DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO. ACAD/NP/M.Tech./Syllabi/188/2013

It is hereby informed to all concerned that, on recommendation of the Faculty of Engineering and Technology, the Hon'ble Vice-Chancellor has accepted the ***"Revised Syllabi with Cumulative Grade Point Average [CGPA] for [1] M.Tech. [Food Processing Technology], [2] M.Tech. [Computer Science & Technology] and [3] M.Tech. [Mechanical]"*** on behalf of the **Academic Council Under Section-14(7) of the Maharashtra Universities Act, 1994** as appended herewith.

This is effective from the Academic Year 2013-2014 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO. ACAD/ NP/ M.TECH./
SYLLABI / 2013/14083-91
V.C.14[7] A-08.

Date:- 14-06-2013.

★
★
★
★
★
★
★

Director,
Board of College and
University Development.

******

Copy forwarded with compliments to :-

1] The Principals, affiliated concerned Colleges,
Dr. Babasaheb Ambedkar Marathwada University.
2] The Director, University Network & Information Centre, UNIC, with **a request to upload the above all syllabi on University Website [www.bamu.net].**

Copy to :-

1] The Controller of Examinations,
2] The Superintendent, [Engineering Unit],
3] The Programmer [Computer Unit-1] Examinations,
4] The Programmer [Computer Unit-2] Examinations,
5] The Superintendent, [Eligibility Unit] ,
6] The Director, [E-Suvidha Kendra], in-front of Registrar's Quarter,
Dr. Babasaheb Ambedkar Marathwada University,
7] The Record Keeper,
Dr. Babasaheb Ambedkar Marathwada University.

-=**=-

S/140613/-*

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Syllabus of

M. Tech. (Food Processing Technology)

[Effective from Academic Year 2013 - 2014]

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
Teaching/Examination Scheme for the degree of Master of Technology (Food Processing Technology)
w.e.f. Year 2013-14

Semester-I

Course Code	Name of the Subject	Teaching Scheme Contact Hours per week				Examination Scheme - Marks					Duration of Theory exam	Credit
		Lectures	Tutorials	Practical	Total Hours	Theory	Class Test	Term work	Viva-voce	Total		
MTF 601	Food Microbiology & Bio-Chemistry	3	1	-	4	80	20	--	--	**100**	**3 Hrs**	**4**
MTF 602	Food Preservation Technology	3	1	-	4	80	20	--	--	**100**	**3 Hrs**	**4**
MTF 603	Food from Animal Sources	3	1	-	4	80	20	--	--	**100**	**3 Hrs**	**4**
MTF 604	Food from Plant Sources	3	1	-	4	80	20	--	--	**100**	**3 Hrs**	**4**
MTF-641-643	Elective-1	3	1	-	4	80	20	--	--	**100**	**3 Hrs**	**4**
MTF 621	Food Processing Lab-I	--	-	3	3	--	--	50	50	**50**		**1.5**
MTF 622	Food Analysis Lab			3	3					**50**		**1.5**
MTF 623	Seminar-I	--	-	2	2	--	--		50	**50**		**1**
	Total	**15**	**05**	**08**	**28**	**400**	**100**	**50**	**100**	**650**		**24**

Elective-1: 1. Food Plant Design and Economics, 2. Cold Chain Management and 3. Utilization of Food Industry Waste

Semester-II

Course Code	Name of the Subject	Teaching Scheme Contact Hours per week				Examination Scheme - Marks					Duration of Theory exam	Credit
		Lectures	Tutorials	Practical	Total Hours	Theory	Class Test	Term work	Viva-voce	Total		
MTF 651	Food Process Engineering	3	1	-	4	80	20	-	-	**100**	**3 Hrs**	**4**
MTF 652	Bakery & Confectionary Technology	3	1	-	4	80	20	-	-	**100**	**3 Hrs**	**4**
MTF 653	Food Handling and Packaging	3	1	-	4	80	20	-	-	**100**	**3 Hrs**	**4**
MTF 654	Beverage and Industrial Fermentation	3	1	-	4	80	20	-	-	**100**	**3 Hrs**	**4**
MTF 691-693	Elective-II	3	1	-	4	80	20	-	-	**100**	**3 Hrs**	**4**
MTF 671	Food Processing Lab-II	--	-	3	3	--	--	50	-	**50**	-	**1.5**
MTF 672	Food Microbiology & Enzymology Lab	--	--	3	3				50	**50**	-	**1.5**
MTF 673	Seminar-II	--	-	2	2				50	**50**	-	**1**
	Total	**15**	**05**	**08**	**28**	**400**	**100**	**50**	**100**	**650**		**24**

Elective-2: 1. Food Standards and Regulations, 2. Business Management and International Trade and 3. Marketing, Distribution and Logistics

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
Proposed Teaching/Examination Scheme for the degree of Master of Technology (Food Processing Technology)
w. e. f. Year 2013-14

Semester-III

Course Code	Name of the Subject	Teaching Scheme (Hrs. Per Week)				Examination Scheme - Marks					Duration of Theory exam	Credit
		Lectures	Contact Hours	Practical	Total Hours	Theory	Class Test	Term work	Viva-voce	Total		
MTF 731	Dissertation Part-I	-	12	-	12	-	-	50	50	**100**	-	**12**
	Total	**-**	**12**	**-**	**12**	**-**	**-**	**50**	**50**	**100**	**-**	**12**

- 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 Scheme (Hrs. Per Week)				Examination Scheme – Marks					Duration of Theory exam	Credit
		Lectures	Contact Hours	Practical	Total Hours	Theory	Class Test	Term work	Viva-voce	Total		
MTF 781	Dissertation Part-II	-	20	-	20	-	-	100	200	**300**	-	**20**
	Total	**-**	**20**	**-**	**20**	**-**	**-**	**100**	**200**	**300**	**-**	**20**
	Grand Total									**1700**		

Total Credits = SEM I + SEM II + SEM III + SEM IV
= 24 + 24 + 12 + 20
= 80

(MTF 601) Food Microbiology and Bio-Chemistry

Teaching Scheme:
Lectures: 03 hrs/week
Tutorials: 01 hrs/week
Credit: 4

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

Units	Contents	hrs
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**: 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, salvation. 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

(MTF 602) Food Preservation Technology

Teaching Scheme:
Lectures: 03 hrs/week
Tutorials: 01 hrs/week
Credit: 4

Examination Scheme:
Theory Paper: 80 Marks (3 hrs)
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

(MTF 603) Food from Animal Sources

Teaching Scheme:
Lectures: 03 hrs/week
Tutorials: 01 hrs/week
Credit: 4

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

Units	Contents	H
1.	**Introduction**: 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, by product 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.	**Fish**: 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 by products, Quality control of processed fish; Fish processing industries in India.	6
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.	6
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.	12

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

(MTF 604) Food from Plant Sources

Teaching Scheme:
Lectures: 03 hrs/week
Tutorials: 01 hrs/week
Credit: 4

Examination Scheme:
Theory Paper: 80 Marks (3 hrs)
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**: Objectives, Canning Process for Fruits and Vegetables, Principles, Process, Types of Tin Containers, Spoilage in Canned Fruits and Vegetables, Canning of Fruits, Canning of Vegetables Aseptic Canning of Fruit and Vegetable Products	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.	**Processing**: 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

(MTF 641) Food Plant Design and Economics (Elective-I)

Teaching Scheme:
Lectures: 03 hrs/week
Tutorials: 01 hrs/week
Credit: 4

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

Units	Contents	h
1.	**Introduction**: 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**: 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 elasticity's: concept of market demand, price and income elasticity's 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 & disinfestations, 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.

(MTF 642) Cold Chain Management (Elective-I)

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week
Credit: 4

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

Units	Contents	h
1.	Importance & scope of post harvest management of fruits and vegetables in Indian economy. Morphology, structure and composition of fruits and vegetables; maturity indices and standards for selected fruits and vegetables; methods of maturity determinations.	4
2.	Harvesting and handling of important fruits and vegetables, Harvesting tools and their design aspects ; Field heat of fruits and vegetables and primary processing for sorting and grading at farm and cluster level; factors affecting post harvest losses; Standards and specification for fresh fruits and vegetables.	4
3.	Post harvest physiological and biochemical changes in fruits and vegetables; ripening of climacteric and non-climacteric fruits; regulations, methods; Storage practices :CA and MA, hypobaric storage, pre-cooling and cold storage, Zero energy cool chamber; Commodity pre-treatments- chemicals, wax coating, pre-packaging, VHT and irradiation. Post Harvest handling system for fruits and vegetables of regional importance citrus, mango, banana, pomegranate, tomato, papaya and carrot etc., packaging house operations; principles of transport and commercial transport operations.	10
4.	Fundamentals of Freezing: crystallization and Glass transition in frozen foods and biomaterials, Microbiology of frozen food, thermo physical properties of frozen food, freezing loads and freezing time calculations, innovations in freezing process. Facilities for the cold chain: Freezing methods and equipment, cold storage design and maintenance, transportation of frozen foods, retail display equipment and management, house hold refrigerators and freezers, monitoring and control of cold chain.	12
5.	Quality and safety of frozen foods: Quality and safety of frozen meat and meat products, frozen poultry and poultry products, frozen fish, shell fish and related products, Quality and safety of frozen vegetables,frozen fruits, frozen dairy products, Quality and safety of frozen eggs and egg products. Monitoring and measuring techniques for quality and safety: Chemical measurements, sensory analysis of frozen foods, food borne illnesses and detection of pathogenic microorganisms, shelf life prediction of frozen foods.	10

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. S Cohen and J Roussel, Strategic Supply Chain Management : The five desciplines for top performance, McGraw-Hill Co, (2004).
5. N Lewis, The Cold Chain, Hamish Hamilton (1988).

(MTF 643) Utilization of Food Industry Waste (Elective-I)

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week
Credit: 4

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

Units	Contents	h
1.	Types of food processing wastes and their present disposal methods.Waste and its consequences in pollution and global warming	6
2.	Treatment of plant waste by physical, chemical and biological methods, Effluent treatment plants, Use of waste and waste water.	6
3.	Types, availability and utilization of by-products of cereals, legumes and oilseeds, Utilization of by-products from fruits and vegetables processing industries, sugar and agro based industries, and brewery and distillery waste.	10
4.	Status and utilization of dairy by-products i.e. whey, buttermilk and ghee residues, Availability and utilization of by-products of meat industry, poultry industry and fish processing units.	8
5.	Biomethanation and biocomposting technology for organic waste utilization, incineration and efficient combustion technology, Integration of new and renewable energy sources for waste utilization.	10

Suggested Readings

Chaturvedi P. 2000. Energy Management: Challenges for the Next Millennium.
Energy Conservation through Waste Utilization, American Society of Mechanical Engineers, New York.
Kreit F &Goswami DY. 2008.Energy Management and Conservation Handbook.CRC Press.
Murphy WR &Mckay G. 1982.Energy Management. BS Publ.
Patrick DR. 1982..Energy Management and Conservation. Elsevier
Publ.Patrick DR., Fardo SW, Richardson RE & Steven 2006.
Energy Conservation Guidebook.The Fairmont Press.
Wulfinghoff DR. Energy Efficiency Manual.Energy Institute Press.

(MTF 621) Food Processing Lab-1

Teaching Scheme:
Practical: 03 h/week
Credit:1.5

Examination Scheme:
Term Work: 50 Marks

S. No.	Name of the Experiments
1.	Experiment on minimal processing of fruits and vegetables
2.	Experiments on extrusion cooking of foods
3.	Visit to cold storage
4.	Visit to fruit/vegetable processing unit
5.	Determination of tensile strength and elongation of packaging materials
6.	Visit to food industries and familiarize with packaging operations
7.	Experiment with spiral separator
8.	Preparation of carbonated and non-carbonated soft deink
9.	Preparation of soy milk, fruit milk shakes, herbal beverages
10.	Pickling and curing of foods.
11.	Sampling techniques and preparation of test samples.
12.	Industrial visit

Reference 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

(MTF 622) Food Analysis Lab

Teaching Scheme:
Practical: 03 h/week
Credit: 1.5

Examination Scheme:
Viva-voce: 50 Marks

S. No.	Name of the Experiments
1.	Analysis of milk.
2.	Estimation of proteins
3.	Estimation of minerals
4.	Water analysis- pH, Hardness, TDS, N, S, total phosphorous
5.	Measurement of viscosity of the fluid foods using Brookfield viscometer.
6.	Qualitative test for determination of presence of starch in a food sample.
7.	Determination of specific gravity of food sample.
8.	Microwave cooking of foods.
9.	Estimation of crude fat in food sample.
10.	Determination of total ash of food
11.	Estimation of vitamins
12.	Industrial visit

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

(MTF 623) Seminar-I

Teaching Scheme:
Practical: 2 h/week
Credit: 1

Examination Scheme:
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 Books:

1. Gibaldi, Joseph. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East-West Press, New Delhi.
2. Mills Gordon H & John A Walter. 1970. Technical Writing. 3rd Ed. Holt, Rinehart & Winston, New York.
3. Shelton James H. 1994.Handbook for Technical Writing.NTC Business Books, Chicago.
4. Smith Richard W. 1969.Technical Writing.Barnes&Noble, New York.

(MTF 651) Food Process Engineering

Teaching Scheme:
Lectures: 03 hrs/week
Tutorials: 01 hrs/week
Credit:4

Examination Scheme:
Theory Paper: 80 Marks (3 hrs)
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 properties**: 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.,

(MTF 652) Bakery and Confectionary Technology

Teaching Scheme:
Lectures: 03 hrs/week
Tutorials: 01 hrs/week
Credit:4

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

Units	Contents	h
1.	**Introduction:** 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**: 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, flavour 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.	**Extrusion**: 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.

(MTF 653) Food Handling and Packaging

Teaching Scheme:
Lectures: 03 hrs/week
Tutorials: 01 hrs/week
Credit:4

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

Units	Contents	h
1.	**Packaging**: 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.	**Material in Packaging:** 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.	**Effect of Packaging**: 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:

1. Ahvenainen R. 2001. *Novel Food Packaging Techniques*.CRC.
2. Crosby N. T. 1981.*Food Packaging Materials*. App. Sci. Publ.
3. Mahadeviah M & Gowramma RV. 1996. *Food Packaging Materials*. Tata McGraw Hill.
4. Painy F. A. 1992. *A Handbook of Food Packaging*. Blackie.
5. Palling S. J. 1980. *Developments in Food Packaging*. App. Sci. Publ.
6. Rooney M. L. 1988. *Active Food Packaging*.Chapman& Hall.
7. Sacharow S. & Griffin R. C.1980. *Principles of Food Packaging*. AVI Publ.
8. Stanley S. & Roger C. G. 1998. *Food Packaging*. AVI Publ.

(MTF 654) Beverage and Industrial Fermentation

Teaching Scheme:
Lectures: 03 hrs/week
Tutorials: 01 hrs/week
Credit:4

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

Units	Contents	h
1.	**Beverages**: 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.	**Fermentation**: 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:

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

(MTF 691) Food Standards and Regulations (Elective-II)

Teaching Scheme:
Lectures: 03 hrs/week
Tutorials: 01 hrs/week
Credit:4

Examination Scheme:
Theory Paper: 80 Marks (3 hrs)
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 Management Systems- FSMS-22000.	8
2.	**Quality factors**: 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 Cosmetic Act (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 Hazards**: Food related hazards – biological hazards, chemical hazards, physical hazards, trace chemicals. Microbiological considerations in food safety.	8
5.	**Food Rights**: 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

(MTF 692) Business Management and International Trade (Elective-II)

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week
Credit:4

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

Units	Contents	h
1.	Concept and functions of marketing; concepts and scope of marketing management; concepts and elements of marketing mix.	8
2.	Concept of market structure, micro and macro environments; Consumer behaviour; consumerism; Marketing opportunities- Analysis, marketing research and marketing information systems.	8
3.	Market measurement- present and future demand; Market forecasting; market segmentation, targeting and positioning, Allocation and marketing resources, Marketing Planning Process, Product policy and planning: Product-mix; product line; product life cycle, New product development process. Product brand, packaging, services decisions. Marketing channel decisions, Retailing, wholesaling and distribution, Pricing Decisions, Price determination and pricing policy of milk products in organized and unorganized sectors of dairy industry, Promotion-mix decisions	8
4.	Advertising; how advertising works? Deciding advertising objectives, advertising budget and advertising message, Media Planning, Personal Selling, Publicity; Sales Promotion, Food and Dairy Products Marketing.	9
5.	International Marketing and International Trade, Salient features of International Marketing, Composition & direction of Indian exports; International marketing environment; Deciding which & how to enter international market; Exports- Direct exports, indirect exports, Licensing, Joint Ventures, Direct investment & internationalization process, Deciding marketing Programme; Product, Promotion, Price, Distribution Channels. Deciding the Market Organization; World Trade Organization (WTO).	9

Reference Books:

Suggested Readings

Chhabra T.N &Suria RK. 2001. *Management Process and Perspectives*. KitabMahal.
Jhingan ML. 2005.*International Economics*.5th Revised and Enlarged Ed. Virnda Publ.
Kotler P. 2000.*Marketing Management*.Prentice-Hall.
Reddy SS, Ram PR, Sastry TVN &Bhavani ID. 2004. *Agricultural Economics*. Oxford & IBH.

(MTF 693)Marketing, Distribution and Logistics (Elective-II)

Teaching Scheme:
Lectures: 03 h/week
Tutorials: 01 h/week
Credit:4

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

Units	Contents	h
1.	Marketing Management: Understanding Marketing Management, Definitions of Marketing Management, Types of Market, Evolving Views of Marketing's Role in an Organisation. Concepts – Marketers and Prospects, Marketing Environment, Exchange and Transactions, Needs, Wants and Demands, Product or Offering , Brand, Brand Image,Brand Strength and Brand Equity, Competition, Relationships and Networks, Marketing Channels, Supply Chain, Value and Satisfaction, Target Markets and Segmentation,Marketing Mix;Company Orientations towards the Market Place - Production Concept, Product Concept, Selling Concept, Marketing Concept, Societal Marketing Concept, Difference between Selling and Marketing.	8
2.	Product and New Product , Product – Levels of Product, Product Classification, Product Mix, Product Life Cycle. New Product – What is a New Product, Steps of New Product Development.Price Concept of Pricing, Pricing Methods, Pricing Strategies	8
3.	Promotion Advertising - Steps Of Developing an Advertising Program (5 M-s); Sales Promotion – Sales Promotion Tools Targeting the Customers, Trade and Sales Force; Public Relations & Publicity – Functions of PR Dept., Role of MPR; Personal Selling – Steps of Personal Selling, Qualities of a Successful Salesperson; Direct Marketing – Benefits, Major Channels of Direct Marketing;	8
4.	Market Segmentation STP Concept, Need for Segmentation, Bases of Segmentation, Types of Segmentation.Marketing Research Need and Steps for f Marketing Research, Questionnaires;	8
5.	Distribution Logistic : Roles of Intermediaries, Functions of Channels, Channel Levels, Channel Flows, Channel ,Design Decisions, Channel Management Decisions	8

Reference Books:

1. Phillip Kotler : Marketing Management : Prentice Hall/ Pearson Education
2. MahuaDutta, DebrajDutta: Marketing Management: Vrinda Publication
3. RajanSaxena : Marketing Management : Tata McGraw Hill
4. Palmer, Principles of marketing, OUP
5. Czinkota, Marketing Management,Vikas
6. B.K. Chatterjee, Marketing Management , Jaico

(MTF 671) Food Processing Lab-II

Teaching Scheme:
Practical: 03 h/week
Credit: 1.5

Examination Scheme:
Term Work: 50 Marks

Sr. No.	Name of the Experiment
1.	Dehydration of fruits and vegetables
2.	Preparation of squash/beverages/juices/nectars
3.	Preparation of Jam/Jelly/Marmalades.
4.	Preparation of tomato ketchup/sauces/spreads/purees/brines
5.	Preparation of soup mixes.
6.	Manufacture of macaroni/pasta by extruder.
7.	Manufacture of ice cream.
8.	Estimation of total and reducing sugar content.
9.	Estimation of TSS of fruits and fruit products.
10.	Estimation of moisture and total solids.
11.	Estimation of titratable acidity.
12.	Estimation of ascorbic acid content.

Reference Book:

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

(MTF 672) Food Microbiology and Enzymology Lab

Teaching Scheme:
Practical: 03 h/week
Credit: 1.5

Examination Scheme:
Viva-Voce: 50 Marks

Sr. No.	Name of the Experiment
1.	Evaluation of microorganism in raw and processed products by using various techniques
2.	Estimation of Microbial Count of food
3.	Microbiological quality of processed milk
4.	Study of factors influencing growth of microorganisms
5.	Microbiological analysis of raw water quality
6.	Application of enzyme in baking
7.	Meat tenderization
8.	Cheese making
9.	Preparation of wine and beer
10.	Extraction and clarification of juice using enzymes
11.	Industrial visit

(MTF 673)Seminar -II

Teaching Scheme:
Practical: 02 h/week
Credit: 1

Examination Scheme:
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:

1. Gibaldi, Joseph. 2000. MLA Handbook for Writers of Research Papers. 5thEd. Affiliated East-West Press, New Delhi.
2. Mills Gordon H & John A Walter. 1970. Technical Writing. 3rd Ed. Holt, Rinehart & Winston, New York.
3. Shelton James H. 1994.Handbook for Technical Writing.NTC Business Books, Chicago.
4. Smith Richard W. 1969.Technical Writing. Barnes&Noble, New York.

(MTF 731) Dissertation Part-1

Teaching Scheme:	**Examination Scheme:**
Contact hours: 12 hrs/week	**Term Work:** 50 Marks
Credit: 12	**Viva-Voce**: 50 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.

(MTF 781) Dissertation Part- II

Teaching Scheme:	**Examination Scheme:**
Contact hours: 20 hrs/week	**Term Work**: 100 Marks
Credit: 20	**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.