4Course Structure For
Master of Technology (M. Tech) In FOOD TECHNOLOGY

1st Year 1st Semester

A. Theory

		Theory					
SL.No.	**Code**	**Subjects**	**Contacts (Periods/Week)**				**Credit Points**
			L	**T**	**P**	**Total**	
1.	**PGFT101**	**Advanced Food Technology and Nutrition**	**3**	**1**	**0**	**4**	**4**
2.	**PGFT102**	**Advanced Biochemical Engineering**	**3**	**1**	**0**	**4**	**4**
3.	**PGFT103**	**Advanced Statistical Analysis**	**3**	**1**	**0**	**4**	**4**
4.	**PGFT104**	**Advanced Microbial Technology**	**3**	**1**	**0**	**4**	**4**
5.	**PGFT105**	**Elective I**	**3**	**1**	**0**	**4**	**4**
Total			**15**	**5**	**0**	**20**	**20**

		Elective I Subjects					
SL.No.	**Code**	**Subjects**	**Contacts (Periods/Week)**				**Credit Points**
			L	**T**	**P**	**Total**	
1.	**PGFT105A**	**Modern Separation and Purification Process**	**3**	**1**	**0**	**4**	**4**
2.	**PGFT105B**	**Agro Project Planning and Management**	**3**	**1**	**0**	**4**	**4**
3.	**PGFT105C**	**Functional Foods And Nutraceuticals**	**3**	**1**	**0**	**4**	**4**
4.	**PGFT105D**	**Advanced Fruits and Vegetables Technology**	**3**	**1**	**0**	**4**	**4**
Total			**3**	**1**	**0**	**4**	**4**

B. Practical/Sessional

SL.No.	**Code**	**Subjects**	**Contacts (Periods/Week)**				**Credit Points**
			L	**T**	**P**	**Total**	
1.	**PGFT191**	**Advanced Microbial Technology Laboratory**	**0**	**0**	**3**	**3**	**2**
2.	**PGFT192**	**Advanced Food Processing Laboratory**	**0**	**0**	**3**	**3**	**2**
3.	**PGFT193**	**Seminar I**	**0**	**0**	**2**	**2**	**1**
Total			**0**	**0**	**8**	**8**	**5**

1st Year 2nd Semester

A. Theory

		Theory					
SL.No.	**Code**	**Subjects**	**Contacts (Periods/Week)**				**Credit Points**
			L	**T**	**P**	**Total**	
1.	**PGFT201**	**Advanced Food Process Engineering**	**3**	**1**	**0**	**4**	**4**
2.	**PGFT202**	**Food Safety and Quality Assurance**	**3**	**1**	**0**	**4**	**4**
3.	**PGFT203**	**Advanced Techniques of Food Analysis**	**3**	**1**	**0**	**4**	**4**
4.	**PGFT204**	**Management Principles**	**3**	**1**	**0**	**4**	**4**
5.	**PGFT205**	**Elective II**	**3**	**1**	**0**	**4**	**4**
Total			**15**	**5**	**0**	**20**	**20**

		Elective II Subjects					
SL.No.	**Code**	**Subjects**	**Contacts (Periods/Week)**				**Credit Points**
			L	**T**	**P**	**Total**	
1.	**PGFT205A**	**Advanced Enzyme Engineering and Technology**	**3**	**1**	**0**	**4**	**4**
2.	**PGFT205B**	**Advanced Waste Treatment and Engineering**	**3**	**1**	**0**	**4**	**4**
3.	**PGFT205C**	**Advanced Food Biotechnology**	**3**	**1**	**0**	**4**	**4**
4.	**PGFT205D**	**Modern Food Packaging Technology**	**3**	**1**	**0**	**4**	**4**
Total			**3**	**1**	**0**	**4**	**4**

B. Practical/Sessional

SL.No.	**Code**	**Subjects**	**Contacts (Periods/Week)**				**Credit Points**
			L	**T**	**P**	**Total**	
1.	**PGFT291**	**Advanced Food Product Development and Quality Evaluation Laboratory**	**0**	**0**	**3**	**3**	**2**
2.	**PGFT292**	**Term paper**	**0**	**3**	**0**	**3**	**1**
Total			**0**	**3**	**3**	**6**	**3**

2nd Year 1st Semester

A. Theory

		Theory					
SL.No.	Code	Subjects	Contacts (Periods/Week)				Credit Points
			L	T	P	Total	
1.	PGFT301	Information Systems	3	0	0	3	3
2.	PGFT302	Elective III	3	1	0	4	4
Total			6	1	0	7	7

		Elective III Subjects					
SL.No.	Code	Subjects	Contacts (Periods/Week)				Credit Points
			L	T	P	Total	
1.	PGFT302A	Dairy Engineering and Dairy Products	3	1	0	4	4
2.	PGFT302B	Cryogenics	3	1	0	4	4
3.	PGFT302C	Cereal ProcessTechnology	3	1	0	4	4
4.	PGFT302D	Flavour Technology	3	1	0	4	4
Total			3	1	0	4	4

B. Practical/Sessional

SL.No.	Code	Subjects	Contacts (Periods/Week)				Credit Points
			L	T	P	Total	
1.	PGFT391	Information System Laboratory	0	0	3	3	2
2.	PGFT392	Project/Thesis	0	0	10	10	10
3.	PGFT393	Project Viva	0	0	0	0	3
Total			0	0	13	13	15

2nd Year 2nd Semester

A. Practical/Sessional

SL.No.	Code	Subjects	Contacts (Periods/Week)				Credit Points
			L	T	P	Total	
1.	PGFT491	Project/Thesis	0	0	18	18	10
2.	PGFT492	Project Defense	0	0	0	0	14
3.	PGFT493	Comprehensive Viva Voce	0	0	0	0	4

Total	0	0	18	18	28

SL.No.	Semester	Credit Points
1.	First year First Semester	25
2.	First year second semester	23
3.	Second year First Semester	22
4.	Second year Second Semester	28
	Total Credit	98

Detailed Syllabus

PGFT 101 : Advanced Food Technology & Nutrition L-T-P = 3-1-0

Module I:

Recent advances in food technology on different techniques of food preservation including non thermal & thermal processing; Membrane technology - Introduction to pressure activated membrane processes, performance of RO/UF and NF in industrial process.

Module II:

New & emerging technology: HPP, Supercritical and Near critical Fluid extraction, Ultrasound, Pulse electric field, Microwave Technology, Hurdle Technology.

Module III:

Ohmic heating, micro ionization in food processing and preservation, Nanotechnology principles, mechanism and applications in foods.

Studies of various packaging materials - intelligent packaging, aseptic & shrink packaging.

Module IV:

Biochemical pathway: Melanoidin complex (Browning effect), Characteristic changes of oil during repeated deep fat frying operation, Resistant Starch, Food allergens.

Role of micronutrients in biochemical pathways,Hypo & hyper activities of antioxidants.

Text Book/References:

1. Minimally processed fruits &vegetable:S.M.Alzamora, M.S.Tapia, A.Lopez - Malo
2. Food Science by Norman N Potter and Joseph H. Hotchkiss
3. The Technology of Food Preservation by Norman W. Desrosier, James N. Desrosie

PGFT 102: Advanced Biochemical Engineering **L-T-P = 3-1-0**

Module I:

Transport phenomenon in microbial system, Aeration and agitation, Single and multiple bubble aeration, Oxygen transfer in bioprocesses, Design of spargers and aeration equipment, Scale up of biological reactor

Module II:

Characteristics properties of biological fluid, Dynamics of microbial growth- different growth models for microbial processes, Dynamics of continuous culture, Kinetics of thermal death of microorganism, Recent advances in sterilization practice,

Module- III:

Design and analysis of biological reactor, Hollow fiber reactor, Membrane reactor, perfusion reactor for animal and plant cell culture, Bioreactor control, Computer coupled bioreactors,

Module-IV:

Downstream processing, Recent Advances in Enzyme engineering
Introduction to molecular genetics and control system, Principle and Applications of r– DNA technology

Text Book/References:

1. Advances in Biochemical Engineering/Biotechnology: Scheper, Belkins, Mattiasson and others, Springer Verlag, USA
2. Biochemical Engineering: James M Lee
3. Comprehensive Biotechnology; Murray Moo-Young, Elsevier Publications, UK
4. Bioprocess Engineering: Michael L.Shuler&FikretKargiZuiedu. Prentice Hall of India Private limited, New Delhi.
5. Biochemical Engineering: Aiba, Humphrey and Millis, Academic Press
6. Principles of Fermentation Technology: Stanburry and Whitaker, Pergamon Press
7. Biochemical Engineering Fundamentals: Bailey and Ollis, Mcgraw Hill

PGFT 103 :Advanced Statistical Analysis L-T-P = 3-1-0

Module I:

An introduction to statistics : Graphical and pictorial presentation of data, measures of centraltendency and dispersion, sampling techniques, sample size, coefficient of variation, mean error, relativeerror, precision and accuracy.Probability: Probability distributions, Probability Mass Function, Probability Density Function, NormalDistribution, Chi -square Distribution, t-Distribution, F-Distribution, Poisson Distribution, Expectation,Moment Generating Function

Module II:

Regression: Linear regression and correlation, curvilinear regression method of least squares, curvefitting, multiple regression and correlation, significance of correlation and regression.

Module III:

Parametric tests: Testing hypothesis, types of errors, tests of significance based on normal distribution,test of significance for correlation coefficients.Non-parametric tests: Data characteristics and non-parametric procedures, chi-square test, sign test

Module IV:

Experimental design: Randomization in completely randomized and Latin square designs, factorialdesign, cross over and parallel design, Statistical Quality Control (SQC)

Text Book/References:

1. Design and Analysis of Experiments– Douglas C. Montgomery. John Wiley & Sons Inc. (Publication)

2. Probability and Statistics-Morris H. DeGroot, Mark J. SchervishPearson Publication

PGFT 104:Advanced Microbial TechnologyL-T-P = 3-1-0

Module I:

Isolation, identification & quantitative estimation of industrially relevant microorganisms. Selection, development & maintenance of cultures. Morphology, physiology and genetics of microorganisms (bacteria, yeast, mould and actinomycetes). Microbial growthand factors influencing the growth. Growth kinetics-Measurement of growth

Module II:

Introduction to metabolism- Nutrient transport- Glycolysis - TCA cycle andother pathways - Control of metabolism.

Chemistry & biosynthesis of microbial products eg. Vitamins, amino acids, enzymes, steroids, antibiotics & polymers. Microbial transformation of alkanes, alkaloids, terpenes, aromatic compounds & naturally occurring polymers

Module III:

Microbes and their Spores in Foods and their significance. Microbiology of Milk, meat, fish, fruits & vegetables. Oriental and Western **f**ermented foods (fruits vegetables, cereals, meat, fish, milk). Role of Microbes as food and significance of Probiotic Bacteria.

Module IV:

Spoilage microorganisms in foods. Indicator Microorganism and Microbiological Criteria. Sampling for microorganisms in foods. Application of selective and modern techniques for detection and enumeration of microorganisms present in foods and water samples. Different techniques to prevent microbial contamination and food safety management. Biological-based Preservation

Text Book/References:

1. Essentials of Microbiology; K. S. Bilgrami; CBS Publishers, Delhi
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. Basic Food Microbiology; Bannett, Chapman and Hall
6. Food Microbiology; M. R. Adams
7. Hand Book of Microbiology; Bisen

8. Food Biotechnology,Vol 1 & 2; King RD &Cheetham PSJ; 1988, Elsevier App.Sci.
9. Food Biotechnology; Angold R, Buch G & Taggart J; 1989, CambridgeUniversity Press.
10. Fermentation Biotechnology: Principles, Processes & Products; Ward OP; Open University press.

PGFT 105A: Modern Separation & Purification Processes L-T-P = 3-1-0

Module I:

Fixed bed processes- ion exchange (principle & procedure, anion and cation exchanger resin), molecular sieve (principle & procedure, common column materials).

Module II:

Membrane separations techniques- classification, reverse osmosis, ultrafiltration, diafiltration, electrodialysis.cross flow filtration, application of van't Hoff equation, concentration polarization, rejection ratio, Types of devices, design- batch & continuous.

Module III:

Definition of chromatography, Process based on chromatography- partition chromatography, Comparison of paper and thin layer chromatography, Asscending and descending Chromatography, Structure and reactions of ninhydrin, Adsorption chromatography (Freundlich & Langmuir adsorption isotherm), ion exchange chromatography, affinity chromatography.,

Module IV:

Electrophoresis, capillary electrophoresis, iso-electric focusing, gel filtration, solvent extraction, supercritical fluid extraction.

Text Book/References:

1. Introduction to Practical Biochemistry by Plummer Mu, David T. Plummer,Tata McGraw-Hill Education, 1988.

2. Principles of Biochemistry by Lehninger ,6th Edition, Cox & Nelson Publication

3. Handbook of Membrane Separations: Chemical, Pharmaceutical, Food, and Biotechnological Applications. Published byCRC Press , Editor(s):Anil K. Pabby, Syed S.H. Rizvi, Ana Maria Sastre Requena

PGFT 105 B Agro Project Planning and Management L-T-P = 3-1-0

Module I:

Agro Industries & agricultural products, Indian farming community and their development Plan for production system of agricultural commodity, Agricultural products handling and storage

Module II:

Supply chain management, Agro product distribution & marketing, Infrastructure, mechanization & utilities planning, Capacity building of agri business.

Module III:

Processing and market development of live-stock, dairy, poultry silk & allied produce.Long term public- private partnership in agri business,Industrial Engg.

Module IV:

Contact agreement & fund management in agro business, Customized service & retail agribusiness management. Contract Farming, Farm economics, Satellite farming, Buy back farming.

Text Book/References:

1.Agri Business Management-Vedams,HimanshuRitu Publication,2006

2.Agro Industries for development.CarlosA.DaSilva,Baker,Shepherd,Jenanae and Da Cruz,Published by FAO,UNIDO &CAB International

PGFT 105 C Functional Foods and Nutraceutical L-T-P = 3-1-0

Module I:

Functional foods: Definition, Nature, type,scope, applications and their health benefits. Dietary fibers, complex carbohydrates and Protein as a functional food ingredient.

Module II:

Cereal (oats, wheat bran, rice bran etc),vegetables, oil seeds and animal products, Coffee, tea and other beverages as functional foods/drinks and their protective effects. The functional, and health promoting activities of common herbs. Probiotic foods and their functional role.

Module III:

Nutraceuticals: Definition, basis of claims for a compound as a nutraceutical or functional, regulatory issues including CODEX. Classification ofnutraceuticals based on chemical and biochemical nature.Role ofAntioxidants and other phytochemicals, (isoflavones, lycopenes * beta carotene etc.) as nutraceuticals.

Nutraceuticals for specific physiological conditions such as cancer, heart disease, stress, osteoarthritis, hypertension etc,. Clinical testing of nutraceuticals& functional foods. Prescription drugs &nutraceuticals, adverse effect & toxicity

Module IV:

Manufacturing aspects of selected nutraceuticals (such as lycopene, isoflavonoids, prebiotics & probiotics, glucose amine, phytosterolsetc),Formulation of functional foods containing nutraceuticals.Effects of processing, storage and interactions of various environmental factors on the potentials of such foods,

Stability & analytical issues, labeling issues. Marketing and regulatory issues for functional foods and nutraceuticals, Recent development and advances in the areas of nutraceutical and functional foods. Nutrigenomics- its relation to nutraceuticals.

Text Book/References:

- Functional Foods R. Chadwick,S. Henson,B. Moseley,G.
- Methods of Analysis for Functional Foods and Nutraceuticals by W. Jeffrey Hurst
- Handbook of Functional Dairy Products
- Functional Foods Mazza
- Handbook of Nutraceuticals and Functional Foods byRobert E.C. Wildman

PGFT 105 D Advanced Fruits and Vegetables Technology L-T-P = 3-1-0

Module I:

Importance of Post harvest handling, Composition and nutritive value of fruits and vegetables, low cost method of preservation of fruits and vegetables, spoilage of fruits and vegetables, Indian environment of fruit s and vegetable processing.

Module II:

Biochemical changes during post harvest storage, Cold Storage, Commercial Canning, Minimal Processing, Controlled atmospheric packaging of Fruits and Vegetables

Module III:

Osmotic dehydration, Foam mat drying, Freeze drying, microwave heating applications, radiation preservation of fruits and vegetables, Irradiation sources, Spray drying of fruit and vegetable juices, concentrates & powder – processing and packaging.

Module IV:

Intermediate moisture foods, Ohmic heating principle, High pressure processing of Fruits and Vegetables, Sensory evaluation & packaging Technology, Quality standards & Control of Fruits and Vegetables.

References:

- Cruess W. V., 2000 – Commercial Fruit and Vegetable Products – Agrobios.
- Sumanbhatti& Uma Varma, 1995. Fruit and Vegetable Processing, CBS Pub.
- Srivastava RP &Sanjeev Kumar, 1994, Fruits and Vegetable Preservation: Principles and Practices – International Book Distr.

PGFT 191: Adv. Microbial Technology Lab **L-T-P = 0-0-3**

1. Microbial growth and product formation kinetics

2. Production, recovery and control tests for :(a.) Alcohol fermentation, (b).Organic acid fermentation – Vinegar / citric / lactic acid production

3. Propagation of baker's yeast

4. Production of Fermented dairy products

5. Production of antibiotics

6. Production of extracellular Enzyme

7. Amino acid production

8. Vitamin B_{12}production

PGFT 192: Adv. Food Processing Lab **L-T-P = 0-0-3**

1. Preparation of protein isolate &hydrolysate.

2. Preparation of soy Paneer.

3. Preparation of Carrot powder.

4. Preparation of IQF fish by Plate freezer.

5. Preparation of canned Rasogolla.

6. Preparation of Fruit juice concentrate.

7. Preparation of value added Extruded snack foods.

8. Preparation of carbonated non alcoholic beverage.

9. Preparation of probiotic Ice cream.

10. Preparation of value added Bakery products.

11. Studies on dehydration in spray drier. Spray drier, fluidized bed drier, freeze drier etc.

12. Parboiling of paddy wheat & other cereals & determination of their milling characteristics

13. Milling of spices & determination oleoresins

14. Extraction and refining of oils from various oil seeds

15. Production of rice bran oil

PGFT 193: Seminar I **L-T-P = 0-0-2**

A seminar topic will be allotted to individual student according to his/her area of interest (students are also suggested to propose topics with relevant published information during the time of allotment), on which a report should be prepared and submitted after presentation as per schedule.

Semester-II

PGFT 201: Advanced Food Process Engineering **L-T-P = 3-1-0**

Module I :

Unit operation in Food Engineering, Material and energy Balance, Flow of fluids, Fluid flow Application, Hygienic design concepts, sanitary pipe fittings, Evaporation, Drying, Distillation, Centrifugal separation, Cyclone separator, Size reduction and classification, Mixing kneading Blending

Module II :

Module III :

Freeze concentration, homogenization, membrane separation process, reverse osmosis &ultra filtration, Recent development in non thermal processing of food.

Module IV :

Cold storage, modified & controlled atmosphere storage, recent development in food packaging-modified atmosphere packaging, aseptic packaging, vacuum packaging, retort able packaging

Text Book/References:

1. Fundamentals of food process engineering : R.T.Toledo, CBS publishers & distributors New Delhi.
2. Introduction to Food Engineering: R.P.Singh&D.R.Heldman, Academic Press, London
3. Food Process Engineering: D.R.Heldman&R.P.Singh. 2nd ed., AVI Publishing Co. Inc. Connecticut,USA.

4. Food Engineering Operations: Brennan,J.G, Butters, J.R., Cowell,N.D., Lilly, A.E.V., Applied Science Publishers Ltd., London.

PGFT 202 Food safety and Quality Assurance L-T-P = 3-1-0

Module- I:

Food quality and safety standards, FAO/ WHO food standards, Food Additives, Contaminants, Pesticide Residues, Residues of Veterinary Drugs, Food Labeling, , Organically Produced Food, Food Derived by application ofBiotechnology. Food Safety Management Systems and food laws of India.

Module- II:

Codex alimentarius commission, Understanding Codex codes, GMP, Food Import Control, Export Inspection and Certification System.

Module- III:

Principles of HACCP, identifying and monitoring of Critical Control Points, Corrective actions, preparing HACCP forms and documentation.ISO 22000 definitions, British Retail Consortium Food Standard, American Institute of Backing (AIB) standards. Planning, implementation and maintenance of standards.

Module- IV:

Industry specific Issues: Fats and Oils, Marine Products, Dairy Products, Cereals and Cereal Products, Fruits and Vegetables, Meat and Meat Products, Fermented Foods, Mineral and Packaged Drinking Water, Spices and Condiments, Street Food, Safety aspects of Nutrition and Food for Special Dietary Uses

Text Book/References:

1. Management and control of quality. James R Evans, William M Lindsey.Thomson South-western.
2. The Essentials of Quality Control Management, Peter N T Pang, Traffordpublishing.
3. Guide to Quality Management system for the food industry. Ralph Early

PGFT 203 Advanced Techniques of Food Analysis L-T-P = 3-1-0

Module- I:

Instrumental Analysis: Chromatographical Analysis-Use of GC, HPLC, GS-MS, LCMS, HPTLC.

Spectroscopic techniques-AAS,MS, NMR, IR,UV-visible.

Biosensors-Type of Biosensors-Calorimetric, Potentiometric, Amperometric, Optical, Piezoelectric, Immunosensors, Principle of detection, Application, Biosensors in food analysis.

Module - II:

Advanced Technique in Food Analysis:ELISA: Concept of Antigen and Antibody, ELISA, Type of ELISA, Method, Application in Food and Agriculture.Types of Immunoassay, Application of Immunoassay in Food Industry.

Analysis of Food Toxicants: Pesticides, heavy metal, Surface active agent, Radioactive metal detection,Rapid detection of pathogens based on metabolized.

Module- III:

Measurement in food processing- moisture content, humidity, color, temperature, flow metering, viscosity. Measurement of flavor, texture, particle size, food constituents- volatile compounds.

Organoleptic Evaluation: Sensory Quality, Panel selection and training, Judging Quality ,Test methods

Module- IV:

Advanced detection methods for special components: Detection of active biomolecules,Nutraceuticals,Adulterants(Spice,milk and Dairy Products,oil).

Detection of flavourmolecules,Enzymes/Antinutritional factors/NPN detection and Antioxidants

Text Book/References:

1. Handbook of Food Analysis, Second Edition -3, 2004 by CRC Press, Editor(s): Leo M.L. Nollet.

2. Food Analysis by HPLC, Third Edition, Published:November 16, 2012 by CRC Press, Editor(s):Leo M.L. Nollet, Fidel Toldra.

PGFT 204: Management Principles L-T-P = 3-1-0

Module- I:

Basic concepts of management: Definition – Need and Scope. Different schools of management thought – Behavioural, Scientific, Systems, and Contingency, Contribution of Management Thinkers: Taylor, Fayol, Elton Mayo

a)Functions of Management –a) Planning – Concept, Nature, Importance, Steps, Limitations ,Management by objectives

b) Organizing - Concept, Nature, Importance, Principles, Centralization, Decentralization, Organization Structures- Line and Staff Authority, Functional, Product, Matrix,

c) Staffing - Concept, Nature, Importance, Steps, Concept of knowledge worker.

d) Directing – Concept, Nature, Importance.

e) Controlling - Concept, Nature, Importance, Process of controlling, Control Techniques.

Module- II:

Decision making: Concept, Nature, Importance, and Process. Types of decisions, Problems in decision making.

Modern approaches to management .Concept of Knowledge management, change management, technology management, supply chain management, introduction to Intellectual Property Rights (IPR) and cyberlaws, process and project quality standards – six sigma, CMM,CMMI, PCMM, .

Contemporary Issues: Social Responsibility & Ethics, Globalization & Management

Inventing & Reinventing Organizations, Culture & Multiculturalism, Managing Organizational Change .

Module- III:

Sales Forecasting - Methods - Market Research - Scope, Obstacles in acceptance. Consumer Behavior - Factors influencing buyer behavior - Buyer decision process - Consumer Psychology - Industrial Buyer behavior Vs. Domestic Buyer behavior - Customer satisfactions Vs. Customer delight - Consumer value and satisfaction .Personality & Attitudes - Meaning of personality -

Development of personality - Nature and dimensions of attitude - Job Satisfaction - Organizational Commitment

Module- IV:

Motivation - Motives - Characteristics - Classification of motives - Primary Motives - Secondary motives - Morale - Definition and relationship with productivity - Morale Indicators ,Leadership - Definition - Importance - Leadership Styles - Models and Theories of Leadership Styles. Management of Change - Importance - Forces responsible for change - Resistance to change - Overcoming resistance to change - Introduction of change in the organization - Organizational Development as a toll for introduction of change, Total Quality Management - Techniques of TQM - Reengineering - Empowerment - Benchmarking - Down Sizing - Learning Organizations

Text Book/References:

1. P.C. Tripathi, P.N.Reddy: Principles of Management, McGraw Hill
2. Shukla, Madhukar: Understanding Organizations – Organizational Theory & Practice in India, PHI

PGFT 205 A: Advanced Enzyme Engineering & Technology L-T-P = 3-1-0

Module I:

Large scale production & purification of Biomolecules, Extraction of phytoenzymes,

Application of bio catalyst for new reactions & organic synthesis, immobilized enzymes, immobilization of living microbial cells & transformations of steroids.

Module II:

Enzyme kinetics & mass transfer of two liquid phases, heterogeneous systems, New immobilization technique of bio materials, Industrial applications of immobilized biomaterials, Operation of immobilized enzymes in different reactors.

Module III:

Biomass conversion with energy production. Analytical application of immobilized enzymes. Recent studies on antibiotics & low molecular weight enzyme inhibitor.

Module IV:

Medical application of enzyme technology. Genetic engineering for enzyme production. Recent development & future aspects of enzyme engineering.

Text Book/References:

1. Enzymology and Enzyme Technology: S.M.Bhatt, S Chand, New Delhi
2. Fundamentals of Enzymology: Nicholas Price and Lewis Stevens, Oxford University Press
3. Enzymes: Biochemistry, Biotechnology and Clinical Chemistry: Trevor Palmer, Horwood Chemical Science Series
4. Biochemical Engineering Fundamentals: Bailey and Ollis, McGraw Hill
5. Bioprocess Engineering: Michael L.Shuler&FikretKargiZuiedu. Prentice Hall of India Private limited, New Delhi.

PGFT -205 B Advanced Waste Treatment Engineering L-T-P = 3-1-0

Module – I

Classification and characterization of food industrial wastes from Fruit and Vegetable processing industry, Beverage industry; Fish, Meat & Poultry industry, Sugar industry and Dairy industry;

Module – II

Treatment methods of solid wastes: Biological composting, drying and incineration; Design of Solid Waste Management System: Landfill Digester, Vermicomposting Pit.

Module – III

Treatment methods for liquid wastes from food process industries; Design of Activated Sludge Process, Rotating Biological Contactors, Trickling Filters, UASB, Biogas Plant.
Positive water balance and reuse. Drinking-Water treatment.

Module – IV

Utilization of food industry waste: Production and extraction of value added products from fruit, vegetable and cereal industry waste. Processing of fish, meat and poultry industry waste for production of fish and animal feed, preparation of marketable products chitin, nutritional enhancer, chitosan, fertilizer etc.)Valorisation of dairy,tea and coffee industry waste.

Text Book/References:

1. Food Industry Wastes: Disposal and Recovery; Herzka A & Booth RG; 1981,Applied Science Pub Ltd.
2. Water & Wastewater Engineering; Fair GM, Geyer JC &Okun DA; 1986, JohnWiley & Sons, Inc.
3. Wastewater Treatment; Bartlett RE; Applied Science Pub Ltd.
4. Symposium: Processing Agricultural & Municipal Wastes; Inglett GE; 1973, AVI.
5. Food Processing Waste Management; Green JH & Kramer A; 1979, AVI.
6. Environmental Biotechnology: Principles and Applications; Rittmann BE &McCarty PL; 2001, Mc-Grow-Hill International editions.
7. Environmental Biotechnology; Bhattacharyya B C & Banerjee R; OxfordUniversity Press.

PGFT 205 C Advanced Food Biotechnology L-T-P = 3-1-0

Module-I

Introduction to food biotechnology, Application of genetics to food production. Methods of molecular cloning. Advantages and disadvantages of genetically modified foods. Advances in preservation of foods by various biotechnological processes.Regulatory and social aspects of biotechnology of foods.

Module-II

Basic Technological aspects and recent advancement in industrial production of alcoholic beverages (beer, wine,etc.) organic acids, amino acids, vitamins, antibiotics, baker's yeast, single cell protein. Production of food flavour, colour.

Fermentative production of enzymes like amylases, proteases, pectinases, glucose oxidases, cellulases, xylanases, lipases.Purification of enzymes.Extraction & clarification of fruit/ vegetable juice by enzymes.

Module-III:

Basics concepts and application of fermentation technology in food Industry. Fermented food: saurkraut, yoghurt, cheese, miso, tempeh, idli, dosa. Biopreservatives production. Organic foods: basic concept, methodology and advantages.

Module IV:

Biotechnological processes for manufacture of functional foods- nutraceuticals and probiotics. Biotechnological processes for food fortification, prebiotics, oligosaccharides. Treatment of food industry waste by biotechnological processes.

Text Book/References:

1. Food Biotechnology: Dietrich knorr, Marcel dekker Inc. Indian reprint 2005.
2. Food Biotechnology, Vol 1 & 2; King RD &Cheetham PSJ; 1988, Elsevier App.Sci.
3. Food Biotechnology; Angold R, Buch G & Taggart J; 1989, Cambridge University Press.
4. Fermentation Biotechnology: Principles, Processes & Products; Ward OP; Open University press.
5. Fundamental Principles of Bacteriology; Salle AJ; 7th ed, 1985, Tata-McGraw- Hill.

PGFT -205 D Modern Food Packaging Technology L-T-P = 3-1-0

Module- I:

Rigid and flexible packaging materials.Types and roles of active and intelligent packaging: Introduction; oxygen, ethylene and other scavengers; antimicrobial food packaging; non-migratory bioactive polymers in food packaging; time-temperature indicators; freshness indicators

Module-II:

Novel MAP applications for fresh-prepared produce; product safety and nutritional quality; reducing pathogen risks in MAP-prepared produce; detecting leaks in modified atmosphere packaging; MAP with other preservation techniques

Module-III:

Novel packaging and particular products: Active packaging in practice: meat,fish,fruits and vegetables, other fresh produce Laminates, multilayer laminates, testing of packaging materials.

Module-IV:

Legislative issues relating to active and intelligent packaging, recycling packaging materials,green plastics for food packaging, Packaging-flavour interactions; Food-packaging interactions; characteristics of food-grade packaging material.

Text Book/References:

1. Food and Packaging Interactions by Joseph H. Hotchkiss, (ACS symposiumseries -365, April 5-10, 1987, American chemical society, Washington DC, 1988.)

2. Packaging foods with plastics by winter A. Jenkins & James P Harrington –Technomic publishing co. Inc, Lancaster. Basel.

3. Flexible food packaging (Question & Answers) by Arthur Hirsch VNB – VanNostrand Reinhold, New York (An AVI Book), ISBN 0-442-00609-8.

4. Food Packaging and Preservation (theory & practice) by M.MathlouthiElsevier Applied science publisher, London and New york.

5. Food Packaging Materials (Aspect of Analysis & Migration of contaminants) byN.T.crosby applied science publishers LTD. London.

6. Plastics in Packaging by A.S Athlye, TMGH, New Delhi.

7. Packaging (specifications, purchasing & Quality Control) 3rd edition byEdmond A Leonard-Marcel Dekker, INC- Newyork& Basel.

8. Plastics in packaging by forwarded by H.B Ajmera& M.R SubramaniumIndian institute of packaging. Published by A.P.Vaidya, Secretary IIP, E2, MIDC,Industrial Area (Andheri (East), Bombay-400093.

9. Food Packaging- Stanley Sacharois& Roger C. Griffin- The AVI Publishingcompany Inc. 1970.

10. Principles of packaging development- Griffin &Sacharow. (The AVI Publishing company, Inc. 1972).

PGFT 291: Advanced Food Product Development and Quality Evaluation Laboratory

L-T-P = 0-0-3

- Development of a food product prototype including product formulation and specifications
- Selection and analysis of raw materials
- Establishment of suitable process flow-diagram for the developed protocol
- Development of HACCP plan for the processing line
- Establishment of quality assurance protocol
- Product testing (including sensory analyses) and shelf-life study

PGFT 292: Term Paper **L-T-P = 0-3-0**

Semester-III

PGFT 301: Information Systems **L-T-P = 3-0-0**

Module I :

Information Systems Today: introduction, its role in Business Today, Perspectives, Contemporary Approaches, Using Information Systems to Achieve Competitive Advantage, Ethical and Social Issues in Information Systems: Ethics, Moral Dimension, E securities.

Module II:

IT Infrastructure and Emerging Technologies: Infrastructure components, Hardware and Software Platform trends and emerging technologies, Management issues, Foundations of Business Intelligence: Database and Information Management, Organizing data, database approach & use to improve business performance and decision making, Managing data resources

Module III :

Achieving Operational Excellence and Customer Intimacy: Enterprise Applications: Supply chain management systems, Customer relationship management systems: Concepts of ERP,SAP, Enterprise applications: New opportunities and challenges, E-Commerce: Digital Market, Digital Goods: Electronic Commerce, M-Commerce, Electronic Commerce payment systems.

Module IV :

Managing Knowledge: The knowledge management landscape, Enterprise-wide knowledge management systems, Knowledge work systems, Intelligent techniques, Enhancing Decision Making: Systems for decision support, Executive support systems (ESS), Group decision-support systems (GDSS)

Text Book/References:

1.Management information systems- S.Sadagopan.PWI learning Pvt. Ltd.
2.E-commerce: Business, technology , society- Kenneth C. Laudon, carol GuercioTraver, Pearson Publication
3.Wharton on Managing Emerging Technologies- Gorge S.Day, Paul J.W.Schoemaker
4.Executive support systems: The emergence of top management computer use- John F.Rockart& David W.Delong

PGFT302A: Dairy Engg. & Dairy Products L-T-P = 3-1-0

Module I :

Milk as raw material and food –its characteristics, microbiology, quality assurance, quality evaluation,bulk milk coolers, milk collecting and chilling centre, nutritive value and physical characteristics of milk and milk products, In plant cleaning system, Milk Plant hygiene and sanitation, storage transportation and distribution of milk

Module II:

Milk processing- technology, process lines and dairy equipment. processing of market milk, homogenization&standardizationof milk, Biochemical kinetics of pasteurization and sterilization of milk.

Module III :

Market milk, milk drinks; Milk imitation, reconstituted and recombined milk, Manufacture of milk products like condensed, evaporated and dried milk, Infant milk food, cream, butter, ghee, ice cream, fermented milk product, Technology of cheese, cheese spread, yoghurt, dahi, shrikhand and similar products, Instantiation of milk powder. Fortification of milk, milk analogs.

Module IV:

Whey and whey utilization,Whey protein isolation and application of membrane Technology, water supply and waste water treatment, utilization of Dairy waste , refrigeration systems in dairy, packaging of milk and milk product.

Text/Reference Books:

1. Outlines of Dairy Technology by Prof.Sukumar De
2. Textbook of Dairy Chemistry byMathur MP, DattaRai D, Dinakar P.
3. Dairy Plant Engineering & Management by Tufail Ahmad
4. Principles of Dairy Chemistry. Robert Jenness& Stuart Patton

PGFT 302B :Cryogenics **L-T-P = 3-1-0**

Module I :

Introduction to general cryogens, physical & thermo physical properties of cryogens, manufacture of cryogenic fluids.

Module II:

Design & functioning of air separation plants. Recent developments in the manufacture of cryogenic fluids.

Module III :

Storage & transport of cryogenic fluids.Handling of cryogens.Design of such vessels.

Module IV:

Application of cryogens in preservation of food & biological materials, medicine & others.

Text/Reference Books :

1. A Text Book of Cryogenic Engineering ;discoveryPublishing House;valerg V Kostionik
2. CryogenicSystems 2nd Edition ; Randall F Barron ; Oxford UniversityPress ; New York
3. CryogenicProcess Engineering ; Timmerhaus, Flynn ; Plenum Press ; New York

PGFT 302C : Cereal Process Technology **L-T-P = 3-1-0**

Module – I :

Introduction to cerealtechnology; Production trend & prospect of differentcerealproducts (rice, wheat, corn, barley&oat) and millets in India; Storage of cereals; Structure and nutrient distribution in cereals.

Module – II :

Agents and factorsresponsible for spoilage of grains duringstorage; Actions recommended to minimize the spoilage; Modern methods of drying of grains applied in industries; Construction of modern warehouses for storing of cereal grains. Manufacture of differentproductsfromrice, wheat& corn and qualitative study of the products and its packaging. Pest control.

Module – III :

Milling of rice, wheat& corn; Effects of differentfactors on millingyield and quality; Comparative study of the millingoperations (rice, wheat& corn); Nixtamalization, By-products in the milling of theseproducts and theirutilization as food and feed.Production of starchfromcereals: its modification and uses.

Module – IV :

Breakfast cereals – its production and presentstatus; Extruded&puffedfoods – factorsaffectingitsquality; Fortification of theseproducts; Detailedstudy of the equipments and machines used for extrusion &puffing.

Text/Reference Books :

1.Chemistry and Technology of Cereals as Food and Feed, Samuel.A. Matz, Amazon
2.Post HarvestTechnology of Cereals, Pulses and oilseeds, A. Chakraborty, Oxford and IBA companyPvtltd
3. Chemistry and Technologystarch, Edited by James Be Miller and Roy Whistler Elsevier publication

4. Extrusion cooking Technologies and Application, Edited by R Guy, Campden and Choleywood

5.Woadheadpublishingseries in Food Science Technology and Nutrition

PGFT 302D : Flavour Technology **L-T-P = 3-1-0**

Module – I:

Introduction: Fundamentals of flavour, Classification of food flavor, flavour profile, factors affecting flavours, bioflavour and reconstituted flavour, flavor release from foods, interaction of flavor compounds with foods.

Flavour Extraction: Methods of flavour extraction, isolation, separation and equipment

Module – II:

Flavor Precursors: Flavor Compounds from Carbohydrates and Proteins, Lipid oxidation
Flavour intensifiers: Flavour intensifiers and their effects, Chemistry and technology of various flavour intensifiers
Flavour Biogenesis: Fruit aroma, vegetable aroma, Methyl ketones, diacetyl, acetaldehyde, lactones, terpenes, esters, pyrazines, vanillaflavour, enzyme and fermentation flavors.

Module – III:

Process Flavors: Effect of processing on flavor compounds, Non enzymatic browning, heat reaction flavors
Food Flavours: Flavour constituents: Onion, garlic, cheese, milk, meat, wine, coffee, tea, chocolate, citrus flavour

Module – IV

Flavour encapsulation and stabilization: Principles and techniques of flavour encapsulation, types of encapsulation, factors affecting stabilization of encapsulated flavour and their applications in food industry, Packaging and flavor compounds interaction, Effect of storage, processing, transportation and environmental conditions on flavour components /constituents

Textbooks/Recommended Books:

1.Source Book of Flavors Reineccius, G.
2.Flavour chemistry and technology Heath, H. B.
3.Understanding Natural Flavors. Piggott, J. R., Paterson, A.
4.Food Flavor: Morton, I. D., Macleod A. J.
5.Recent advances in flavor researchesYamanishi, T.
6.Bioprocess Production of Flavor,Fragrance, and Color IngredientsGabelman, A.
7.Food Flavorings. Ashurst P. R.

PGFT 391: Information Systems Lab **L-T-P = 0-0-3**

1. Study of commercial DBMS package(Oracle, Ms-Access)

2. Data analysis using Ms-Excel, Chart presentation

3. Web Programming using HTML,XML,CSS

4. Introduction MatLab

PGFT 392: Project/ Thesis **L-T-P = 0-0-10**

PGFT 393: Project Viva

PGFT 491:Project / Thesis L-T-P = 0-0-18

PGFT 492:Project Defense

PGFT 493:Comprehensive Viva Voce