DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO. ACAD / NP /M.E./M.Tech./97/2012

It is hereby notified for the information of all concerned that, the Academic Council at its meeting held on 06-07-2012 **has accepted the following New Syllabi** under the Faculty of Engineering & Technology **as appended herewith** :-

Sr. No.	Syllabi.
[1]	M.E. Mechanical,
[2]	M.E. Mechanical [Design Engineering],
[3]	M.E. [Thermal],
[4]	M.E. [Biotechnology],
[5]	M. Tech. [Computer Science and Technology],
[6]	M.Tech. [Food Processing Tech.].

This is effective from the academic year 2012-2013 and onwards.

All concerned are requested to note the contents of this circular for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO.ACAD/ NP/ M.TECH./
2012/20668-72

A.C.S.S. I.No.84

Date:- 03-08-2012.

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Director,
Board of College and
University Development.

Copy forwarded with compliments to :-

1] The Principals, affiliated concerned Colleges,
Dr. Babasaheb Ambedkar Marathwada University.

Copy to :-

1] The Controller of Examinations,
2] The Superintendent, [Engineering Unit],
3] The Superintendent, [Eligibility Unit],
4] The Record Keeper,
Dr. Babasaheb Ambedkar Marathwada University.

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S/030812/-*

Dr BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

New Structure and Syllabus of

M.TECH.

[FOOD PROCESSING TECHNOLOGY.]

EFECTIVE FROM - 2012-13 & ONWARDS

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

Teaching/Examination Scheme for the degree of Master of Technology (Food Processing Technology)

w.e.f. Year 2012-13

Semester-I

Course Code	Name of the Subject	Teaching h/week			Examination Scheme - Marks				
		Lectures	Tutorials	Total Hours	Theory	Class test	Term work	Viva-voce	Total
FPT-111	Food Microbiology & Bio-Chemistry	3	1	4	80	20	--	--	**100**
FPT-112	Food Preservation Technology	3	1	4	80	20	--	--	**100**
FPT-113	Food from Animal Sources	3	1	4	80	20	--	--	**100**
FPT-114	Food from Plant Sources	3	1	4	80	20	--	--	**100**
FPT-115	Food Plant Design and Economics	3	1	4	80	20	--	--	**100**
FPT-116	Food Processing Lab-I	--	6	6	--	--	50	50	**100**
FPT-117	Seminar-I	--	4	4	--	--	25	25	**50**
	Total	**15**	**15**	**30**	**400**	**100**	**75**	**75**	**650**

Semester-II

Course Code	Name of the Subject	Teaching h/week			Examination Scheme - Marks				
		Lectures	Tutorials	Total Hours	Theory	Class test	Term work	Viva-voce	Total
FPT-121	Food Process Engineering	3	1	4	80	20			**100**
FPT-122	Bakery & Confectionary Technology	3	1	4	80	20			**100**
FPT-123	Food Handling and Packaging	3	1	4	80	20			**100**
FPT-124	Food Standard and Regulations	3	1	4	80	20			**100**
FPT-125	Beverage and Industrial Fermentation	3	1	4	80	20			**100**
FPT-126	Food Processing Lab-II	--	6	6	--	--	50	50	**100**
FPT-127	Seminar-II	--	4	4			25	25	**50**
	Total	**15**	**15**	**30**	**400**	**100**	**75**	**75**	**650**

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

Teaching/Examination Scheme for the degree of Master of Technology (Food Processing Technology)

w.e.f. Year 2012-13

Semester-III

Course Code	Name of the Subject	Teaching h/week			Examination Scheme - Marks			
		Counselling	Dissertation Work	Total Hours	Theory	Term work	Viva-voce	Total
FPT-211	Dissertation Part-1	4	20	24		50	50	**100**
	Total	**4**	**20**	**24**		**50**	**50**	**100**

- Research Problem Identification and synopsis preparation {Intensive study on Research Idea (Instruction cum self study mode as recommended by the department after synopsis presentation)}
- Comprehensive Viva Voce

Semester-IV

Course Code	Name of the Subject	Teaching h/week			Examination Scheme - Marks			
		Counselling	Dissertation Work	Total Hours	Theory	Term work	Viva-voce	Total
FPT-221	Dissertation Part-2	4	20	24		100	200	**300**
	Total	**4**	**20**	**24**	--	**100**	**200**	**300**
	Grand Total							**1700**

(FPT 111) Food Microbiology and Bio-Chemistry

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

units	Contents	h
1.	Introduction – definition, historical development and significance of food microbiology; Microscope; classification & morphology of microbes; Techniques of pure culture; Anti-microbial agents – physical & chemical – mechanism & action. Sources of contamination: Air, Water, Soil, Sewage, Post processing contamination. Intrinsic &extrinsic factors influencing the growth of microorganisms in foods	6
2.	Microbiology of milk & milk products like cheese, butter, ice cream, and milk powder; Microbiology of meat, fish, poultry & egg and their products. Microbiology of fruits & vegetable and products like jam, jelly, sauce, juice; Microbiology of cereal & cereal products like bread, biscuits, and confectionary; Food Quality aspects of Fruits & vegetables; Milk & Milk products, Meat &Poultry: Introduction, Quality principles, Quality enhancement model. Application of quality enhancement model.	8
3.	Water: The basic molecule of life. Physical properties of water. Properties of hydration, solvation. Bound water, free water, water activity. Distribution of water in various foods and moisture determination.	6
4.	Carbohydrates: Nomenclature and classification, structure and chemical properties of monosaccharide carbohydrates, disaccharides and polysaccharides, changes in carbohydrates during processing. Lipids: Classification, structure, physical and chemical properties of fatty acids and fats. Simple and derived lipids. Changes during food processing.	10
5.	Proteins: Classification, structure and properties of amino acids, structure of protein, physical and chemical properties of proteins. Changes in proteins during processing, Vitamins and minerals: Classification, structure and role of vitamins in food. Aroma substances. Enzymes: Classification, nomenclature, activation energy, factors affecting enzymes action, mechanism of enzyme action. Enzyme inhibition.	10

Reference Books:

1. Food Microbiology, M R Adams and M O Moss, New Age International, New Delhi (1996)
2. Food Microbiology; WC Frazier; Tata McGraw Hill, Delhi
3. Modern Food Microbiology; James M Jay; CBS Publishers, Delhi
4. Microbiology; Pelczar, Chan and Krieg; Tata McGraw Hill, Delhi
5. Essentials of Microbiology; K. S. Bilgrami; CBS Publishers, Delhi
6. Food: Facts and Principles-N. ShakuntalaManay, Shadksharawamis.
7. Essentials of Biochemistry by U.Satyanarayana, Books and Allied (P) Ltd
8. Principles of Biochemistry-Lehninger

(FPT 112) Food Preservation Technology

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

units	Contents	h
1.	Preservation, general principles of food preservation Basic consideration: Aims and objectives of preservation and processing of foods, Raw material quality and supply chain management. Characteristics of tissue and non-tissue foods, degree of perishability of unmodified foods, causes of quality deterioration and spoilage of perishable foods, intermediate moisture foods, wastage of foods	8
2.	Preservation Methods: Chemical Preservation: Preservation of foods by use of sugar, salt, chemicals and antibiotics and by smoking Radiations: Sources of radiations. Mode of action, effect on microorganisms and different nutrients; dose requirements for radiation preservation of foods.	6
3.	Preservation of foods by low temperature: Principles of Refrigeration. Chilling temperatures: Considerations relating to storage of foods at chilling temperature, applications and procedures, controlled and modified atmosphere storage of foods, post-storage handling of foods. Freezing temperatures: Freezing processes, slow and fast freezing of foods and its consequences, other occurrences associated with freezing of foods. Technological aspects of pre-freezing, Actual freezing, frozen storage and thawing of foods.	9
4.	Preservation of foods by high temperature: Basic concepts in thermal destruction of microorganisms D, Z, F, values Heat resistance and thermophilisms in microorganisms. Cooking, blanching, pasteurization and sterilization of foods. Assessing adequacy of thermal processing of foods, general process of canning of foods, spoilages in canned foods.	9
5.	Principles of Grain Storage, Material storage and handling, transportation of solid, various method of storage viz, silos, bins and hoppers	8

Reference Books:

1. Food Science, 3rd Ed., N N Potter, AVI Pub. Co., Connecticut (1978).
2. "Principles of Food Science-Part-II":Physical Method of Food Preservation by M.Karel, O.R.Fennema and D.B.Lund, Marcel Dekkar Inc.
3. 'Principles of Food Preservation' by V.Kyzlink, Elsevier Press.
4. Unit operation in Agriculture, Singh and Sahay

(FPT 113) FOOD FROM ANIMAL SOURCES

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

units	Contents	h
1.	Sources of meat and meat products in India, its importance in national economy. Chemical composition and microscopic structure of meat. Slaughtering of animals, inspection and grading of meat. Factors affecting post-mortem changes, properties and shelf life of meat. Meat quality evaluation. Mechanical deboning, meat tenderization. Aging, pickling and smoking of meat. Meat plant sanitation and safety, byproduct utilization.	8
2.	Poultry: classification, composition, preservation methods and processing. Structure, composition, nutritive value and functional properties of eggs and its preservation by different methods. Processing of egg products. Factors affecting egg quality and measures of egg quality.	8
3.	Types of fish, composition, structure, post-mortem changes in fish. Handling of fresh water fish. Canning, smoking, freezing and dehydration of fish. Preparation of fish products, fish sausage and home makings. Fish products - production of fish meal, fish protein concentrate, fish liver oil and fish sauce and other important byproducts; Quality control of processed fish; Fish processing industries in India.	8
4.	Milk processing Milk processing flow sheet – Filtration / clarification, Storage of milk, Standardization – simple problems in standardization, Homogenization, pasteurization – types of pasteurization process. Equipments used in each process - Cream separating centrifuges, Pasteurizers (Heat Exchangers), Homogenizers, Bottle and pouch fillers, Milk Chillers, Plant piping, Pumps.	8
5.	Manufacture of dairy products Manufacture of Cream, Butter, Ghee, Milk powder, Cheese – types and defects in cheese. Quality aspects of these products. Equipment's used for manufacture of each product like butter, churn, and ghee. Manufacture of Ice Cream and other dairy products Manufacture of Ice cream – Chemistry and technology –Manufacture of paneer, Toned Milk, Sweetened condensed milk, Khoa. Fermented dairy products: Fermented products – Yoghurt, curd, acidophilus milk, butter milk. Dairy plant sanitization – Cleaning in place – bottle and can washing, cleaning of tankers and silos – Detergents and sanitizers used.	8

Reference Books:

1. Lawrie, R.A. 1975. Meat Science, 2nd Edn. Pergamon Press, Oxford UK.
2. VijayaKhader, 2001, "A Textbook of Food Science and Technology", ICAR, New Delhi
3. Modern Dairy Products, Lampert LH; 1970, Chemical Publishing Company.
4. Developments in Dairy Chemistry – Vol 1 & 2; Fox PF; Applied Science Pub Ltd.
5. Milk & Milk Processing; Herrington BL; 1948, McGraw-Hill Book Company.
6. Portsmouth, J.I. 1979, Commercial Rabit Meat Production. 2nd Edn. Saiga Survey, England

(FPT 114) Food from Plant Sources

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

units	Contents	h
1.	Production of fruits and vegetables in India.,Causes for heavy losses. Spoilage factors, post harvest field operations including methods to reduce the post harvest losses, General methods of preservation of fruits and vegetables.Mushroom technology, production of mushroom processing	6
2.	Canning of fruits and vegetables	6
3.	Physico-chemical and thermal properties of grains - grain dimensions, bulk density, true density, porosity, coefficient of friction, angle of repose, thermal conductivity and aerodynamic properties. Grain drying - moisture content, equilibrium moisture content; free and bound water, rate of drying, constant and falling rate of drying rate; factors affecting rate of drying process, types of dryers used for drying of grains.	10
4.	Milling of wheat and production of wheat products, including flour.Milling of corn, barley, oat, coarse grains including sorghum, ragi and millets; Processing of tea, coffee and cocoa.	9
5.	Specialty products - Fruit Bars, Fruit juice concentrates – methods of concentration - evaporators used for concentration of fruit juices and pulp - Tubular, Plate and scraped surface evaporators and Fruit Powders - Preparation of Fruit material for powder production - Working of Spray Dryer and Drum Dryer - Fruit juice aroma Recovery and its importance. Brief on Aroma Recovery and food flavour	9

Reference Books:

1. Lal, G., Siddappa, G. and Tondon G.L. : Preservation of Fruits and Vegetables, Indian Council of Agricultural Research, New Delhi. (1986).
2. VijayaKhader, "Textbook of Food Science and Technology", ICAR, New Delhi (2001)
3. N L Kent and A D Evers, "Kent's Technology of Cereals: An Introduction for students of Food Science and Agriculture", 4th Ed., Woodhead Pub. Ltd., Cambridge, UK (1994).
4. Dauthy, M.E.: Fruit and Vegetable Processing. International Book Distributing Co. Lucknow, India. (1997)
5. Hamson, L.P: Commercial Processing of Vegetables. Noyes Data Corporation, New Jersey. (1975)
6. Srivastava,R.P., and Sanjeev Kumar: Fruit and vegetable preservation; principles and practices.: International Book Distributing Co., Lucknow. 1998
7. A.K.Thompson (2003): Fruit and Vegetables – Harvesting, handling and storage. 2nd edition Blackwell Publishing
8. W.V Cruess (1997): Commerical Fruit and Vegetable Products. Allied Scientific Publishers. Bikaner (India)
9. Girdharilal (1996) Preservation of Fruits and Vegetables. ICAR, New Delhi

(FPT 115) Plant Design and Economics

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

Units	Contents	h
1.	Basic concepts of plant layout and design with special reference to food process industries. Design considerations for location of food plants. Basic understanding of equipment layout and ventilation in food process plants. Preparation of flow sheets for material movement and utility consumption in food plants.Application of HACCP concept, ISO, FPO & MPO requirements in food plant layout and design.	8
2.	Plant layout and design of bakery and biscuit industries. Plant layout and design of fruits and vegetables processing industries including beverages.Plant layout and design of milk and milk products.	8
3.	Introduction to economics: Meaning, scope, and contribution to business decisions.Analysis of Demand: Law of demand, Utility function, Rate of commodity substitution, Maximization of utility, Demand functions, Indifference curve analysis, Substitution and income effects.Market demand and demand elasticities: concept of market demand, price and income elasticities of demand, importance of elasticity.Demand forecasting: causes and techniques of demand forecasting.	8
4.	Analysis of supply and market equilibrium: Law of supply, price elasticity of supply, equilibrium of demand and supply.Theory of the Farm: Production function, returns to scale, Optimizing behavior, Input demands, Cost functions, Profit maximization, economics & diseconomies of scale, break even analysis.	8
5.	Plant maintenance program; Role of maintenance staff and plant operators Preventive maintenance; Guidelines for good maintenance & safety precautions; Lubrication & lubricants; Work place improvement through '5S'.Hygiene and sanitation requirement in food processing and fermentation industries; CIP methods, sanitizing & disinfestation, pest control in food processing; storage and service areas.	8

Reference Books:

1. Peters and Timmehaus, Plant Design and economics for chemical Engineers, 4th Ed., McGraw-Hill, Inc., (1989).
2. D G Rao, Fundamentals of Food Engg., Prentice-Hall of India, N.Delhi (2010)
3. D N Dwivedi : Engineering Economics, Vikas.
4. Plant design and economics for chemical engineers- Peters and Timmerhans, McGraws-Hill Inc
5. Basic Concepts of Industrial Hygiene, Ronald M Scott, CRC Press
6. P A Samuelson & W D Nordhans: Economics: TMH.
7. James M Moore, "Plant Layout and Design", Mcmillan& Co., (1959)
8. Safety design criteria for industrial plants. M. Cumo& A.Naviglia CRC Press.
9. A. Koutsoyianni : Modern Micro Economics, Macmillan.
10. R Dutta& K P M Sundaran : Indian Economy. S.Chand.
11. A N Agarwal : Indian Economy, Vikas.
12. J.M. Apple-Plant Layout and material handling – John Willey & Son (1977)

(FPT 116) Food Processing Lab-1

S. No.	Name of the Experiments	S. No.	Name of the Experiments
1.	Estimation of Microbial Count of food	12.	Sampling techniques and preparation of test samples.
2.	Separation of sugars/amino acids by Thin Layer Chromatography.	13.	Qualitative test for determination of presence of starch in a food sample.
3.	Measurement of Food Color by Tintometer/ spectrophotometer	14.	Determination of specific gravity of food sample.
4.	Analysis of milk.	15.	Microwave cooking of foods.
5.	Estimation of a) Iodine value, (b) Saponification value (c) Acid value (d) RM value (e) K value of fats & oils.	16.	Estimation of crude fat to determine the oil in pickle sample.
6.	Microbiological quality of processed milk.	17.	Estimation of amount of preservatives in fruit juice sample.
7.	Pickling and curing of foods.	18.	Determination of total ash of food
8.	Estimation of proteins	19.	Estimation of tin in canned foods.
9.	Estimation of minerals	20.	Estimation of vitamins
10.	Water analysis- P^h, Hardness, TDS, N, S, total phosphorous	21.	In bottle pasteurization and sterilization of fruit juices.
11.	Measurement of viscosity of the fluid foods using Brookfield viscometer.	22.	Effect of pH on microbial stability of food.

Sr. No.	Name of the Recommended Books
1	Sathe, A.Y.A First course in Food Analyses. 1999, New Age International Publisher, New Delhi
2	Jacobs, Norris B: The chemical analysis of foods and food Products, CBS Publisher, New Delhi
3	Nielsen, S. Suzanne. 2002, Introduction to the Chemical Analysis of Foods. CBS publishers & Distributors, New Delhi
4	Hand Book of Analysis and Quality Control for Fruits and Vegetable Products, S. Raganna, TMH publishing company limited, New Delhi

(FPT-117) Seminar

Teaching Scheme:	Examination Scheme:
Lectures: 00 h/week	Term work: 50 Marks
Tutorials: 04 h/week	Viva-Voce: 50 Marks

Objective

- To equip the students/scholars with skills to write dissertations, research papers, etc.
- To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing)

Technical writing

Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

Report Preparation and Presentation:

It shall be based on the literature survey on any topic, which may lead to dissertation in that area. It will be submitted as a report.

The candidate will have to deliver a seminar presentation before the faculty members and examiners, one of them will be guide (internal examiner) and the other will be examiner appointed by the university.

Reference Book:

Gibaldi, Joseph. 2000. MLA Handbook for Writers of Research Papers. 5ªEd. Affiliated East-West Press, New Delhi.

Mills Gordon H & John A Walter. 1970. Technical Writing. 3rd Ed. Holt, Rinehart & Winston, New York.

Shelton James H. 1994.Handbook for Technical Writing.NTC Business Books, Chicago.

Smith Richard W. 1969.Technical Writing.Barnes&Noble, New York.

(FPT 121) FOOD PROCESS ENGINEERING

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

units	Contents	h
1.	Material and energy balances – calculations for food processing operations	4
2.	Psychometrics: Properties of dry air, water vapour and air-vapor mixtures: Gibbs-Dalton law, Dew-point temp, humidity ratio (or moisture content), relative humidity, wet bulb temperature. The psychometrics chart: Use of psychometrics chart to evaluate complex air conditioning processes.	10
3.	Fluid flow, fluid statics, fluid dynamics, fluid flow applications, transportation of fluids, fluid flow machinery. Heat Transfer – modes of heat transfer conduction, convection and radiation. Heat exchangers, plate type, scraped surface heat exchangers, evaporation, concentration.	12
4.	Theory and principles of size reduction, types, size reduction equipment, disintegration of fibrous materials, cryogenic grinding. Mechanical separations, screening, screening equipment, filtration, centrifugation, sedimentation – classification, principles and equipment. Mixing of solids and pastes, equipment, agitation and mixing of fluids, power requirement in mixing. Membrane separation	8
5.	Extraction, theory and principals. Application of Extraction in food processing, solid-liquid extraction, leaching, theory and principle. Application of leaching, Refrigeration basic concept.	6

Reference Books:

1. Unit operations in Food Processing – R.L.Earle (2ed) Pergamon press, 1983
2. Fundamentals of Food Engineering – D.G.Rao, Prentice-Hall of India, New Delhi, 2010
3. Unit operations of chemical engineering, 5ht Ed – W L McCabe, J C Smith and P Harriot, McGraw-Hill Inc., New York (1993).
4. Mass transfer operations, – R.E.Treybal, McGraw – Hill Int Book Co., (1981).
5. Food process engineering – D R Heldman, & RP Singh,
6. Fundamentals of food process engineering – R.T.Toledo, CBS Publishers & Distributors, New Delhi (2005).
7. Singh, R. P. and Heldman, D. R. (1984). Introduction to Food Engg., Academic Press, INC, London.
8. Harper, J.C. (1976) Elements of Food Engg., AVI Publ. Co., Westport, Connecticut.
9. Brennan, J.G., Buffers, J.R., Cowell N.D., Lilly, A.E.V. (1976). Food Engg. Operations, 2nd Ed.,

(FPT 122) Bakery and Confectionary Technology

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

Units	Contents	h
1.	Introduction to baking; Bakery ingredients and their functions; Machines & equipment for batch and continuous processing of bakery products. Technology for the manufacture of bakery products – bread, biscuits, cakes and the effect of variations in formulation and process parameters on the quality of the finished product; quality consideration and parameters; Staling and losses in baking.	8
2.	Chocolate Processing Technology, Compound coatings & Candy Bars, Tempering technology, Chocolate hollow figures, Chocolate shells, Enrobing technology, Manufacture of candy bars and Production of chocolate mass.	8
3.	Sugar confectionery manufacture, General technical aspects of industrial sugar confectionary manufacture, Manufacture of high boiled sweets- Ingredients, Methods of manufacture- Types- Center- filled, lollipops, coextruded products. Manufacture of gums and jellies- Quality aspects.	8
4.	Quality characteristics of confectionery ingredients; technology for manufacture of flour , fruit, milk, sugar, chocolate and special confectionery products; colour, flavor and texture of confectionery; standards and regulations ; machineries used in confectionery industry. Manufacture of Miscellaneous Products, caramel, Toffee and fudge- Liquorices paste and aerated confectionery, Lozenges, sugar panning and Chewing gum, Count lines Quality aspects, fruit confections.	8
5.	Objectives and importance of extrusion in food product development; Components and functions of an extruder; Classification of extruder; Advantages and disadvantages of different types of extrusion; Change of functional properties of food components during extrusion; Pre and post extrusion treatments; Manufacturing process of extruded products; Application of extrusion technologies in food industries.	8

Reference Books:

1. Extrusion of Food, Vol 2; Harper JM; 1981, CRC Press.
2. Bakery Technology & Engineering; Matz SA; 1960; AVI Pub.
3. Up to-date Bread Making; Fance WJ &Wrogg BH; 1968, Maclasen& Sons Ltd.
4. Modern Cereal Chemistry; Kent-Jones DW & Amos AJ; 1967, Food Trade Press Ltd.

(FPT 123) Food Handling and Packaging Technology

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

Units	Contents	h
1.	Active and intelligent packaging, Active packaging techniques, Intelligent packaging techniques, Current use of novel packaging techniques, Oxygen, ethylene and other scavengers, Oxygen scavenging technology, Ethylene scavenging technology, Carbon dioxide and other scavengers, Antimicrobial food packaging: Constructing an antimicrobial packaging system, Factors affecting the effectiveness of antimicrobial packaging.	8
2.	Non-migratory bioactive polymers (NMBP) in food packaging, Advantages of NMBP, limitations, inherently bioactive synthetic polymers: types and applications, Polymers with immobilized bioactive compounds.	8
3.	Time-temperature indicators (TTIs), Defining and classifying TTIs, Requirements for TTIs, The development of TTIs, Current TTI systems, Maximizing the effectiveness of TTIs, Using TTIs to monitor shelf-life during distribution, Using TTIs to optimize distribution and stock rotation..	8
4.	Packaging-flavour interactions, Factors affecting flavour absorption, role of the food matrix, role of differing packaging materials, Case study: packaging and lipid oxidation, Modeling flavour absorption, Packaging–flavour interactions and active packaging, Novel MAP applications for fresh-prepared produce, Novel MAP gases, Testing novel MAP applications, Applying high O2 MAP.	8
5.	Modern packaging systems: Green plastics for food packaging, The problem of plastic packaging waste, The range of biopolymers, Developing novel biodegradable materials, Legislative issues, Current applications, Integrating intelligent packaging, role of packaging in the supply chain, Creating integrated packaging, storage and distribution: alarm systems and TTIs, Traceability: radio frequency identification, Recycling packaging materials: The recyclability of packaging plastics, Improving the recyclability of plastics packaging, Testing the safety and quality of recycled material, Using recycled plastics in packaging.	8

Reference Books:

Ahvenainen R. 2001. *Novel Food Packaging Techniques*.CRC.
Crosby NT. 1981.*Food Packaging Materials*. App. Sci. Publ.
Mahadeviah M &Gowramma RV. 1996. *Food Packaging Materials*. Tata McGraw Hill.
Painy FA. 1992. *A Handbook of Food Packaging*. Blackie.
Palling SJ. 1980. *Developments in Food Packaging*. App. Sci. Publ.
Rooney ML. 1988. *Active Food Packaging*.Chapman & Hall.
Sacharow S & Griffin RC.1980.*Principles of Food Packaging*. AVI Publ.
Stanley S & Roger CG. 1998. *Food Packaging*. AVI Publ.

(FPT 124) Food Standards and Regulations

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

Units	Contents	h
1.	Concepts and trends in food legislation. International and federal standards: Codex alimentations, ISO series, food safety in USA. Indian perspective- Histroy-PFA act-1954. Food safety and Standards Act-2006.Food Safety and Managenent Systems- FSMS-22000.	8
2.	Quality factos: appearance, texture and flavor, Appearance factors – size and shape, colour ad gloss, consistency. Textural Factors – measuring texture, texture changes. Flavour Factors – influence of colour and texture on flavor. Taste Panels.	8
3.	Food laws: Federal Food Drug and CosmeticAct (1938), Good Manufacturing Practices (Code of GMP), Fair Packaging and Labeling Act (1966), Federal Meat Inspection Act (1906),. International Food, Standards and Codex Alimentarius, HACCP and ISO 9000 series FPO,Agmark,BIS,FAO, WTO,TBT,GATT AND Tracecibility issues. .	8
4.	Food – related hazards – biological hazards, chemical hazards, physical hazards, trace chemicals. Microbiological considerations in food safety.	8
5.	Concept of property, rights, duties and their correlation; History and evaluation of IPR; Copyrights and related rights. Distinction among Various forms of IPR. Patent rights/protection and procedure; Infringement or violation; Remedies against infringement; Indian Patent Act 1970 and TRIPS; Geographical indication and Industrial design	8

Reference Books:

1. Santaniello, Evenson, Ziberman, Carlson – Agriculture and Intellectual Property Rights, Univ. Press, 1998
2. S. K. Chakraborty : Values and Ethics in Organization, OUP
3. A. N. Tripathi : Human Values, New Age International
4. Economic Reforms And Food Security: The Impact of Trade and Technology in South Asia by Suresh Chandra Babu, Haworth Press
5. Intellectual property rights in Agricultural Biotechnology; Edited by Erbisch, Maredia; CABI

(FPT-125) Beverage and Industrial Fermentation

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

Units	Contents	h
1.	Types of beverages and their importance; status of beverage industry in India; Manufacturing technology for juice-based beverages; synthetic beverages; technology of still, carbonated, low calorie and dry beverages; isotonic and sports drinks; role of various ingredients of soft drinks, carbonation of soft drinks. Specialty beverages based on tea, coffee, cocoa, spices, plant extracts, herbs, nuts, dairy and imitation dairy-based beverages.	8
2.	Alcoholic beverages- types, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, equipments used for brewing and distillation, wine and related beverages, distilled spirits.	8
3.	Packaged drinking water- definition, types, manufacturing processes, quality evaluation and raw and processed water, methods of water treatment, BIS quality standards of bottled water; mineral water, natural spring water, flavoured water, carbonated water. Introduction to fermentation, rate of microbial growth and death, fermentation kinetics, mass transfer diffusion, membrane transport, dialysis, nutrient uptake.	8
4.	Fermenter design, operation measurement and control in fermentation, aeration and agitation in fermentation, oxygen requirement, measurement of absorption coefficients, bubble aeration, mechanical agitation correlation between mass transfer coefficient and operating variables,	8
5.	Types of fermentation-sub-merged/solid state, sterilization-air and media sterilization, Batch/continuous fermentation, scale up in fermentation, product recovery, Principle and use of biosensor, production of vitamins, amino acids organic acids, Enzymes, antibiotics and alcohol. Biological waste treatment.	8

Reference Books:

Hardwick WA. 1995. Handbook of Brewing. Marcel Dekker.
Hui YH et al 2004 Hand book of Food & Beverage Fermentation Technology Marcel Dekker
Priest FG & Stewart GG. 2006. Handbook of Brewing. 2nd Ed. CRC.
Richard P Vine 1981 Commercial Wine Making - Processing and Controls. AVI Publ.
Varnam AH & Sutherland JP. 1994. Beverages: Technology, Chemistry and Microbiology. Chapman & Hall
Wood roof JG & Phillips GF, 1974, Beverages: Carbonated and Non-Carbonated. AVI Publ.
Lea, A.G.H., and J. R. Piggott, Fermented Beverage Production, 2nd Edition, Kluwer Academic/Plenum Publishers, New York, NY, USA 2003.
Geankoplis Christie J., Transport Processes and Separation Process Principles, fourth edition, Prentice-Hall PTR, New Jersey, US, 2003

(FPT 126) Food Processing Lab-II

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

Sr. No.	Name of the Experiment	S. No.	Name of the Experiment
1.	Dehydration of fruits and vegetables	14.	Estimation of total carotenoids.
2.	Preparation of squash/ beverages / juices/ nectars	15.	Estimation of total and reducing sugar content.
3.	Preparation of Jam/Jelly/Marmalades.	16.	Preparation of fruit juice products.
4.	Preparation of tomato ketchup/sauces/spreads/purees/brines	17.	Estimation of total polyphenolic compounds in fruit powder.
5.	Preparation of soup mixes.	18.	Production of alcohol by fermentation
6.	Manufacture of macaroni/pasta by extruder.	19.	Estimation of TSS of fruits and fruit products.
7.	Dehydration of meat, fish, shrimp by tray drying/yard drying – Quality evaluation	20.	Estimation of moisture and total solids.
8.	Manufacture of ice cream.	21.	Estimation of titratable acidity.
9.	Production of cheese/yoghurt and examination of its microbiological study	22.	Preparation of bread- Sponge & Straight Dough
10.	Estimation of tannin in fruit juice.	23.	Estimation of ascorbic acid content.
11.	Inert Gas Packaging & Vacuum Packaging	24.	Determination of non enzymatic browning in processed fruit product.
12.	Capping & sealing	25.	Estimation of pectin content in fruits.
13.	Determination of maturity indices for fruits.		

Reference Books:

1. Ranganna, S. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2nd edition. Tata McGraw Hill Publishing Company Ltd., New Delhi

(FPT-127) Seminar

Teaching Scheme:	Examination Scheme:
Lectures: 00 h/week	Term work: 50 Marks
Tutorials: 04 h/week	Viva-Voce: 50 Marks

Objective

- To equip the students/scholars with skills to write dissertations, research papers, etc.
- To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing)

Technical writing

Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

Report Preparation and Presentation:

It shall be based on the literature survey on any topic, which may lead to dissertation in that area. It will be submitted as a report.

The candidate will have to deliver a seminar presentation before the faculty members and examiners, one of them will be guide (internal examiner) and the other will be examiner appointed by the university.

Reference Book:

Gibaldi, Joseph. 2000. MLA Handbook for Writers of Research Papers. 5thEd. Affiliated East-West Press, New Delhi.

Mills Gordon H & John A Walter. 1970. Technical Writing. 3rd Ed. Holt, Rinehart & Winston, New York.

Shelton James H. 1994.Handbook for Technical Writing.NTC Business Books, Chicago.

Smith Richard W. 1969.Technical Writing.Barnes&Noble, New York.

(FPT-211) Dissertation Part-1

Teaching Scheme:	Examination Scheme:
Lectures: 00 h/week	Term Work: 100 Marks
Tutorials: 20 h/week	Viva Voce: 100 Marks

The dissertation shall consist of a report on any research work done by the candidate or a comprehensive and critical review of any recent development in the subject or detailed report of the project work consisting of a design and / or development work that the candidate has executed. The report must include comprehensive literature work and detailed work plan on the topic selected for dissertation.

Term work:

The dissertation part-I will be in the form of seminar report on the project work being carried out by the candidate and will be assessed by two examiners appointed by the university, one of whom will be the guide and other will be a senior faculty member from the department.

Viva-voce:

The dissertation part I will be in the form of seminar report on the project work being carried out by the candidate and will be assessed by two examiners appointed by the university, one of whom will be the guide and other will be an examiner.

(FPT-221) Dissertation Part- II

Teaching Scheme:	Examination Scheme:
Lectures: 00 h/week	Term Work: 200 Marks
Tutorials: 04 h/week	Viva Voce: 200 Marks

The dissertation part-II will be in continuation of dissertation part-I and shall consist of a report on the research work done by the candidate or a comprehensive and critical review of any recent development in the subject or detailed report of the project work consisting of a design and /or development work that the candidate has executed. The examinee shall submit the dissertation in five copies to the head of the department duly certified by the guide, head of department and the Principal that the work has been satisfactorily completed. If you will perform work in other institute, you have to submit separate copies of dissertation as per the requirement to the institute.

Term work:

The dissertation will be assessed by two internal examiners appointed by the institute, one of whom will be the guide and other will be a senior faculty member from the department.

Viva-Voce:

It shall consist of a PPT presentation by the examinee on his work in the presence of examiners appointed by the university, one of whom will be the guide and other will be as external examiner.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

Teaching/Examination Scheme for the degree of Master of Technology (Food Processing Technology)

w.e.f. Year 2012-13

Semester-1

Course Code	Name of the Subject	Teaching h/week			Examination Scheme - Marks				
		Lectures	Tutorials	Total Hours	Theory	Class test	Term work	Viva-voce	Total
FPT-111	Food Microbiology & Bio-Chemistry	3	1	4	80	20	--	--	**100**
FPT-112	Food Preservation Technology	3	1	4	80	20	--	--	**100**
FPT-113	Food from Animal Sources	3	1	4	80	20	--	--	**100**
FPT-114	Food from Plant Sources	3	1	4	80	20	--	--	**100**
FPT-115	Food Plant Design and Economics	3	1	4	80	20	--	--	**100**
FPT-116	Food Processing Lab-I	--	6	6	--	--	50	50	**100**
FPT-117	Seminar-I	--	4	4	--	--	25	25	**50**
	Total	**15**	**15**	**30**	**400**	**100**	**75**	**75**	**650**

Semester-II

Course Code	Name of the Subject	Teaching h/week			Examination Scheme - Marks				
		Lectures	Tutorials	Total Hours	Theory	Class test	Term work	Viva-voce	Total
FPT-121	Food Process Engineering	3	1	4	80	20			**100**
FPT-122	Bakery & Confectionary Technology	3	1	4	80	20			**100**
FPT-123	Food Handling and Packaging	3	1	4	80	20			**100**
FPT-124	Food Standard and Regulations	3	1	4	80	20			**100**
FPT-125	Beverage and Industrial Fermentation	3	1	4	80	20			**100**
FPT-126	Food Processing Lab-II	--	6	6	--	--	50	50	**100**
FPT-127	Seminar-II	--	4	4			25	25	**50**
	Total	**15**	**15**	**30**	**400**	**100**	**75**	**75**	**650**

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

Teaching/Examination Scheme for the degree of Master of Technology (Food Processing Technology)

w.e.f. Year 2012-13

Semester-III

Course Code	Name of the Subject	Teaching h/week			Examination Scheme - Marks			
		Counselling	Dissertation Work	Total Hours	Theory	Term work	Viva-voce	Total
FPT-211	Dissertation Part-1	4	20	24		50	50	**100**
	Total	**4**	**20**	**24**		**50**	**50**	**100**

- Research Problem Identification and synopsis preparation {Intensive study on Research Idea (Instruction cum self study mode as recommended by the department after synopsis presentation)}
- Comprehensive Viva Voce

Semester-IV

Course Code	Name of the Subject	Teaching h/week			Examination Scheme - Marks			
		Counselling	Dissertation Work	Total Hours	Theory	Term work	Viva-voce	Total
FPT-221	Dissertation Part-2	4	20	24		100	200	**300**
	Total	**4**	**20**	**24**	--	**100**	**200**	**300**
	Grand Total							**1700**

(FPT 111) Food Microbiology and Bio-Chemistry

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

units	Contents	h
1.	Introduction – definition, historical development and significance of food microbiology; Microscope; classification & morphology of microbes; Techniques of pure culture; Anti-microbial agents – physical & chemical – mechanism & action. Sources of contamination: Air, Water, Soil, Sewage, Post processing contamination. Intrinsic &extrinsic factors influencing the growth of microorganisms in foods	6
2.	Microbiology of milk & milk products like cheese, butter, ice cream, and milk powder; Microbiology of meat, fish, poultry & egg and their products. Microbiology of fruits & vegetable and products like jam, jelly, sauce, juice; Microbiology of cereal & cereal products like bread, biscuits, and confectionary; Food Quality aspects of Fruits & vegetables; Milk & Milk products, Meat &Poultry: Introduction, Quality principles, Quality enhancement model. Application of quality enhancement model.	8
3.	Water: The basic molecule of life. Physical properties of water. Properties of hydration, solvation. Bound water, free water, water activity. Distribution of water in various foods and moisture determination.	6
4.	Carbohydrates: Nomenclature and classification, structure and chemical properties of monosaccharide carbohydrates, disaccharides and polysaccharides, changes in carbohydrates during processing. Lipids: Classification, structure, physical and chemical properties of fatty acids and fats. Simple and derived lipids. Changes during food processing.	10
5.	Proteins: Classification, structure and properties of amino acids, structure of protein, physical and chemical properties of proteins. Changes in proteins during processing, Vitamins and minerals: Classification, structure and role of vitamins in food. Aroma substances. Enzymes: Classification, nomenclature, activation energy, factors affecting enzymes action, mechanism of enzyme action. Enzyme inhibition.	10

Reference Books:

1. Food Microbiology, M R Adams and M O Moss, New Age International, New Delhi (1996)
2. Food Microbiology; WC Frazier; Tata McGraw Hill, Delhi
3. Modern Food Microbiology; James M Jay; CBS Publishers, Delhi
4. Microbiology; Pelczar, Chan and Krieg; Tata McGraw Hill, Delhi
5. Essentials of Microbiology; K. S. Bilgrami; CBS Publishers, Delhi
6. Food: Facts and Principles-N. ShakuntalaManay, Shadksharawamis.
7. Essentials of Biochemistry by U.Satyanarayana, Books and Allied (P) Ltd
8. Principles of Biochemistry-Lehninger

(FPT 112) Food Preservation Technology

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

units	Contents	h
1.	Preservation, general principles of food preservation Basic consideration: Aims and objectives of preservation and processing of foods, Raw material quality and supply chain management. Characteristics of tissue and non-tissue foods, degree of perishability of unmodified foods, causes of quality deterioration and spoilage of perishable foods, intermediate moisture foods, wastage of foods	8
2.	Preservation Methods: Chemical Preservation: Preservation of foods by use of sugar, salt, chemicals and antibiotics and by smoking Radiations: Sources of radiations. Mode of action, effect on microorganisms and different nutrients; dose requirements for radiation preservation of foods.	6
3.	Preservation of foods by low temperature: Principles of Refrigeration. Chilling temperatures: Considerations relating to storage of foods at chilling temperature, applications and procedures, controlled and modified atmosphere storage of foods, post-storage handling of foods. Freezing temperatures: Freezing processes, slow and fast freezing of foods and its consequences, other occurrences associated with freezing of foods. Technological aspects of pre-freezing, Actual freezing, frozen storage and thawing of foods.	9
4.	Preservation of foods by high temperature: Basic concepts in thermal destruction of microorganisms D, Z, F, values Heat resistance and thermophilisms in microorganisms. Cooking, blanching, pasteurization and sterilization of foods. Assessing adequacy of thermal processing of foods, general process of canning of foods, spoilages in canned foods.	9
5.	Principles of Grain Storage, Material storage and handling, transportation of solid, various method of storage viz, silos, bins and hoppers	8

Reference Books:

1. Food Science, 3rd Ed., N N Potter, AVI Pub. Co., Connecticut (1978).
2. "Principles of Food Science-Part-II":Physical Method of Food Preservation by M.Karel, O.R.Fennema and D.B.Lund, Marcel Dekkar Inc.
3. 'Principles of Food Preservation' by V.Kyzlink, Elsevier Press.
4. Unit operation in Agriculture, Singh and Sahay

(FPT 113) FOOD FROM ANIMAL SOURCES

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

units	Contents	h
1.	Sources of meat and meat products in India, its importance in national economy. Chemical composition and microscopic structure of meat. Slaughtering of animals, inspection and grading of meat. Factors affecting post-mortem changes, properties and shelf life of meat. Meat quality evaluation. Mechanical deboning, meat tenderization. Aging, pickling and smoking of meat. Meat plant sanitation and safety, byproduct utilization.	8
2.	Poultry: classification, composition, preservation methods and processing. Structure, composition, nutritive value and functional properties of eggs and its preservation by different methods. Processing of egg products. Factors affecting egg quality and measures of egg quality.	8
3.	Types of fish, composition, structure, post-mortem changes in fish. Handling of fresh water fish. Canning, smoking, freezing and dehydration of fish. Preparation of fish products, fish sausage and home makings. Fish products - production of fish meal, fish protein concentrate, fish liver oil and fish sauce and other important byproducts; Quality control of processed fish; Fish processing industries in India.	8
4.	Milk processing Milk processing flow sheet – Filtration / clarification, Storage of milk, Standardization – simple problems in standardization, Homogenization, pasteurization – types of pasteurization process. Equipments used in each process - Cream separating centrifuges, Pasteurizers (Heat Exchangers), Homogenizers, Bottle and pouch fillers, Milk Chillers, Plant piping, Pumps.	8
5.	Manufacture of dairy products Manufacture of Cream, Butter, Ghee, Milk powder, Cheese – types and defects in cheese. Quality aspects of these products. Equipment's used for manufacture of each product like butter, churn, and ghee. Manufacture of Ice Cream and other dairy products Manufacture of Ice cream – Chemistry and technology –Manufacture of paneer, Toned Milk, Sweetened condensed milk, Khoa. Fermented dairy products: Fermented products – Yoghurt, curd, acidophilus milk, butter milk. Dairy plant sanitization – Cleaning in place – bottle and can washing, cleaning of tankers and silos – Detergents and sanitizers used.	8

Reference Books:

1. Lawrie, R.A. 1975. Meat Science, 2nd Edn. Pergamon Press, Oxford UK.
2. VijayaKhader, 2001, "A Textbook of Food Science and Technology", ICAR, New Delhi
3. Modern Dairy Products, Lampert LH; 1970, Chemical Publishing Company.
4. Developments in Dairy Chemistry – Vol 1 & 2; Fox PF; Applied Science Pub Ltd.
5. Milk & Milk Processing; Herrington BL; 1948, McGraw-Hill Book Company.
6. Portsmouth, J.I. 1979, Commercial Rabit Meat Production. 2nd Edn. Saiga Survey, England

(FPT 114) Food from Plant Sources

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

units	Contents	h
1.	Production of fruits and vegetables in India.,Causes for heavy losses. Spoilage factors, post harvest field operations including methods to reduce the post harvest losses, General methods of preservation of fruits and vegetables.Mushroom technology, production of mushroom processing	6
2.	Canning of fruits and vegetables	6
3.	Physico-chemical and thermal properties of grains - grain dimensions, bulk density, true density, porosity, coefficient of friction, angle of repose, thermal conductivity and aerodynamic properties. Grain drying - moisture content, equilibrium moisture content; free and bound water, rate of drying, constant and falling rate of drying rate; factors affecting rate of drying process, types of dryers used for drying of grains.	10
4.	Milling of wheat and production of wheat products, including flour.Milling of corn, barley, oat, coarse grains including sorghum, ragi and millets; Processing of tea, coffee and cocoa.	9
5.	Specialty products - Fruit Bars, Fruit juice concentrates – methods of concentration - evaporators used for concentration of fruit juices and pulp - Tubular, Plate and scraped surface evaporators and Fruit Powders - Preparation of Fruit material for powder production - Working of Spray Dryer and Drum Dryer - Fruit juice aroma Recovery and its importance. Brief on Aroma Recovery and food flavour	9

Reference Books:

1. Lal, G., Siddappa, G. and Tondon G.L. : Preservation of Fruits and Vegetables, Indian Council of Agricultural Research, New Delhi. (1986).
2. VijayaKhader, "Textbook of Food Science and Technology", ICAR, New Delhi (2001)
3. N L Kent and A D Evers, "Kent's Technology of Cereals: An Introduction for students of Food Science and Agriculture", 4th Ed., Woodhead Pub. Ltd., Cambridge, UK (1994).
4. Dauthy, M.E.: Fruit and Vegetable Processing. International Book Distributing Co. Lucknow, India. (1997)
5. Hamson, L.P: Commercial Processing of Vegetables. Noyes Data Corporation, New Jersey. (1975)
6. Srivastava,R.P., and Sanjeev Kumar: Fruit and vegetable preservation; principles and practices.: International Book Distributing Co., Lucknow. 1998
7. A.K.Thompson (2003): Fruit and Vegetables – Harvesting, handling and storage. 2nd edition Blackwell Publishing
8. W.V Cruess (1997): Commerical Fruit and Vegetable Products. Allied Scientific Publishers. Bikaner (India)
9. Girdharilal (1996) Preservation of Fruits and Vegetables. ICAR, New Delhi

(FPT 115) Plant Design and Economics

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

Units	Contents	h
1.	Basic concepts of plant layout and design with special reference to food process industries. Design considerations for location of food plants. Basic understanding of equipment layout and ventilation in food process plants. Preparation of flow sheets for material movement and utility consumption in food plants.Application of HACCP concept, ISO, FPO & MPO requirements in food plant layout and design.	8
2.	Plant layout and design of bakery and biscuit industries. Plant layout and design of fruits and vegetables processing industries including beverages.Plant layout and design of milk and milk products.	8
3.	Introduction to economics: Meaning, scope, and contribution to business decisions.Analysis of Demand: Law of demand, Utility function, Rate of commodity substitution, Maximization of utility, Demand functions, Indifference curve analysis, Substitution and income effects.Market demand and demand elasticities: concept of market demand, price and income elasticities of demand, importance of elasticity.Demand forecasting: causes and techniques of demand forecasting.	8
4.	Analysis of supply and market equilibrium: Law of supply, price elasticity of supply, equilibrium of demand and supply.Theory of the Farm: Production function, returns to scale, Optimizing behavior, Input demands, Cost functions, Profit maximization, economics & diseconomies of scale, break even analysis.	8
5.	Plant maintenance program; Role of maintenance staff and plant operators Preventive maintenance; Guidelines for good maintenance & safety precautions; Lubrication & lubricants; Work place improvement through '5S'.Hygiene and sanitation requirement in food processing and fermentation industries; CIP methods, sanitizing & disinfestation, pest control in food processing; storage and service areas.	8

Reference Books:

1. Peters and Timmehaus, Plant Design and economics for chemical Engineers, 4th Ed., McGraw-Hill, Inc., (1989).
2. D G Rao, Fundamentals of Food Engg., Prentice-Hall of India, N.Delhi (2010)
3. D N Dwivedi : Engineering Economics, Vikas.
4. Plant design and economics for chemical engineers- Peters and Timmerhans, McGraws-Hill Inc
5. Basic Concepts of Industrial Hygiene, Ronald M Scott, CRC Press
6. P A Samuelson & W D Nordhans: Economics: TMH.
7. James M Moore, "Plant Layout and Design", Mcmillan& Co., (1959)
8. Safety design criteria for industrial plants. M. Cumo& A.Naviglia CRC Press.
9. A. Koutsoyianni : Modern Micro Economics, Macmillan.
10. R Dutta& K P M Sundaran : Indian Economy. S.Chand.
11. A N Agarwal : Indian Economy, Vikas.
12. J.M. Apple-Plant Layout and material handling – John Willey & Son (1977)

(FPT 116) Food Processing Lab-1

S. No.	Name of the Experiments	S. No.	Name of the Experiments
1.	Estimation of Microbial Count of food	12.	Sampling techniques and preparation of test samples.
2.	Separation of sugars/amino acids by Thin Layer Chromatography.	13.	Qualitative test for determination of presence of starch in a food sample.
3.	Measurement of Food Color by Tintometer/ spectrophotometer	14.	Determination of specific gravity of food sample.
4.	Analysis of milk.	15.	Microwave cooking of foods.
5.	Estimation of a) Iodine value, (b) Saponification value (c) Acid value (d) RM value (e) K value of fats & oils.	16.	Estimation of crude fat to determine the oil in pickle sample.
6.	Microbiological quality of processed milk.	17.	Estimation of amount of preservatives in fruit juice sample.
7.	Pickling and curing of foods.	18.	Determination of total ash of food
8.	Estimation of proteins	19.	Estimation of tin in canned foods.
9.	Estimation of minerals	20.	Estimation of vitamins
10.	Water analysis- P^h, Hardness, TDS, N, S, total phosphorous	21.	In bottle pasteurization and sterilization of fruit juices.
11.	Measurement of viscosity of the fluid foods using Brookfield viscometer.	22.	Effect of pH on microbial stability of food.

Sr. No.	Name of the Recommended Books
1	Sathe, A.Y.A First course in Food Analyses. 1999, New Age International Publisher, New Delhi
2	Jacobs, Norris B: The chemical analysis of foods and food Products, CBS Publisher, New Delhi
3	Nielsen, S. Suzanne. 2002, Introduction to the Chemical Analysis of Foods. CBS publishers & Distributors, New Delhi
4	Hand Book of Analysis and Quality Control for Fruits and Vegetable Products, S. Raganna, TMH publishing company limited, New Delhi

(FPT-117) Seminar

Teaching Scheme:	Examination Scheme:
Lectures: 00 h/week	Term work: 50 Marks
Tutorials: 04 h/week	Viva-Voce: 50 Marks

Objective

- To equip the students/scholars with skills to write dissertations, research papers, etc.
- To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing)

Technical writing

Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

Report Preparation and Presentation:

It shall be based on the literature survey on any topic, which may lead to dissertation in that area. It will be submitted as a report.

The candidate will have to deliver a seminar presentation before the faculty members and examiners, one of them will be guide (internal examiner) and the other will be examiner appointed by the university.

Reference Book:

Gibaldi, Joseph. 2000. MLA Handbook for Writers of Research Papers. 5ªEd. Affiliated East-West Press, New Delhi.

Mills Gordon H & John A Walter. 1970. Technical Writing. 3rd Ed. Holt, Rinehart & Winston, New York.

Shelton James H. 1994.Handbook for Technical Writing.NTC Business Books, Chicago.

Smith Richard W. 1969.Technical Writing.Barnes&Noble, New York.

(FPT 121) FOOD PROCESS ENGINEERING

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

units	Contents	h
1.	Material and energy balances – calculations for food processing operations	4
2.	Psychometrics: Properties of dry air, water vapour and air-vapor mixtures: Gibbs-Dalton law, Dew-point temp, humidity ratio (or moisture content), relative humidity, wet bulb temperature. The psychometrics chart: Use of psychometrics chart to evaluate complex air conditioning processes.	10
3.	Fluid flow, fluid statics, fluid dynamics, fluid flow applications, transportation of fluids, fluid flow machinery. Heat Transfer – modes of heat transfer conduction, convection and radiation. Heat exchangers, plate type, scraped surface heat exchangers, evaporation, concentration.	12
4.	Theory and principles of size reduction, types, size reduction equipment, disintegration of fibrous materials, cryogenic grinding. Mechanical separations, screening, screening equipment, filtration, centrifugation, sedimentation – classification, principles and equipment. Mixing of solids and pastes, equipment, agitation and mixing of fluids, power requirement in mixing. Membrane separation	8
5.	Extraction, theory and principals. Application of Extraction in food processing, solid-liquid extraction, leaching, theory and principle. Application of leaching, Refrigeration basic concept.	6

Reference Books:

1. Unit operations in Food Processing – R.L.Earle (2ed) Pergamon press, 1983
2. Fundamentals of Food Engineering – D.G.Rao, Prentice-Hall of India, New Delhi, 2010
3. Unit operations of chemical engineering, 5ht Ed – W L McCabe, J C Smith and P Harriot, McGraw-Hill Inc., New York (1993).
4. Mass transfer operations, – R.E.Treybal, McGraw – Hill Int Book Co., (1981).
5. Food process engineering – D R Heldman, & RP Singh,
6. Fundamentals of food process engineering – R.T.Toledo, CBS Publishers & Distributors, New Delhi (2005).
7. Singh, R. P. and Heldman, D. R. (1984). Introduction to Food Engg., Academic Press, INC, London.
8. Harper, J.C. (1976) Elements of Food Engg., AVI Publ. Co., Westport, Connecticut.
9. Brennan, J.G., Buffers, J.R., Cowell N.D., Lilly, A.E.V. (1976). Food Engg. Operations, 2nd Ed.,

(FPT 122) Bakery and Confectionary Technology

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

Units	Contents	h
1.	Introduction to baking; Bakery ingredients and their functions; Machines & equipment for batch and continuous processing of bakery products. Technology for the manufacture of bakery products – bread, biscuits, cakes and the effect of variations in formulation and process parameters on the quality of the finished product; quality consideration and parameters; Staling and losses in baking.	8
2.	Chocolate Processing Technology, Compound coatings & Candy Bars, Tempering technology, Chocolate hollow figures, Chocolate shells, Enrobing technology, Manufacture of candy bars and Production of chocolate mass.	8
3.	Sugar confectionery manufacture, General technical aspects of industrial sugar confectionary manufacture, Manufacture of high boiled sweets- Ingredients, Methods of manufacture- Types- Center- filled, lollipops, coextruded products. Manufacture of gums and jellies- Quality aspects.	8
4.	Quality characteristics of confectionery ingredients; technology for manufacture of flour , fruit, milk, sugar, chocolate and special confectionery products; colour, flavor and texture of confectionery; standards and regulations ; machineries used in confectionery industry. Manufacture of Miscellaneous Products, caramel, Toffee and fudge- Liquorices paste and aerated confectionery, Lozenges, sugar panning and Chewing gum, Count lines Quality aspects, fruit confections.	8
5.	Objectives and importance of extrusion in food product development; Components and functions of an extruder; Classification of extruder; Advantages and disadvantages of different types of extrusion; Change of functional properties of food components during extrusion; Pre and post extrusion treatments; Manufacturing process of extruded products; Application of extrusion technologies in food industries.	8

Reference Books:

1. Extrusion of Food, Vol 2; Harper JM; 1981, CRC Press.
2. Bakery Technology & Engineering; Matz SA; 1960; AVI Pub.
3. Up to-date Bread Making; Fance WJ &Wrogg BH; 1968, Maclasen& Sons Ltd.
4. Modern Cereal Chemistry; Kent-Jones DW & Amos AJ; 1967, Food Trade Press Ltd.

(FPT 123) Food Handling and Packaging Technology

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

Units	Contents	h
1.	Active and intelligent packaging, Active packaging techniques, Intelligent packaging techniques, Current use of novel packaging techniques, Oxygen, ethylene and other scavengers, Oxygen scavenging technology, Ethylene scavenging technology, Carbon dioxide and other scavengers, Antimicrobial food packaging: Constructing an antimicrobial packaging system, Factors affecting the effectiveness of antimicrobial packaging.	8
2.	Non-migratory bioactive polymers (NMBP) in food packaging, Advantages of NMBP, limitations, inherently bioactive synthetic polymers: types and applications, Polymers with immobilized bioactive compounds.	8
3.	Time-temperature indicators (TTIs), Defining and classifying TTIs, Requirements for TTIs, The development of TTIs, Current TTI systems, Maximizing the effectiveness of TTIs, Using TTIs to monitor shelf-life during distribution, Using TTIs to optimize distribution and stock rotation..	8
4.	Packaging-flavour interactions, Factors affecting flavour absorption, role of the food matrix, role of differing packaging materials, Case study: packaging and lipid oxidation, Modeling flavour absorption, Packaging–flavour interactions and active packaging, Novel MAP applications for fresh-prepared produce, Novel MAP gases, Testing novel MAP applications, Applying high O2 MAP.	8
5.	Modern packaging systems: Green plastics for food packaging, The problem of plastic packaging waste, The range of biopolymers, Developing novel biodegradable materials, Legislative issues, Current applications, Integrating intelligent packaging, role of packaging in the supply chain, Creating integrated packaging, storage and distribution: alarm systems and TTIs, Traceability: radio frequency identification, Recycling packaging materials: The recyclability of packaging plastics, Improving the recyclability of plastics packaging, Testing the safety and quality of recycled material, Using recycled plastics in packaging.	8

Reference Books:

Ahvenainen R. 2001. *Novel Food Packaging Techniques*.CRC.
Crosby NT. 1981.*Food Packaging Materials*. App. Sci. Publ.
Mahadeviah M &Gowramma RV. 1996. *Food Packaging Materials*. Tata McGraw Hill.
Painy FA. 1992. *A Handbook of Food Packaging*. Blackie.
Palling SJ. 1980. *Developments in Food Packaging*. App. Sci. Publ.
Rooney ML. 1988. *Active Food Packaging*.Chapman & Hall.
Sacharow S & Griffin RC.1980.*Principles of Food Packaging*. AVI Publ.
Stanley S & Roger CG. 1998. *Food Packaging*. AVI Publ.

(FPT 124) Food Standards and Regulations

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

Units	Contents	h
1.	Concepts and trends in food legislation. International and federal standards: Codex alimentations, ISO series, food safety in USA. Indian perspective- Histroy-PFA act-1954. Food safety and Standards Act-2006.Food Safety and Managenent Systems- FSMS-22000.	8
2.	Quality factos: appearance, texture and flavor, Appearance factors – size and shape, colour ad gloss, consistency. Textural Factors – measuring texture, texture changes. Flavour Factors – influence of colour and texture on flavor. Taste Panels.	8
3.	Food laws: Federal Food Drug and CosmeticAct (1938), Good Manufacturing Practices (Code of GMP), Fair Packaging and Labeling Act (1966), Federal Meat Inspection Act (1906),. International Food, Standards and Codex Alimentarius, HACCP and ISO 9000 series FPO,Agmark,BIS,FAO, WTO,TBT,GATT AND Tracecibility issues. .	8
4.	Food – related hazards – biological hazards, chemical hazards, physical hazards, trace chemicals. Microbiological considerations in food safety.	8
5.	Concept of property, rights, duties and their correlation; History and evaluation of IPR; Copyrights and related rights. Distinction among Various forms of IPR. Patent rights/protection and procedure; Infringement or violation; Remedies against infringement; Indian Patent Act 1970 and TRIPS; Geographical indication and Industrial design	8

Reference Books:

1. Santaniello, Evenson, Ziberman, Carlson – Agriculture and Intellectual Property Rights, Univ. Press, 1998
2. S. K. Chakraborty : Values and Ethics in Organization, OUP
3. A. N. Tripathi : Human Values, New Age International
4. Economic Reforms And Food Security: The Impact of Trade and Technology in South Asia by Suresh Chandra Babu, Haworth Press
5. Intellectual property rights in Agricultural Biotechnology; Edited by Erbisch, Maredia; CABI

(FPT-125) Beverage and Industrial Fermentation

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

Units	Contents	h
1.	Types of beverages and their importance; status of beverage industry in India; Manufacturing technology for juice-based beverages; synthetic beverages; technology of still, carbonated, low calorie and dry beverages; isotonic and sports drinks; role of various ingredients of soft drinks, carbonation of soft drinks. Specialty beverages based on tea, coffee, cocoa, spices, plant extracts, herbs, nuts, dairy and imitation dairy-based beverages.	8
2.	Alcoholic beverages- types, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, equipments used for brewing and distillation, wine and related beverages, distilled spirits.	8
3.	Packaged drinking water- definition, types, manufacturing processes, quality evaluation and raw and processed water, methods of water treatment, BIS quality standards of bottled water; mineral water, natural spring water, flavoured water, carbonated water. Introduction to fermentation, rate of microbial growth and death, fermentation kinetics, mass transfer diffusion, membrane transport, dialysis, nutrient uptake.	8
4.	Fermenter design, operation measurement and control in fermentation, aeration and agitation in fermentation, oxygen requirement, measurement of absorption coefficients, bubble aeration, mechanical agitation correlation between mass transfer coefficient and operating variables,	8
5.	Types of fermentation-sub-merged/solid state, sterilization-air and media sterilization, Batch/continuous fermentation, scale up in fermentation, product recovery, Principle and use of biosensor, production of vitamins, amino acids organic acids, Enzymes, antibiotics and alcohol. Biological waste treatment.	8

Reference Books:

Hardwick WA. 1995. Handbook of Brewing. Marcel Dekker.
Hui YH et al 2004 Hand book of Food & Beverage Fermentation Technology Marcel Dekker
Priest FG & Stewart GG. 2006. Handbook of Brewing. 2nd Ed. CRC.
Richard P Vine 1981 Commercial Wine Making - Processing and Controls. AVI Publ.
Varnam AH & Sutherland JP. 1994. Beverages: Technology, Chemistry and Microbiology. Chapman & Hall
Wood roof JG & Phillips GF, 1974, Beverages: Carbonated and Non-Carbonated. AVI Publ.
Lea, A.G.H., and J. R. Piggott, Fermented Beverage Production, 2nd Edition, Kluwer Academic/Plenum Publishers, New York, NY, USA 2003.
Geankoplis Christie J., Transport Processes and Separation Process Principles, fourth edition, Prentice-Hall PTR, New Jersey, US, 2003

(FPT 126) Food Processing Lab-II

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week

Examination Scheme:
Theory Paper: 80 Marks (3 h)
Class Test: 20 Marks

Sr. No.	Name of the Experiment	S. No.	Name of the Experiment
1.	Dehydration of fruits and vegetables	14.	Estimation of total carotenoids.
2.	Preparation of squash/ beverages / juices/ nectars	15.	Estimation of total and reducing sugar content.
3.	Preparation of Jam/Jelly/Marmalades.	16.	Preparation of fruit juice products.
4.	Preparation of tomato ketchup/sauces/spreads/purees/brines	17.	Estimation of total polyphenolic compounds in fruit powder.
5.	Preparation of soup mixes.	18.	Production of alcohol by fermentation
6.	Manufacture of macaroni/pasta by extruder.	19.	Estimation of TSS of fruits and fruit products.
7.	Dehydration of meat, fish, shrimp by tray drying/yard drying – Quality evaluation	20.	Estimation of moisture and total solids.
8.	Manufacture of ice cream.	21.	Estimation of titratable acidity.
9.	Production of cheese/yoghurt and examination of its microbiological study	22.	Preparation of bread- Sponge & Straight Dough
10.	Estimation of tannin in fruit juice.	23.	Estimation of ascorbic acid content.
11.	Inert Gas Packaging & Vacuum Packaging	24.	Determination of non enzymatic browning in processed fruit product.
12.	Capping & sealing	25.	Estimation of pectin content in fruits.
13.	Determination of maturity indices for fruits.		

Reference Books:

1. Ranganna, S. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2nd edition. Tata McGraw Hill Publishing Company Ltd., New Delhi

(FPT-127) Seminar

Teaching Scheme:	Examination Scheme:
Lectures: 00 h/week	Term work: 50 Marks
Tutorials: 04 h/week	Viva-Voce: 50 Marks

Objective

- To equip the students/scholars with skills to write dissertations, research papers, etc.
- To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing)

Technical writing

Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

Report Preparation and Presentation:

It shall be based on the literature survey on any topic, which may lead to dissertation in that area. It will be submitted as a report.

The candidate will have to deliver a seminar presentation before the faculty members and examiners, one of them will be guide (internal examiner) and the other will be examiner appointed by the university.

Reference Book:

Gibaldi, Joseph. 2000. MLA Handbook for Writers of Research Papers. 5thEd. Affiliated East-West Press, New Delhi.

Mills Gordon H & John A Walter. 1970. Technical Writing. 3rd Ed. Holt, Rinehart & Winston, New York.

Shelton James H. 1994.Handbook for Technical Writing.NTC Business Books, Chicago.

Smith Richard W. 1969.Technical Writing.Barnes&Noble, New York.

(FPT-211) Dissertation Part-1

Teaching Scheme:	Examination Scheme:
Lectures: 00 h/week	Term Work: 100 Marks
Tutorials: 20 h/week	Viva Voce: 100 Marks

The dissertation shall consist of a report on any research work done by the candidate or a comprehensive and critical review of any recent development in the subject or detailed report of the project work consisting of a design and / or development work that the candidate has executed. The report must include comprehensive literature work and detailed work plan on the topic selected for dissertation.

Term work:

The dissertation part-I will be in the form of seminar report on the project work being carried out by the candidate and will be assessed by two examiners appointed by the university, one of whom will be the guide and other will be a senior faculty member from the department.

Viva-voce:

The dissertation part I will be in the form of seminar report on the project work being carried out by the candidate and will be assessed by two examiners appointed by the university, one of whom will be the guide and other will be an examiner.

(FPT-221) Dissertation Part- II

Teaching Scheme:	Examination Scheme:
Lectures: 00 h/week	Term Work: 200 Marks
Tutorials: 04 h/week	Viva Voce: 200 Marks

The dissertation part-II will be in continuation of dissertation part-I and shall consist of a report on the research work done by the candidate or a comprehensive and critical review of any recent development in the subject or detailed report of the project work consisting of a design and /or development work that the candidate has executed. The examinee shall submit the dissertation in five copies to the head of the department duly certified by the guide, head of department and the Principal that the work has been satisfactorily completed. If you will perform work in other institute, you have to submit separate copies of dissertation as per the requirement to the institute.

Term work:

The dissertation will be assessed by two internal examiners appointed by the institute, one of whom will be the guide and other will be a senior faculty member from the department.

Viva-Voce:

It shall consist of a PPT presentation by the examinee on his work in the presence of examiners appointed by the university, one of whom will be the guide and other will be as external examiner.