know details about process equipment, which can be utilized for fabrication, maintenance, assembling and dismantling.

Department	**: Department of Food Technology**
Course code	**: FTL-403**
Course Title	**: Food Processing- II**
Course Type	**: Theory**
Total Hrs	**: 04**
Course credit	**: 04**

Course Pre-requisite:
To learn the basic knowledge of Food Processing- II, requires pre-knowledge of (FTL-306) Advanced Technology in Food Packaging, (FTC-304) Food Processing I and (FTC-201) Food Chemistry.

Course Objective:

1. To learn quality assessment of fruits and vegetables.
2. To learn post-harvest changes in fruits and vegetable storage.
3. To learn the process technology of fruits and vegetable products.
4. To learn the process technology of meat, fish, poultry product.
5. To learn the process technology of milk and milk product.
6. To learn the process technology of tea, coffee and spices.

Course Content:
Unit-I

Process Technology of fruits & vegetables I:

Fruits & vegetables structure, Chemistry & physiology of plant tissues. Texture of fruits & vegetables.
Plant Pigments.Effect of processing on color & texture.
Ripening of fruits, postharvest changes in climacteric & non-climacteric fruits.
CA & MA storage, dehydration of fruits & vegetables.

[10 Hrs]

Unit –II

Process Technology of fruits & vegetables II:
Processing of fruits & vegetables & their products.
Technology of fruits & vegetable purees, concentrates, jams, jellies, marmalades, squash, cordials, crush preserves, candied fruits, pickles, chutney, sauce & ketchup, RTS beverages & carbonated soft drinks (CSD).

[10 Hr]

Unit –III

Process Technology of meat:
Structure & chemical composition of muscle proteins, hemoglobin, myoglobin, collagen & gelatin.
Post mortem changes in muscle, rigor mortis, livestock and various cuts of meat. Texture of meat.Effect of cooking & processing on texture, palatability & tenderness of meat.
Quality control& microbiological standards of meat.
Preservation & packaging of meat.

[10 Hrs]

Unit –IV

Process Technology of meat, fish and Poultry:
Processing of poultry, poultry preparation
Preservation & packaging of poultry & their products, processing of fish.
Quality control& microbiological standards of fish & poultry products, processing of eggs.
By products in meat processing industry.

[10 Hrs]

Unit –V

Process technology of milk & milk products, spices and tea:-
Composition of milk, processing, storage & distribution of milk, manufacture of cream, butter, ghee, evaporated, condensed and skimmed milk, whole & skimmed milk powder. Preparation of Indian milk products like khoa, channa, curd & their products, standards of milk & milk products.
Process technology of cocoa, tea and coffee
Composition & processing of tea and coffee.Flavor and aroma development and evaluation.Processing of spices.

[10 Hrs]

Course Outcome:

1. Students will be able to assess the quality of fruits and vegetables.
2. Students will be able to preserve the fruits and vegetables by preventing post-harvest changes.

3. Students will able to prepare jam, jellies, marmalade, pickle, candies and RTS and other products.
4. Students will be able to preserve, meat, fish, poultry to maintain their texture, palatability and tenderness.
5. Students will be able to prepare condensed milk products, khoa, butter, channa, curd and processing of spices.

Reference:-

1. Girdharilal&Sidappa G. S, Preservation of fruits and vegetables, ICAR., New Delhi, (6th reprint, 2nd edition, 2013).
2. Tressler D. K. & Joslyn M. A., Fruits & vegetables juice processing technology, AVI publishing Co. Westport, Connecticut, (2nd edition, 1980).
3. Leviea , The meat & book, AVI publishing Co., Connecticut(1970).
4. Price J. F. & Schweigrt B. S., W. H. Freeman, The scientist of meat & meat products San Francisco, (2nd edition, 1971).
5. Mountney G. J., Poultry product technology, AVI publishing Co. Inc. Westport Connecticut, 1976. (2nd edition,vol. 5,1988)

Department	**: Department of Food Technology**
Course code	**: FTP-404**
Course Title	**: Food Processing- II**
Course Type	**: Practical**
Total Hrs	**: 06**

Course Pre-requisite:
To learn the practical knowledge of Food Processing Lab-II, requires pre-knowledge ofof (FTL-306) Advanced Technology in Food Packaging, (FTC-304) Food Processing I and (FTC-201) Food Chemistry.

Course Objective:

1. To prepare various fruits and vegetable products.
2. To analyze the canned products.
3. To process spices.
4. To evaluate the quality of processed products.

Course Content:
Processing of fruit juices, squash, crush, cordial, jam, jelly, marmalade, RTS beverage, pickles, tomato products etc.
Cutout analysis of canned foods
Preparation of Butter, Butter milk, Ghee, Milk powder, sweetened condensed milk.
Processing of spices, Quality evaluation.

Course Outcome:

1. Students will be able to prepare various fruit juices, jam, jelly, pickles.
2. Students can process the spices.
3. Students will be able to evaluate the quality parameters of processed foods.

Reference books:

1. Jacob M.R., D.Van Nostrand Co. Inc., The analysis of foods & food products, Princeton,- New jersey, New york, (1958).
2. Pearson D., J.E.A. Churchill, 104, Goucester place, The Chemical analysis of foods, London, Sixth edition, 1970.(7th edition, 1976)
3. Ranganna S, Manual of analysis of fruits & vegetable products, McGraw Hill publishing Co., New Delhi, (2nd edition, 2005)
4. Official Methods of Analysis of the association of Official Analytical chemists, Pub. Assoc. Office, Anal chemists. Washington D.C., (11th edition, 1970).
5. Food Analysis : Theoryand practice IS:6273(Part-1&Part-2) Y.Pomeranz (3rd edition)
6. BIS and AOAC Methods of Food analysis (17th edition, 2000).
7. M.A. Amerine, Principles of Sensory Analysis of Food (1st edition, 1965)
8. J.M. De Man, Rheology and Texture in Food Quality A V I Publishing Company, Westport Connecticut, USA (1976).
9. Ranganna S., Hand Book of analysis and quality control for fruit and Vegetable Products", McGraw-Hill Publishing Company Ltd. New Delhi(2nd edition, 2001)
10. Morris B. Jacobs, The Chemical Analysis of Foods &Food Products (Publication Date: February 1939)
11. Morris B. Jacobs, he chemical analysis of food and food products, published Van Nostrand Company Ing, Princeton New jersey, (3rd edition, 2006).

Department	**: Department of Food Technology**
Course code	**: FTC-405**
Course Title	**: Food Quality**
Course Type	**: Theory**
Total Hrs	**: 04**
Course credit	**: 04**

Course Pre-requisite:

To learn the basic knowledge of Food Quality, requires pre-knowledge of Food Chemistry, Food Processing I, Principles of Food Preservation, Food Microbiology, Food Biochemistry and nutrition.

Course Objective:

1. To study the sensory evaluation techniques and quality control.
2. To learn the latest food analysis instrumental techniques.
3. To learn the control of Food quality by fortification, food standards, food laws and regulation.
4. To learn the control of microbial quality and antinutritional factors in food and food safety system HACCP.

5. To learn the defects, causes and remedies of different foods, to maintain their quality.

Course Content:

UNIT-I

Food quality, quality control and quality assurance.Sensation of color, flavor & texture by human organ, taste panel, sensory evaluation techniques. Quality aspect of cooking, Undesirable and anti-nutritionals in processed food products.

[10 Hrs]

UNIT-II

Quality evaluation by chemical and biological methods, calorific values, browning reaction, nutritive nonnutritive sweeteners. Techniques used in food analysis (Spectrophotometer, chromatography, Scanning electron microscopy, Electrophoresis, Texurometer).

[10 Hrs]

UNIT-III

Essential fatty acids, polyunsaturated Fat, Trans fat, omega 3 fatty acid, protein quality, essential amino acid, available lysine, Food Fortification/Enrichment of vitamins and minerals. Food standard, food law & regulation. FSSAI, AGMARK, BIS, Codex alimentary commission.

[10 Hrs]

UNIT-IV

Microbial Food poisoning, Microbiological quality of foods& their control. Sources of microbial contamination, pest control, GHK, GMP, GLP, history of HACCP, concept of HACCP, various types of hazard and their control, Principals of HACCP.

[10Hrs]

UNIT-V

Food products defects, their cause and remedies during harvesting, processing, storage and packaging of various food products like fruits and vegetables, milk and milk products, bakery products, confectionary products & other food products.

[10 Hrs]

Course Outcome:

1. Students will able to evaluate sensory attributes like color, flavor, texture and acceptance of food products.
2. Students will able to analyze quality parameters by different analytical techniques.
3. Students will know the food standards, food laws and regulations.
4. Students will know the microbial parameters in food products.
5. Students will able know the various defects and rectify them.

Reference Books:

1. L. H. Meyer, Food chemistry, Published van Nostrand Reinhold co. New York (5th edition, March 2017).

2. Owen R. Fennema, Principle of food science, food chemistry, publisher Marcel Dekker inc New York, (3rd edition, 1996).

3.Morries B. Jacobs, The chemical analysis of food and food products, published Van Nostrand Company Priceton New Jersey (3rd edition, 2006).

Department	**: Department of Food Technology**
Course code	**: FTC-405**
Course Title	**: Food Quality Lab**
Course Type	**: Practical**
Total Hrs	**: 03**
Course credit	**: 1.5**

Course Pre-requisite:
To learn the basic knowledge of Food Quality, requires pre-knowledge of Food Chemistry, Food Processing I, Principles of Food Preservation, Food Microbiology, Instrumentation and Process Control.

Course Objective:

1. To analyze various food products as per specification.
2. To analyze various milk products as per specification.
3. To analyze the quality of confectionery products and beverages as per specification.
4. Analysis of the raw material.

Course Content:
Analysis of finished products Quality, Bread, biscuits, cake, extruded products, protein Concentrates.
Fruit juices, squashes, jams, jellies, concentrates, pickles, canned fruitProducts.
Milk products like cheeses, paneer, shreekhand. Milk powder.
Alcholic beverages & soft drinks.
Confectionary products.
Raw materials analysis, Maida , oils and fats.

Course Outcome:

1. Students will be capable of analyzing the quality parameters of bakery and extruded products.
2. Students will be capable to analyzing the quality parameters of jam, squash, pickles, canned fruits.
3. Students will be capable to analyzing the quality parameters of cheese, paneer, milk powder and shrikhand.
4. Students will be capable to analyzing the quality parameters of soft drinks and alcoholic beverages.
5. Students will be capable to perform the proximate analysis of raw material.

Reference Books:

1. Jacob M.R., D.VanNostrandCo. Inc., The chemical analysis of foods & food products, Princeton,- New jersey, New York, (3rd edition, 2006).

2. Pearson D., J.E.A. Churchill, The Chemical analysis of foods 104, Goucester place, London (7th edition, 1976).
3. Ranganna S., Tata, Manual of analysis of fruits & vegetable products, McGraw Hill publishing Co., New Delhi, (2nd edition, 2005).
4. Official Methods of Analysis of the association of Official Analytical chemists, Pub. Assoc. Office, Anal chemists. Washington D.C. (11th edition, 1970).
5. Food Analysis: Theory and practice IS:6273(Part-1&Part-2) Y.Pomeranz(3rd edition).
6. BIS and AOAC Methods of Food analysis (17th edition, 2000).
7. Principle of Sensory Analysis of Food M.A. Amerine, Elsevier (1st edition, 1965) (ISBN: 978-1-4832-0018-7).
8. J.M. DeMan, Rheology and Texture in Food Quality, A V I Publishing Company, Westport Connecticut, USA (1976).
9. Tata, "Hand Book of analysis and quality control for fruit and Vegetable Products", McGraw-Hill Publishing Company Ltd. New Delhi, (2nd edition).
10. Morris B. Jacobs, The Chemical Analysis of Foods & Food Products (Publication Date: February 1939).
11. Morris B. Jacobs, The chemical analysis of food and food products, published Van Nostrand Company Ing, Princeton New jersey, (3rd edition).

Department : Department of Food Technology
Course code : FTL-406
Course Title : Biochemical Engineering (Elective-III)
Course Type : Theory
Total Hrs : 04
Course credit : 04

To learn the basic knowledge of Biochemical Engineering, requires knowledge of Food Biotechnology, Food microbiology, Food biochemistry and nutrition & Chemical engineering.

Course Objective:

1. To study energy and mass balance of biosystem.
2. To study the sterilization techniques by batch and continuous process.
3. To study the bioreactors design and process control.
4. To study the isolation of products from fermentation broth by various downstream processing.
5. To study the immobilized enzyme & their industrial application**.**

Course Content:

UNIT I:

Microbial growth&kinectics,Mass& energy balance and Thermodynamics of biosystem, kinetics of substrate utilization & product formation. Application of material balances to bioprocess.

(10 Hrs)

UNIT II:

Sterilization: Importance of sterilization, batch sterilization of liquid, continuous sterilization of liquid and sterilization of air. Design, Preparation &sterilization of fermentationmedia. (10Hrs)

UNIT III:

Oxygen transfer & microbial respiration, bubble aeration and mechanical agitation. Oxygen mass transfer in bioreactor, measurement of oxygen transfer coefficient (Kla), operating variables, effect of bubble size and temperature, impeller, surface active agents, mycelium and types of sparger on mass transfer coefficient.

(10 Hrs)

UNIT IV:

Types of reactor, continuous stirred tank reactor (CSTR), packed bed bioreactor, bubble column bioreactor, fluidized bed bioreactor, trickle bed bioreactor and air lift bioreactor, design of fermenter. Scale up of bioreactor systems. Bioprocess simulation & control.

(10 Hrs)

UNIT V:

Downstream processing &bio separation, recovery of intracellular product from fermentation broth by disruption of cell, mechanical methods and celllysis.
Techniques of Immobilization of enzymes and their industrial application

(10 Hrs)

Course outcomes:

1. Student will be able to estimate energy and mass balance of bio-system.
2. Students will able to sterilize fermenter, medium and air by using thermal and filtration techniques.
3. Student will able to design bioreactor
4. Student will able to isolate the product from fermentation broth and immobilize enzyme.

Reference Books:

1. GhoseT.K.,Bioprocess Computations in Biotechnology, Published by Ellis Horwood Ltd. (2nd edition, 1990).
2. GhoseT.K. & Fletcher A, Advances in biochemical Engineering, Springer verlag Berlin, Heidelberg, New York, (vol 1 to 6, 1971).
3. Blake Brough, Biochemical Engineering Science, Academic press,London, (vol 1& 2, 1968).
4. Weetal H.H., ,Immobilised enzymes, Antigens, antibodies & Peptides , Marcel Dekkar, New York, (vol,2,3& 4, 1975).
5. Bailey James E. & Ollis D.F., Biochemical Engineering fundamentals, McGraw Hill Book Co., (1977).
6. Peter Stanbury, Allan Whitaker, Stephen Hall ; Principles of Fermentation Technology, (3rd edition, 2016)

Department : Department of Food Technology
Course code : FTL-407 (Elective-III)
Course Title : Dairy Technology
Course Type : Theory
Total Hrs : 04
Course credit : 04

Course Pre-requisite:
To learn the basic knowledge of Dairy Technology, requires pre-knowledge of Food processing-I & Food Processing II, Food Biotechnology, Food Microbiology& Biochemical Engineering.

Course Objectives:
1. To study various milk products and their bi-products.
2. To study the preservation techniques of raw milk.
3. To study packaging technology of milk products.
4. To study the concentration techniques of the milk & milk products
5. To study the cleaning & sanitization of dairy industry

Course Content:

Unit I:
Milk chemistry, storage and distribution, Important manufacturing steps of packed milk, butter, ghee, evaporated, condensed, Whole and skimmed milk powder.

(10 Hrs)

Unit II:
Use of bio-protective factors for preservation of raw milk: effects on physicochemical, microbial and nutritional properties of milk and milk products, present status of preservation of raw milk by chemical preservatives; thermal processing for preservation.

(10 Hrs)

Unit III:
Status of current packaging; types of packaging materials; criteria for selection of proper packaging; testing of packaging materials.

(10 Hrs)

Unit IV:
Dehydration: advances in drying of milk and milk products; freeze concentration, freeze dehydration: physicochemical changes during freeze drying and industrial developments.

(10 Hrs)

Unit V:
Current trends in cleaning and sanitization of dairy equipment: biological; detergents; Automation; Ultrasonic techniques in cleaning; bio-detergents, development of sanitizers-heat; chemical; radiation, mechanism of fouling and soil removal; Bio-films, assessing the effectiveness of cleaning and sanitization of dairy products.

(10 Hrs)

Course Outcomes:

1. Student will able to prepare various milk products and their byproducts.

2. Student will able to preserve the raw milk and their products
3. Student will able to properly pack the dairy products for increasing shelf life.
4. Student will able to prepare dehydrated, concentrate milk & milk product.
5. Student will able to maintain cleanliness and hygiene in milk dairy.

Reference Books:

1. Smit, G., Dairy Processing – Improving quality, CRC – Woodhead, Publishing, England (2003).
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