



Department of Technology
SHIVAJI UNIVERSITY, KOLHAPUR
THIRD YEAR B.TECH (FOOD TECHNOLOGY)
 Curriculum Structure
Semester – V

Sr. No.	Subject Code	Subject Title	Contact hours			Credits
			L	T	P	
1	FT 311	Process Instrumentation, Dynamics & Control	3	-	-	03
2	FT312	Food Process Engineering-II	3	-	-	03
3	FT 313	Fruits & Vegetables Processing Technology	3	-	-	03
4	FT314	Technology of Cereals & Bakery Products	4	-	-	04
5	FT315	Dairy Technology	3	-	-	03
6	FT 316	Process Instrumentation, Dynamics & Control	-	-	2	01
7	FT317	Food Process Engineering- II Lab	-	-	2	01
8	FT 318	Fruits & Vegetables Processing Technology Lab	-	-	2	01
9	FT319	Technology of Cereals & Bakery Products Lab	-	-	2	01
10	FT3110	Dairy Technology Lab	-	-	2	01
11	AC 312	Audit Course II Presentation and Communication Techniques	2	-	-	-
Total			18	-	10	21
Total Contact hours per week = 28						

Semester –VI

Sr. No.	Subject Code	Subject Title	Contact hours			Credits
			L	T	P	
1	FT 321	Sugar and Confectionery Technology	3	-	-	03
2	FT 322	Food Packaging	3	-	-	03
3	FT 323	Industrial Economics and Management	3	-	-	03
4	FT 324	Biochemical Engineering	3	-	-	03
5	FT 325	Process Equipment Design and Drawing	3	1	-	04
6	FT 326	Sugar and Confectionery Technology Lab	-	-	2	01
7	FT 327	Food Packaging Lab	-	-	2	01
8	FT 328	Biochemical Engineering	-	-	2	01
	FT 329	Process Equipment Design & Drawing Lab	-	-	2	01
9	FT 3210	Mini Project	-	-	2	01
10	AC 323	Audit Course III Research Methodology	2	-	-	-
Total			17	1	10	21
Total Contact hours per week = 28						

Note : Tutorials and Practical shall be conducted in batches with batch strength not exceeding 18 students.



Shivaji University, Kolhapur

Department of Technology
Third Year B. Tech (Food Technology) (Semester V)

PROCESS INSTRUMENTATION, DYNAMICS & CONTROL (FT 321)

Teaching Scheme: L: 3 hrs/week

Credits: 3

UNIT I Measuring Instruments

(06 Hrs)

Theories, practice and applications of measurements of temperature, mass and levels. Measurement of pressure, vacuum, humidity & pH in process industry.

UNIT II Flow measuring instruments

(04 Hrs)

Flow measuring devices for incompressible and compressible fluids. Electro-hydraulic valves, hydraulic servomotors, electro-pneumatic valves. Pneumatic actuators.

UNIT III Introduction to simple system analysis

(06 Hrs)

Characteristics of Chemical Process Control, Mathematical Modeling of Chemical Processes, State Variables and State Equation for Chemical Processes. Input –Output Model, Linearization of non linear systems, Solution of Linear differential equation using Laplace Transform. Block diagrams, linearization. First and higher order systems.

UNIT IV Dynamic behavior of first & second order system

(10 Hrs)

Pure capacity process, First order system with variable time constant and gain, Response of first order system in series: Interacting and Non-interacting systems. Under damped and over damped and critically damped systems, Transportation lag. Higher order systems. Introduction to feedback control, Controllers and final control elements. Control action block diagram of chemical reactant control systems.

UNIT V Dynamic behavior of feedback control processes

(08 Hrs)

P, PD, PI, and PID. Design of feedback controller, Performance criteria, selection of type of controller, Tuning of feedback controller. Stability analysis by Routh criteria, Root Locus Diagram.

UNIT VI Frequency response analysis of linear processes

(08 Hrs)

Bode's diagram, Nyquist plots. Design of feedback control system using frequency response technique: Bode's stability criteria, gain and phase margin. Ziegler – Nichols tuning technique. Nyquist stability criteria, Control Systems with Multiple Loops, Feed forward control, Cascade control, Ratio control, selective control, split range control, Adaptive and Inferential control. Multi Variable Control

TEXT BOOKS/ REFERENCES:

- 1) Eckman, Industrial Instrumentation; Wiley Eastern
- 2) Erwing, Instrumental Methods of Chemical Analysis; McGraw Hill.
- 3) W.Bottom, Instrumentation & Process Measurements; Orient Longman.
- 4) George Stephanopoulos, Chemical Process Control, Prentice Hall of India.
- 5) D.R. Coughnour, Process System Analysis and Control, McGraw-Hill.
- 6) R.P.Vyas, Process Control & Instrumentation, 2nd edition, Central Techno publication, Nagpur.
- 7) K. Krishnaswamy, Process Control, New age International.
- 8) Peter Harriott, “Process Control”, Tata McGraw Hill, New Delhi, 1977.
- 9) Coulson and Richardson, “Chemical Engineering” Volume – III, Second Edition, Pergmon Press, (UK), 1985.
- 10) Stephanopoulos G., “Chemical process control and introduction to theory and practice”



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Department of Technology
Third Year B. Tech (Food Technology) (Semester V)
FOOD PROCESS ENGINEERING II (FT 312)

Teaching Scheme: L: 3 hrs/week

Credits: 3

UNIT I Evaporation (6Hrs)

Principles of evaporation, types and selection of evaporators, mass and energy balance. Design of single and multiple effect evaporators

UNIT II Crystallization (4 Hrs)

Theory and principles of Crystallization . Nucleation, crystal growth, crystallization equipment. Application of crystallization in food processing.

UNIT III Thermal processing (10 Hrs)

Principles of Blanching, Pasteurization and Sterilization. Microbial survivor curves, thermal death time F, spoilage probability, methods for process calculations.

UNIT IV Psychrometrics (6Hrs)

Properties of dry-air : composition of air, specific volume of air, specific heat of dry air,enthalpy of dry air, dry bulb temp.

Properties of water-vapor : Specific volume of water vapor, specific heat of water vapor,enthalpy of water vapor.

Properties of air-vapor mixtures: Gibbs-Dalton law, Dew-point temp, humidity ratio (or moisture content), relative humidity, wet bulb temperature.

The psychrometric chart : Use of psychrometric chart to evaluate complex air conditioning processes.

UNIT V Drying (6Hrs)

Principles of drying, drying rate kinetics, Classification, mass and energy balance. Different types of dryers and components - roller, spray, tray, fluidized bed etc

UNIT VI Freezing and Refrigeration (8 Hrs)

Types, refrigerants, effect of low temperature on quality, equipments and freeze drying, freezing time calculation methods

TEXT BOOKS/ REFERENCES:

1. R. Paul Singh and Heldman” Introduction to Food Engg.”, Academic Press ,4th ed.,2009.
2. Charm SE;”The Fundamentals of Food Engineering” AVI Pub. 1963,
3. Toledo RT “Fundamentals of Food Process Engineering”; CBS Publishers2nd ed, 2000,
4. McCabe, Smith & Harriot; ”UNITOperations of Chemical Engineering”; 6th ed,TMH.
5. Geankopolis “Transport Processes & UNIToperation” 3rd ed, PHI.
6. Coulson, J. M. & Richardson, J. F. “Chemical Engineering” (Vol. I & II) SecondEdition, Pergmon Press, (UK), 1985.



Shivaji University, Kolhapur

Department of Technology
Third Year B. Tech (Food Technology) (Semester V)

FRUITS AND VEGETABLES PROCESSING TECHNOLOGY (FT 313)

Teaching Scheme: L: 3 hrs/week

Credits: 3

UNIT I Introduction to Fruits & Vegetables (6 Hrs)

Current status of production and processing of fruits and vegetables. Post-harvest physiology, handling, losses and conservation of

UNIT II Structure & Composition (6 Hrs)

Structural, compositional and nutritional aspects of fruits and vegetables.

UNIT III Canning (08Hrs)

Canning, Materials for canning, different machineries in cannery plant, defects in canning and plant layout of ideal canning unit. Aseptic packaging.

UNIT IV Processing Technology of fruits (08 Hrs)

Technology of Jams, Jellies marmalade, Glazed fruits, Crystallized fruits, fruits candy, and fruit preserve.

UNIT V Processing Technology of vegetables (6 Hrs)

Tomato Products: sauces, ketchups, puree, pastes.
Chutneys & pickles, Dehydrated fruits and vegetables : powders

UNIT VI Technology of beverages (6 Hrs)

Juices & pulps, RTS, concentrates squashes, cordials, nectars, carbonated beverages.

TEXT BOOKS/ REFERENCES:

1. Girdharilal & Sidappa G.S. "Preservation of fruits & vegetables", ICAR. New Delhi.
2. Tressler D.K. & Joslyn M.A. "Fruits & vegetables juice processing technology" edited by AVI publishing Co. Westport, Connecticut 1971
3. Wills, Lee, Graham, McGlasson & Hall "Post-Harvest Physiology & Handling of Fruits & Vegetables" AVI Publication
4. Shrivastava and Kunal. "Fruit and Vegetable Preservation"



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Department of Technology
Third Year B. Tech (Food Technology) (Semester V)

TECHNOLOGY OF CEREALS AND BAKERY PRODUCTS (FT 314)

Teaching Scheme: L: 4 hrs/week

Credits: 4

UNIT I Introduction of Cereals

(4Hrs)

Present status and future prospects of cereals (Rice, Wheat, Corn, Sorghum, Rye)

UNIT II Wheat

(4Hrs)

Morphology, Structure, composition, milling, Parboiling, Products

UNIT III Rice

(6Hrs)

Morphology, Structure, composition, milling, Parboiling, Products

UNIT IV Corn

(6Hrs)

wet milling and dry milling, corn flakes, starch and its hydrolyzed syrups.

UNIT V Barley, Sorghum and Millets – Oat / Rye

(14Hrs)

Barley

Morphology, Physico-chemical properties and processing (Malting)

Sorghum

Morphology, Physico-chemical properties, Milling, Malting, Pearling and industrial utilization

Millets – Oat / Rye

Importance of Millet, composition, processing of millets for food uses

UNIT VI Bakery products

(6Hrs)

Bread, biscuits, cookies, Cake, Pastry (Role of ingredients, processing, major machineries, Quality control)

TEXT BOOKS/ REFERENCES:

1. Matz Samuel A “Cereal technology:” AVI publishing co. Inc Westport Connecticut 1970
2. Kent Jones W.D. & Amos A.J., “Modern Cereal Chemistry” Food Trade Press Ltd. London 1976
3. Matz S.A, “Snack food technology” AVI publishing Co.1976.
4. Matz Samuel “Bakery technology” CBS Publications
5. Pomeranz Y. “Wheat chemistry & technology”, edited by American Association of cereal chemists, Minnesota 1978
6. Daniel A.R “Bakery materials & methods” Mc Larene & sons Ltd.London 1947
7. Manufacture of biscuits cakes & wafers by Fritsch J. & Grosspicrre, London 1932.
8. Bakery Technology and Engineering by Samuel a. Matz,
9. Samuel A Matz “ Cereals as Food and Feed “, CBS Publications
10. S.A. Matz “Cookies & Cracker Technology “CBS Publications
11. Pyler “Baking Science and Technology”
12. S.C. Dubey “Basic Baking”.



Shivaji University, Kolhapur

Department of Technology
Third Year B. Tech (Food Technology) (Semester V)

DAIRY TECHNOLOGY (FT 315)

Teaching Scheme: L: 3 hrs/week

Credits: 3

UNIT I Introduction

(4 Hrs)

Present status and future prospects of dairy industry,

UNIT II Properties of milk

(3 Hrs)

Definition of milk, composition of milk from different species, colostrums, Nutritive value of milk and milk products. Physico – Chemical properties of milk.

UNIT III Processing of milk

(8Hrs)

Collection, Processing: Pasteurization and sterilization of milk, Distribution of milk, Dairy equipments.

UNIT IV Milk Products

(15 Hrs)

Butter and butter oil (Ghee), yoghurt and cheese: Classification, manufacturing process and quality controls, Ice-cream : Types of ice creams and manufacturing process

Indigenous milk products

Dahi, Khoa, Channa, Shrikhand, Paneer, Lassi, Butter milk, Rasgolla, pedha and burfi

UNIT V Condensation & Evaporation of milk

(7Hrs)

Condensed milk, Kheer, Basundi, Milk powder: Skim milk powder and whole milk powder,

UNIT VI Hygiene & Sanitation in Dairy Industry

(6 Hrs)

Hygiene, Sanitation & cleaning in Dairy Industry

TEXT BOOKS/ REFERENCES:

1. Robinson RK; 1996; Modern Dairy Technology, Vol 1 & 2; Elsevier Applied Science Pub.
2. Herrington BL “Milk & Milk Processing”, McGraw-Hill Book Company. 1948
3. Lampert LH; “Modern Dairy Products”, Chemical Publishing Company 1970.
4. Fox PF “Developments in Dairy Chemistry – Vol 1 & 2”, Applied Science Pub Ltd.
5. De Sukumar “Outlines of Dairy Technology” Oxford University Press 6
6. Lampert I.M. “Modern dairy products”, Eurasia publishing House Ramnagar New Delhi, 1970.
7. Webb B.H. & Whittier E.O “Byproducts from milk” , AVI publishing Co., Connecticut, 1970.
8. James N.Warner “Principles of Dairy Processing “, Wiley Eastern Ltd.
9. Eckles, Combs and Macy “Milk and Milk Products”, Tata McGraw Hill.
10. Aneja et al “Technology of Indian Milk Products”. A Dairy India Publication.



Shivaji University, Kolhapur

Department of Technology
Third Year B. Tech (Food Technology) (Semester V)

Laboratory-I

PROCESS INSTRUMENTATION, DYNAMICS & CONTROL (FT 316)

Teaching Scheme: P: 2 hrs/week

Credits: 1

PRACTICALS:

Practical and Term work shall consist of minimum eight experiments from list given below.

Dynamic behavior of first order system

1. Mercury Thermometer
2. Single tank system.
3. C.S.T.R.

Dynamic behavior of first order system in series

4. Two tank non-interacting system.
5. Two tank interacting system.

Dynamic behavior of second order system

6. Mercury Manometer

Dynamic behavior of final control Element

7. Pneumatic control valve.

Study of Pneumatic controllers.

8. Proportional Controller
9. Proportional Derivative Controller
10. Proportional Integral Controller
11. Proportional Integral Derivative Controller

Control Systems

12. Study of closed loop control system.



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Department of Technology
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Laboratory-II

FOOD PROCESS ENGINEERING II (FT 317)

Teaching Scheme: P: 2 hrs/week

Credits: 1

PRACTICALS :

1. Study of evaporator
2. Study of dryers
3. Study of Freezing of foods by different methods
4. Study of crystalliser
5. Design problems on evaporators,
6. Design problems on Dryers,
7. Numerical problem on Thermo bacteriology (D, Z, & F)
8. Determination of freezing time of a food material,
9. Determination of air properties using psychometric chart
10. Visit to food industry



Shivaji University, Kolhapur

Department of Technology
Third Year B. Tech (Food Technology) (Semester V)

Laboratory-III

FRUITS AND VEGETABLES PROCESSING TECHNOLOGY (FT 318)

Teaching Scheme: L: 2 hrs/week

Credits: 1

PRACTICALS :

1. Demonstration of canning of Fruits and Vegetables,
2. Preparation of fruit jam,
3. Preparation of fruit jelly,
4. Preparation of fruit marmalade,
5. Preparation of fruit preserve and candy,
6. Preparation of fruit RTS/Syrups,
7. Preparation of fruit squash
8. Preparation of grape raisin,
9. Preparation of pickle
10. Dried vegetables



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Department of Technology
Third Year B. Tech (Food Technology) (Semester V)

Laboratory-IV

TECHNOLOGY OF CEREALS AND BAKERY PRODUCTS (FT 319)

Teaching Scheme: L: 2 hrs/week

Credits: 1

PRACTICALS :

1. Physico-chemical properties grains
2. Physico-chemical properties flours,
3. Determination of gluten content
4. Preparation of bread,
5. Preparation of biscuits,
6. Preparation of cookies,
7. preparation of crackers,
8. Preparations of buns,
9. Preparation of cake,
10. Visit to Bakery industry



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Department of Technology
Third Year B. Tech (Food Technology) (Semester V)

Laboratory-V

DAIRY TECHNOLOGY (FT 3110)

Teaching Scheme: L: 2 hrs/week

Credits: 1

PRACTICALS:

1. Sampling and analysis of milk – physico chemical properties and composition,
2. DMC and DYC reduction tests, presence of adulterants and preservatives.
3. Standardization of milk for markets,
4. Clarification and separation of milk,
5. Preparation of butter and ghee,
6. Ice-cream preparation,
7. Preparation of dahi, shrikhand, lassi etc,
8. Preparation of khoa and khoa based sweets,
9. Preparation of channa, paneer and chana based sweets,
10. Visit to Dairy plant



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Department of Technology
Third Year B. Tech (Food Technology) (Semester V)

AUDIT COURSE-II

PRESENTATION AND COMMUNICATION TECHNIQUES (AC 312)

Teaching Scheme: P: 2 hrs/week

No Credits, University grade

UNIT I Communication in a Business Organization (05 Hrs)

Internal (Upward, Downward, Horizontal, Grapevine, Problems, Solutions) External Communication, Strategies for conducting successful business meetings, documentation (notice, agenda minutes) of meetings. Introduction to modern communication techniques (for e.g. e-mail, internet, video conferencing etc), Legal & ethical issues in communication (intellectual property rights, patents)

UNIT II Advanced Technical Writing (05 Hrs)

- a. Report – Writing and presentation: Definition and importance of reports. Qualities of Reports, language and style in reports, type of reports, formats (letter, memo, and project- reports), and methods of compiling data. A computer-aids
- b. Technical Paper Writing
- c. Writing Proposals

UNIT III Interpersonal Skills (05Hrs)

Introduction to emotional intelligence, Motivation, Negotiation and conflict-resolution Assertiveness, Leadership, Team-building, Decision-making, And Time-management.

UNIT IV Interview Techniques (06Hrs)

Preparing for job interviews, verbal and non-verbal communication during interview. Observation sessions and role-play techniques may be used to demonstrate interview strategies.

UNIT V Group Discussion (05Hrs)

Dynamics of Group Behavior, Techniques for effective participation.

ASSIGNMENTS:

- a) Written

assignments on Communication topics (minimum 2)

assignments on Report writing (minimum 3)

assignments on Interpersonal Skills (minimum 3)

- b) One class test

c) Oral: Practical sessions on Group-discussion / Interview Skills / Project Presentation / Power point Presentation.

Break up of Term Work Marks

a) Assignments Written: 20 marks

b) Test: 10 marks

c) Performance in Oral: 20 marks

Total 50 marks

Books Recommended:

A. For classroom teaching

- (i) Fred Luthans, ‘ Organizational Behavior’ McGraw Hill International Edition
- (ii) Lesiker and Petit ‘Report writing For Business’ McGraw Hill International Edition
- (iii) Huckin and Olsen ‘Technical Writing and Professional Communication’ – McGra Hill International Edition
- (iv)Wallace and Masters ‘Personal Development for life and Work’ (workbook) ThomsonLearning
- (v)Herta Murphy ‘Effective Business Communication’ Hearta Murphy

B. For Additional Reading:

- (i) Lewicki, Saunders, Minton ‘Essential of Negotiation’ McGraw Hill International Edition
- (ii) Hartman Lemay ‘Presentation Success’ Thomson learning.
- (iii)Kitty O Locker & Kaczmark – Business Communication Building Critical Skills McGraw Hill
- (iv) Vikas Gupta:Comdex Computer Course Kit, IDG Books Pvt, Ltd.
- (v) Heller & Handle: The Essential Manager’s Manual – Dorleen Kindercey
- (vi) The Sunday Times ‘Creating Success Series’ 1.

Develop your Assertiveness.

2. Make every Minute Count.

3. Successful Presentation Skills.

4. How to motivate people.

5.Team building.



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Department of Technology
Third Year B. Tech (Food Technology) (Semester VI)

SUGAR AND CONFECTIONARY TECHNOLOGY (FT 321)

Teaching Scheme: L: 3 hrs/week

Credits: 3

UNIT I Introduction of sugar and Confectionary

(6 Hrs)

Present status and future scope of sugar and confectionery industries.

UNIT II Properties of ingredients

(6 Hrs)

Sugar : sugar qualities, physical, chemical, optical properties of sugar.

Other Ingredients :

Properties of invert sugar, glucose syrup, dextrose, fructose, lactose, caramel, maltose, honey, sorbitol, xylitol, iso malt, soy maltose, polydextrose, lactitol, maltitol, Additives used in confectionery.

UNIT III Sugar, Cocoa and Chocolate processing

(08 Hrs)

Sugar :

Processing of sugar,

Cocoa :

cocoa bean processing, roasting, fermentation, production of cocoa butter, cocoa powder, its quality

Chocolate :

Ingredients, mixing, refining, conching, tempering, moulding, cooling, coating, fat bloom

UNIT IV High boiled sweets

(6 Hrs)

Introduction, composition, properties of high boiled sweets, preparation of high boiled sweets, traditional, batch and continuous method of preparation. different types of higher boiled sweets, recipes

UNIT V Toffee, Fudge and Caramel

(10 Hrs)

Definition, composition, types of ingredient and their role. batch and continuous method of Toffee, Fudge and Caramel

UNIT VI Lozenges ,Fondant and Chewing Gums

(4 Hrs)

definition recipe, method of manufacture, compositions, factors affecting quality, industrial production, checklist of faults

TEXT BOOKS/ REFERENCES:

1. R. Less and E.B. Jackson “Sugar Confectionery and Chocolate Manufacture”
2. S.T. Beekelt “Industrial Chocolate Manufactory and Use”
3. Bernared W. Minifie “Chocolate, Cocoa & Confectionery Sci and Tech.”
4. E.B Jackson & Lees R “Sugar confectionary & chocolate”, Leonard Hill Books 24, market square Aylesbury



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Department of Technology
Third Year B. Tech (Food Technology) (Semester VI)

FOOD PACKAGING (FT 322)

Teaching Scheme: L: 3 hrs/week

Credits: 3

UNIT I Introduction to Food Packaging

(6Hrs)

Package requirements, package functions, Hazards acting on package during transportation, Storage and atmospheric package, labeling laws

Mechanical and functional tests on Package :

Various mechanical and functional testes perform in laboratories on package boxes and package materials

UNIT II Package Materials

(08Hrs)

Classification packages, paper as package material its manufacture, types, advantages corrugated and paper board boxes etc. Glass as package material, Manufacture, Advantages, disadvantages. Metal as package material-manufacture, Advantages, disadvantages, Aluminum as package material,. Its advantages and disadvantages, plastic as package material classification of polymers, properties of each plastics, uses of each plastics, chemistry of each plastic such as polyethylene, Polypropylene, polystyrene, polycarbonate, PVC, PVDC, Cellulose acetate, Nylon etc.

UNIT III Lamination and Coating on paper & films

(8 Hrs)

Lamination, need of lamination, types, properties, advantages & disadvantages of each type. Types of coatings. Need of coating, methods of coatings.

UNIT IV Aseptic packaging

(6 Hrs)

Need, Advantaged, process, comparison of conventional & aseptic packaging, system of aseptic packaging and materials used in aseptic packaging. Machineries used in Packing foods

UNIT V Packaging of Specific Foods

(6 Hrs)

Packaging of specific foods with its properties like bread, biscuits, coffee, milk powder, egg powder, carbonated beverages. Snack foods etc.

UNIT VI Novel Food Packaging

(6 Hrs)

Packaging of Space food, Retort able pouches, Controlled and Modified atmosphere Packaging, Active packaging, Edible Packages etc.

TEXT BOOKS/ REFERENCES:

1. Joseph H. Hotchkiss “Food and Packaging Interactions” ACS symposium series -365, April 5-10, 1987, American chemical society, Washington DC, 1988.)
2. Winter A. Jenkins & James P Harrington “Packaging foods with plastics” Technomic publishing co. Inc, Lancaster. Basel.
3. Arthur Hirsch VNB – Van Nostrand Reinhold, New York “Flexible food packaging An AVI Book, ISBN 0-442-00609-8.
4. M.Mathlouthi “Food Packaging and Preservation (theory & practice)” Elsevier Applied science publisher, London and New york.
5. N.T.crosby “Food Packaging Materials (Aspect of Analysis & Migration of contaminants)” applied science publishers LTD. London.
6. A.S Athlye “Plastics in Packaging”, TMGH, New Delhi.
7. Edmond A Leonard “Packaging (specifications, purchasing & Quality Control)” 3rd edition by Marcel Dekker, INC- Newyork & Basel.
8. H.B Ajmera & M.R Subramanium “Plastics in packaging” Indian institute of packaging. Published by A.P.Vaidya, Secretary IIP, E2, MIDC,Industrial Area (Andheri (East), Bombay-400093.
9. Stanley Sacharois & Roger C. Griffin “Food Packaging” The AVI Publishing company Inc. 1970.



Shivaji University, Kolhapur
Department of Technology
Third Year B. Tech (Food Technology) (Semester VI)

INDUSTRIAL ECONOMICS AND MANAGEMENT (FT 323)

Teaching Scheme: L: 3 hrs/week

Credits: 3

Unit I Economic problem & National income (08 Hrs)

Economic problem

Law of demand, equilibrium between demand and supply, concepts of costs, cost curves and revenue curves of a firm, equilibrium of a firm under perfect competition, break-even analysis, break-even point.

National income

Concept of national income, estimation of national income, difficulties in measurement of national income, uses of national income figures.

Unit II Inflation (04Hrs)

Meaning, types of inflation, causes, effects, control of inflation, value of money, index numbers, construction, utility, limitations, business cycles, phases of business cycles.

Unit III Industrialization (04 Hrs)

Need, capital requirement, block and working, raising, finance, cottage and small scale industries, role in the Indian economy, problems of small scale industries, remedies.

Unit IV Principles of management (05Hrs)

Definition, nature, levels of management, functions of management.

- i. Planning: Nature, importance, types of plans, planning process, decision making.
- ii. Organization: Principles of organization, organizational structure.
- iii. Directing: Theories of motivation, communication, process and barriers, leadership styles.
- iv. Controlling: Control techniques.

Unit V Production management (03 Hrs)

Selection of site, plant layout, its type, functions of P.P.C. Materials management, purchase, inventory control, production and quality control.

Unit VI Finance management & Marketing management (07 Hrs)

Finance management

Scope and importance, capital structure planning, working capital management, sources of funds, financial industries of India.

Marketing management

Marketing concepts, physical distribution, advertising and sales promotion, marketing research, sales management.

TEXT BOOKS/REFERENCES:

1. Stonier, A. W. and Hague, D. C., “A Text Book of Economic Theory”, Longman.
2. Bach, George Leland, “Economics -Analysis, Decision Making and policy”, Prentice- Hall Inc. Englewood Cliffs N. J.
3. Bonham F., “Economics”, Sir Isaac Pitman and Sons Ltd., London.
4. Seth, M. L., “Principles of Economics”, Lakshmi Narayan Agarwal, Agra.
5. Agarwal, A. N., “Indian Economy”, Vikas Publishing House Pvt. Ltd., New Delhi.
6. Datta R. and Sundharam, K. P. M., “Indian Economy” S. Chand & Co. Ltd., New Delhi
7. Peter F. Drucker, “The Practice of Management”, Allied publishers pvt. ltd.,Bombay.
8. Barat, Nikhil, “Production management & Control”, Academic Publishers, Calcutta.
9. Garrett, Leonard J. & Silver, Milton, “Production Management Analysis”, Harcourt Brace Jovanovich, Inc. New York.
10. Kuchhal, S. C., “Financial Management: An- Analytical & Conceptual Approach”,Chaitanya Publishing House, Allahabad.
11. Pandey, L. M., “Financial Management”, Vikash Publishing House Pvt. Ltd., New Delhi.
12. Kotlel, Philip, “Marketing Management: Analysis, Planning & Control”, Prentice –Hall of India Pvt. Ltd: New Delhi
13. Sinha, J. C., “Marketing and Salesmanship”, S. Chand & Co., Delhi.
14. H.L. Ahuja, “Modern economics”, S. Chand and co. ltd., New Delhi.



Shivaji University, Kolhapur
Department of Technology
Third Year B. Tech (Food Technology) (Semester VI)

BIOCHEMICAL ENGINEERING (FT 324)

Teaching Scheme: L: 3 hrs/week

Credits: 3

UNIT I Kinetics of microbial growth and death (6 Hrs)

Definition, fermentation kinetics rate of cell synthesis, product formation and effect of environment. Types of kinetics, Batch and continuous type, control measures

UNIT II Simple enzyme kinetics (10 Hrs)

Simple kinetics model for enzyme substrate interaction. Derive the equation of Michelin Menton, for reaction rate, product formation, calculation of K_m and V_{max} values. Complex enzyme kinetics: Oxidation – reduction form of enzymes, observed apparent rate constant, factors affecting the inhibition, competitive, non competitive inhibition, substrate interaction

UNIT III Kinetics pattern of various fermentations (6 Hrs)

Classification of kinetics pattern, as per different scientists, simple, simultaneous, consecutive, stepwise, complex reactions and their examples

UNIT IV Air sterilization, aeration and agitation (10 Hrs)

Definition, thermal death time, media heat sterilization, advantages of continuous sterilization.

Aeration and agitation :

Oxygen requirement of industrial fermentations, determination of K_{La} Value, factors affecting K_{La} Value

UNIT V Fermenter (6 Hrs)

Design, operation and their problems during Scale up, management of cellular process.

UNIT VI Downstream processing and product recovery (10 Hrs)

Separation techniques like adsorption, chromatography, precipitation, ultra filtration etc., purification techniques: spray drying, fluidized bed drying etc, Product formation for value added products using bioconversions techniques, production of antibiotics, economic process, utilization of byproducts through bioconversion, present mode of utilization and their nutritional value.

TEXT BOOKS/ REFERENCES

- 1 Shuichi Alba, Arthur E. Humphrey and Nancy F. Millis “Biochemical Engineering”
- 2 Baily J.E. and Ollis D.F. “Biochemical Engineering Fundamentals” McGraw Hill Book Co., 1977.
- 3 Lee J. M. “Fundamentals of biochemical engineering”
- 4 Ghose T.K., “Bioprocess Computations in Biotechnology” Published by Ellis Horwood Ltd. 1990.
- 5 Ghose T.K. & Fietcher A “Advances in biochemical Engineering vol 1 to 6”, Springer verlag Berlin, Heidelberg, Newyork, 1971
- 6 Blakebrough, “Biochemical Engineering science vol1 & 2” Academic press London, 1968.
- 7 Weetal H.H “Immobilised enzymes, Antigens, antibodies & Peptides vol 1, 2, 3, & 4”., Marcel Dekkar Inc. Co., New York, 1975.
- 8 Whitaker “Principles of Fermentation Technology”



Shivaji University, Kolhapur

Department of Technology

Third Year B. Tech (Food Technology) (Semester VI)

PROCESS EQUIPMENT DESIGN AND DRAWING (FT 325)

Teaching Scheme: L: 3 hrs/week

Credits: 4

T: 1 hrs/week

UNIT I Design Considerations ,Keys & Storage vessels (11 Hrs)

Design Considerations

Design codes, Maximum working pressure, Design pressure, Design Temperature, Design stress, Factors of safety, Selection of factor of safety, Design wall thickness, Corrosion ratio, Poisson ratio, Criteria of failure, Elastic stability. Materials of construction: Mechanical properties, Materials, Corrosion, Protective coating ,Corrosion prevention, Choice of materials

Keys

Introduction, Types of keys, Strength of sunk key, Effect of key ways, Design of keys, Design of Heads: Introduction, Analysis and design of conical head, Flat cover head, Standard dished heads. Gaskets & Flanges: Introduction, Types of Gaskets & Flanges. Pipe joints: Standard pipe flanges for steam, Hydraulic pipe joints for high pressure, Design of circular flange pipe joints. Welded Joints, Riveted joints

Storage Vessels

Introduction, Design fixed conical roof cylindrical tank, Storage of gases in Spherical vessels Supports for vessels: Introduction, Bracket or Lug supports, Leg Supports, Skirt Supports

UNIT II Design of Cylindrical Vessels under internal Pressure (05 Hrs)

Introduction, Thin wall vessels, Design Equations. Design of process vessels and pipes under external pressure: Introduction, Determination of safe pressure against elastic failure, Determination safe external pressure against plastic deformation, Circumferential stiffness, Pipes and tubes under external pressure.

UNIT III Process Design of Heat Exchanger & Evaporators (06 Hrs)

Introduction, Types Of Heat Exchanger, Process Design of Shell & Tube Heat Exchanger. Process Design of Evaporator: Introduction, Types of Evaporators, Methods of Feeding of Evaporators, Design of Evaporator.

UNIT IV Process Design of Reaction Vessels & Design of Tall Vessels (11 Hrs)

Introduction, Materials of Construction, Agitation, Classification of Reaction Vessels, Heating Systems, Design of Reaction Vessels. Crystallizer Design: Introduction, Types of Crystallizers, Design of crystallizers. Process Design of Rotary Dryer: Introduction, Types Dryers, Design of Rotary Dryer.

Design of Tall Vessels

Introduction, The Axial Stresses Due To Dead Loads, The Axial Stresses Due To Pressure, Longitudinal Bending Stresses due to Dynamic Loads, Design Of Distillation (Tall) Column (Tower).

UNIT V Design for Distillation and Agitation

(05 Hrs)

Design of Sieve Tray for Distillation Column, Design of Thick Walled High Pressure Vessel, Design of Bubble Cap Tray For Distillation Operation, Agitators : Introduction, Types Of Agitators, Baffling, Power Requirements, Design Of Turbine Agitator.

UNIT VI Process Hazards and Safety Measures in Equipment Design

(05 Hrs)

Introduction, Hazards in Process Industries, Hazards Analysis, Safety Measures, Safety Measures in Equipment Design, Pressure relief Devices, Design of packed absorption tower: Introduction, Design of circular & diameter of Packed Absorption Tower

TEXT BOOKS/ REFERENCES

- 1 B.C. Bhattacharya, Introduction to Chemical Equipment Design (Mechanical Aspects), CBS Publisher and Distributors, New Delhi
- 2 M.V.Joshi, V.V. Mahajan, Process Equipment Design, 3rd Edition, Macmillan India Ltd.
- 3 Coulson & Richardson, Chemical Engineering (Vol. VI), Pergamon Press
- 4 R. S. Khurmi, J.M. Gupta, A Text Book of Machine Design, S. Chand & Company Ltd, New Delhi.
- 5 S.D. Dawande, Process Design of Equipments (Vol. I),Central Techno Publications, Nagpur.



Shivaji University, Kolhapur

Department of Technology

Third Year B. Tech (Food Technology) (Semester VI)

Laboratory-I

SUGAR AND CONFECTIONARY TECHNOLOGY (FT 326)

Teaching Scheme: L: 2 hrs/week

Credits: 1

PRACTICALS:

1. Production of invert sugar,
2. Preparation of hard boiled sweets,
3. Preparation of toffee,
4. Preparation of fudge
5. Preparation of chewing gum,
6. Preparation of chocolate,
7. Preparation of fruit toffee,
8. Preparation of lozenge,
9. Preparation of traditional Indian confection,
10. Visit to confectionary industry



Shivaji University, Kolhapur

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Third Year B. Tech (Food Technology) (Semester VI)

Laboratory-II

FOOD PACKAGING (FT 327)

Teaching Scheme: L: 2 hrs/week

Credits: 1

PRACTICALS:

1. Classification of various packages based on material and rigidity,
2. Measurement of thickness of paper, paper boards,
3. Measurement of water absorption of paper, paper boards,
4. Measurement of bursting strength of paper of paper boards,
5. Measurement Tear resistance of papers,
6. Measurement of puncture resistance of paper and paperboard,
7. Measurement of tensile strength of paper of paper boards,
8. Determination of gas transmission rate of package films,
9. Determination of WVTR of film,
10. Identification of Packaging materials,
11. Edible packaging of Fruits,
12. Visit to packaging industry



Shivaji University, Kolhapur
Department of Technology
Third Year B. Tech (Food Technology) (Semester VI)

Laboratory-III

BIOCHEMICAL ENGINEERING (FT 328)

Teaching Scheme: L: 2 hrs/week

Credits: 1

PRACTICALS:

1. Instrumentation and their control in fermentation industry - physical parameter
2. Instrumentation and their control in fermentation industry – chemical parameter,
3. To study the different parts and operation of laboratory fermentors
4. To study the thermal stability of peroxidase enzyme in potato
5. To asses the amylase activity from given foods sample
6. To measure the microbial growth during fermentation
7. To study the time temperature relationship for destruction of microorganisms
8. To study the ethyl alcohol production through bioconversion
9. Visit to Distillery Plant



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Third Year B. Tech (Food Technology) (Semester VI)

Laboratory- IV

PROCESS EQUIPMENT DESIGN AND DRAWING (FT 329)

Teaching Scheme: L: 2 hrs/week

Credits: 1

PRACTICALS:

- 1) Standard equipment symbols , Standard instrumentation symbols
- 2) Pipe fittings , flanges and gaskets, Heads and closures
- 3) Keys and couplings , Riveted joints , Welded joints
- 4) Pressure relief devices
- 5) Supports for vessels-Bracket Support ,Leg Support, Skirt Support.
- 6) Design and drawing of packed absorption tower
- 7) Design of heat exchangers.
- 8) Design of tall vertical vessels, Design of reaction vessel.
- 9) Design of evaporator.
- 10) Design of agitation system.



Shivaji University, Kolhapur
Department of Technology
Third Year B. Tech (Food Technology) (Semester VI)

Laboratory- VI

MINI PROJECT (FT 3210)

Teaching Scheme: L: 2 hrs/week

Credits: 1

MINI PROJECT

The purpose of this particular exercise is to promote self-study, critical thinking and independent research ability. Students have to initiate their own small conceptual or practical based projects individually or as a team of no more than 2 members. While making this exercise it is expected that the knowledge acquired by them through Research Methodology subject is applied by them

Carrying out mini project work will certainly help the students to for satisfactory and successful complete their major project in the final year.

Project Completion & Assessment

A 15 to 20-pages report is to be written upon completion of the activity. For team projects, each member has to write his own report. The report should include academic content such as the background, objectives, product/system description, the work done, the achievements and difficulties encountered. (20 Marks)

The students will deliver a seminar (for 10 Marks) and will make the demonstration of their work (for 20 Marks)



Shivaji University, Kolhapur

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Third Year B. Tech (Food Technology) (Semester VI)

AUDIT COURSE-III
RESEARCH METHODOLOGY (AC 323)

Teaching Scheme: L: 2 hrs/week

No Credits, University grade

Unit I: Research:

(14 Hrs)

a) Types, Research process and steps in it, Hypothesis, Research proposals and aspects.

b) Research Design: Need, Problem Definition, variables, research design concepts, Literature survey and review, Research design process, Errors in research.

c) Research Modeling: Types of Models, Model building and stages, Data consideration and testing, Heuristic and Simulation modeling.

d) Report Writing: Pre writing considerations, Thesis writing, Formats of report writing, Formats of publications in Research journals.

Unit II: Design of Experiments:

(14Hrs)

a) Objectives, strategies, Factorial experimental design, designing engineering

experiments, basic principles-replication, randomization, blocking, Guidelines for design

of experiments.

b) Single Factor Experiment: Hypothesis testing, Analysis of Variance components (ANOVA) for fixed effect model; Total, treatment and error of squares, Degrees of freedom, Confidence interval; ANOVA for random effects model, Estimation of variance components, Model adequacy checking.

c) Two factor Factorial Design, Basic definitions and principles, main effect and

interaction, response surface and contour plots, General arrangement for a two-factor

factorial design; Models-Effects, means and regression, Hypothesis testing.

References:

1. Montgomery, Douglas C. (2007), 5/e, Design and Analysis of Experiments, (Wiley India)
2. Montgomery, Douglas C. & Runger, George C. (2007), 3/e, Applied Statistics & Probability

for Engineers (Wiley India)

3. Kothari, C.R., Research Methodology –Methods and techniques, New Age Publications, New Delhi, 2009.

4. Krishnaswamy, K.N., Sivakumar, Appa Iyer and Mathiranjani M. (2006), Management Research Methodology; Integration of Principles, Methods and Techniques (Pearson Education, New Delhi)

5. Panneerselvam, R., Research Methodology, Prentice-Hall of India, New Delhi, 2004.

Equivalence of T.Y B. Tech (Food Tech.) Semester V & VI

The above detailed syllabus is a revised version of the T.Y. B. Tech (Food Technology) course being conducted by the Shivaji University at the Technology Department of the University. This syllabus is to be implemented from June 2013(academic year2013-14).

The Equivalence for the subjects of Food Technology at T.Y B Tech Semester V and VI pre-revised course under the faculty of Engineering and Technology is as follows.

T.Y.B Tech Semester V (Food Technology)

Sr. No.	T. Y. B. Tech(Food Tech.) Pre-revised syllabus	T. Y. B. Tech(Food Tech.) Revised syllabus	Remark
1.	Process Instrumentation, Dynamics & Control	Process Instrumentation, Dynamics & Control	No change in syllabus content
2.	Food Process Engineering-II	Food Process Engineering-II	Some improvements in syllabus content
3.	Fruits& Vegetables Processing Technology	Fruits& Vegetables Processing Technology	No change in syllabus content
4.	Technology of Cereals & Bakery Products	Technology of Cereals & Bakery Products	No change in syllabus content
5.	Dairy Technology	Dairy Technology	No change in syllabus content
6.	-----	Presentation and Communications Techniques	For introduction of research oriented subjects in Semester VI and for alignment with other division of the Department Presentation and Communications Techniques is shifted from Semester VI to Semester V

T.Y.B Tech Semester VI (Food Technology)

Sr. No.	T. Y. B. Tech (Food Tech.) Pre-revised syllabus	T. Y. B. Tech (Food Tech.) Revised syllabus	Remark
1.	Confectionery Technology	Sugar & Confectionery Technology	As per the suggestions of syllabus sub-committee and considering the importance of sugar technology especially in our area , it will be introduced with confectionary technology
2.	Process Equipment Design and Drawing	Process Equipment Design and Drawing	No change in syllabus content
3.	Food Packaging	Food Packaging	No change in syllabus content
4.	Biochemical Engineering	Biochemical Engineering	No change in syllabus content
5.	Food Quality & Safety Management	Industrial Economics and Management	Interchange between these subjects for better alignment as per the suggestion of committee
6.	Presentation and Communications Techniques	i. Mini Project ii. Research Methodology	As per the suggestions of syllabus sub-committee ,for introduction of research oriented subjects Mini project & Research Methodology and for alignment with other divisions of the Department, Presentation& Communications Techniques is shifted from Semester VI to V
7.	-----	Mini Project	As per the suggestions of syllabus sub-committee ,for increasing the interest of the student in research, this subject in introduced.
8.	-----	Research Methodology	As per the suggestions of syllabus sub-committee, for increasing the interest of the student in research, this subject is introduced.