



केन्द्रीय प्रौद्योगिकी संस्थान कोकराझार
CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR

Deemed to be University, MHRD, Govt. of India
Kokrajhar, BTAD, Assam 783370

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DEPARTMENT
OF
FOOD ENGINEERING
AND TECHNOLOGY
M.Tech.
Syllabus
(2020-21)



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Course Structure of M. Tech in Food Engineering & Technology

SEMESTER-I

CODE	SUBJECTS	Teaching Scheme (per week)			Contact hours	Credits
		L	T	P		
PFET101	Research Methodology and IPR	2	2	0	4	8
PFET102	Recent Trends in Food Engineering and Technology	1	2	0	3	6
PFET103	Recent Advances in Enzyme and Microbial Technology	1	2	0	3	6
PFET104	Food Product Development and Entrepreneurship	3	0	0	3	6
PFET111*	Elective-I	3	0	0	3	6
PFET112*	Elective-II	3	0	0	3	6
Total		13	6	0	19	38

Total Credits in Semester-I=38

SEMESTER-II

CODE	SUBJECTS	Teaching Scheme (per week)			Contact hours	Credits
		L	T	P		
PFET201	Emerging Food Processing Technologies-I; Beverages and Dairy	1	2	0	3	6
PFET202	Emerging Food Processing Technologies-II; Fats, Oils, Bakery & Confectionary	1	2	0	3	6
PFET203	Recent Trends in Food Safety and Quality Management	3	0	0	3	6
PFET211*	Elective-III	3	0	0	3	6
PFET212*	Elective-IV (open elective)	3	0	0	3	6
PFET271	Emerging Food Processing Technologies-I; Beverages and Dairy Lab	0	0	2	2	2
PFET272	Emerging Food Processing Technologies-II; Fats, Oils, Bakery & Confectionary Lab	0	0	2	2	2
PFET291	Seminar-I	0	0	4	4	4
Total		11	4	8	23	38



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Total Credits in Semester-II=38

SEMESTER-III

CODE	SUBJECTS	Teaching Scheme			Contact hours	Credits
		L	T	P		
PFET391	Dissertation-I	0	0	28	28	28
PFET392	Seminar-II	0	0	2	2	2
Total		0	0	30	30	30

Total Credits in Semester-III=30

SEMESTER-IV

CODE	SUBJECT S	Teaching Scheme			Contact hours	Credits
		L	T	P		
PFET491	Dissertation-II	0	0	32	32	32
Total		0	0	32	32	32

Total Credits in Semester-IV=32

Total Credits in (Semester I to Semester IV): 38+38+30+32=138

As per CIT Academic Ordinance:

1 h Lecture (L) per week	2 credit
1 h Tutorial (T) per week	2 credit
1 h Studio Project	2 credit
1 h Practical (P) per week	1 credit
1 h Project Work	1 credit
1 h Seminar / Training / Industrial Training	1 credit



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Elective-I (PFET111*) Subjects

CODE	SUBJECTS
PFET1111	Modern Fruits & Vegetables Processing Techniques
PFET1112	Refrigeration and Cold Chain Management
PFET1113	Technology of Food Flavors and Spices
PFET1114	Instrumental Analytical Techniques

Elective-II (PFET112*) Subjects

CODE	SUBJECTS
PFET1121	Food Biotechnology
PFET1122	Functional Food and Nutraceuticals
PFET1123	Modern Separation and Purification Technologies in Food Processing
PFET1124	Advanced Food Process Equipment and Design
PFET1125	Recent Trends in Muscle Foods and Poultry Processing

Elective-III (PFET211*) Subjects

CODE	SUBJECTS
PFET2111	Utilization of Food Industries Byproducts
PFET2112	Novel Food Packaging Technologies and Regulations
PFET2113	Indigenous Fermented Food Products
PFET2114	Engineering Properties of Biological Materials

Elective-IV (Open electives) (PFET212*) Subjects

CODE	SUBJECTS
PFET2121	Waste to energy
PFET2122	Nanomaterials Synthesis and Characterization Techniques
PFET2123	Cost Management of Engineering Project
PFET2124	Industrial Safety
PFET2125	Environmental Engineering



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DETAILED SYLLABUS

Subject: Research Methodology and IPR

SubjectCode: PFET101

Credit: 08

L-T-P: 2-2-0

Syllabus Contents:

UNIT-I: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, data analysis, interpretation

UNIT-II: Effective literature studies approaches, analysis. Plagiarism and Research ethics, Effective technical writing, how to write a report, a paper? Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT-III: Overview of Intellectual Property; introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR in abroad, International cooperation on Intellectual Property, Licensing and transfer of technology.

UNIT-IV: Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions? Granting of patent Rights of a patent, Searching a patent, Drafting of a patent, Filing of a patent, The different layers of the international patent system (national, regional and international options), Patents, Designs, Trade and Copyright.

References:

- T. M Murray and M.J. Mehlman, Encyclopedia of Ethical, Legal and Policy issues in Biotechnology, John Wiley & Sons 2000
- Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India Ltd, 2006
- Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students”
- Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
- Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”
- Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd, 2007



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Subject: RECENT TRENDS IN FOOD ENGINEERING & TECHNOLOGY

SubjectCode: PFET102

Credit: 06

L-T-P: 1-2-0

Syllabus Contents:

UNIT-I: Recent advances in Food Technology on different Techniques of foodpreservation including thermal processing- canning,pasteurization, sterilization.Design of various sterilizes for food processing, asepticsterilization, Plate heat exchanger, Evaluation of process time in canning.

UNIT-II: Design of storage units, freezing system in food, slow and quick-freezing, Different freezes used in foodindustry including cryogenic freezing system. Modified Atmospheric Packaging (MAP) and Controlled Atmosphere Storage (CAS) systems.Basics of hurdle technology – Mechanism, Application to foods, Newer Chemical and Biochemical hurdles

UNIT-III: Food flavour and flavour evaluation, Colour of Food and colour measurement, Rheological properties of foods, Modern design used in food industryincluding freeze drying, spray drying, Microwave processing of food, Extrusion technology- single &twin screw system.

UNIT-IV: Supercritical fluid extraction (SCFE/SFE) technology. Freeze concentration, Homogenization, Membrane separation process, Reverse osmosis, Purification of component by crystallization, filtration, and centrifugation. Modern techniques of food processing and quality control

References:

1. *Novel Food Processing Technologies* (Food Science and Technology Series) (2004). Gustavo V. Barbosa-Canovas, Maria S. Tapia, M. Soledad Tapia, M. PilarCano, Publisher: CRC Press,
2. *Hand Book of Microwave Technology for Food Applications.* (1999). Dutta AK &Anantheswaran RC.1999.
3. *Hurdle Technologies – Combination treatments for foodstability safety and quality,* (2002).Leistner L. and Gould G. Kluwer Academics / Plenum Publishers, New York
4. *New Methods of Food Preservation,*(2000) Gould GW. CRC.
5. *Trends in Food Engineering,* (2000). Jorge E. Lozano, Cristina Anon, Efren Parada-Arias, Gustavo V. Barbosa-Canovas, Contributor Jorge E. Lozano, Published by CRC Press.



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Subject: RECENT ADVANCES IN ENZYME AND MICROBIAL TECHNOLOGY

SubjectCode: PFET103

Credit: 06

L-T-P: 1-2-0

Syllabus Contents:

UNIT-I: Morphology and physiology of industrial microorganisms (Bacteria, yeasts, molds and actinomycetes). Isolation, identification and quantitative estimation of microorganisms, Microbiological assay, Genetics of some industrial microorganisms, Microbiology of soil, Selection, development and maintenance of cultures.

UNIT-II: Large scale production and purification of biomolecules. Application of biocatalysts for new reactions and organic synthesis. (Immobilised enzymes and synzymes – Application in organic synthesis). Immobilisation of living microbial cells and transformation of steroids. Enzyme kinetics and mass transfer or two liquid phase, Heterogeneous systems. New immobilisation techniques of biomaterials and their application.

UNIT-III: Industrial applications of immobilised biomaterials. Biomass conversion with energy production, Analytical application of immobilised enzymes. Recent studies on Antibiotics and low molecular weight Enzyme inhibitor. Recent development and future aspects of enzyme Engineering.

UNIT-IV: Chemistry and biosynthesis of microbial products e.g. vitamins, amino acids, enzymes, steroids, antibiotics and polymers. Metabolic regulations in industrial fermentation. Microbial transformation of alkanes, alkaloids, terpenes, aromatic compounds and naturally occurring polymers. Microbial food production. Spoilage microorganisms in foods and their control. Mycotoxins and Microbial insecticides.

References:

1. Fundamentals of Enzymology: Nicholas Price & Lewis Stevens
2. Enzymes: Biochemistry, Biotechnology and Clinical Chemistry- Trevor Palmer
3. Biochemistry text books by Stryer, Voet and Lehninger (Relevant Chapters)
4. Fermentation Microbiology and Biotechnology, Second Edition by E. M. T. El-Mansi, C. F. A. Bryce, Arnold L. Demain, A.R. Allman
5. Principles of Fermentation Technology by P F Stanbury, A Whitaker, S Hall,



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Subject: FOOD PRODUCT DEVELOPMENT AND ENTREPRENEURSHIP

SubjectCode: PFET104

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: Introduction to food product development, need, importance and objectives of product development in food industry; factors affecting food product development- extrinsic and intrinsic; steps in food product development; methodology involved in food product development; Concept Development: context and planning, frameworks for understanding customer needs, Concept generation, Translating the voice of the customer, Concept Selection, Concept testing overview.

UNIT-II: Food laws in food product development; process control parameters and scale up of developed products, market testing and marketing plans for developed products, costing and economic evaluation of developed products. Customer and user need assessment, market research- prototype development – market testing – feedback- commercial production- feedback- improvement.

UNIT-III: An Overview and Key Concepts of Project Management, Project planning & Project Feasibility Studies. DPR preparation for the project. Structures & techniques adopted by Project Management Institute (PMI). Human Aspects in Project Management, Project Scheduling with PERT/CPM, contingencies arrangement or plan 'B' preparation. Time-Cost-Trade-Off and Crashing of Projects. Human Resources Management.

UNIT-VI: Introduction to entrepreneurship: History, evolution and definitions of entrepreneurship, entrepreneur, entrepreneurial characteristics; Sequential stages of development of an entrepreneurship – Case studies; Definitions and classification of large, medium and small scale business. Trade license and registration; Selection of land for business and/or industries. Source of finance(s); Sources of machine(s) and equipment(s); Agencies for business promotion for food processing industries. Project report, market feasibility report, techno-economic feasibility report on food businesses

References:

1. Accelerating New Food Product Design and Development- Backley, 2007, Blackwell publishing, Oxford, UK.
2. Sensory and Consumer Research in Food Product Design and development- Moskowitz, 2006, Blackwell publishing, Oxford, UK.



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Elective-I (PFET111*) Subjects

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PFET1111	Modern Fruits & Vegetables Processing Techniques
PFET1112	Refrigeration and Cold Chain Management
PFET1113	Technology of Food Flavors and Spices
PFET1114	Instrumentation and Analytical Techniques

Subject: MODERN FRUITS & VEGETABLES PROCESSING TECHNIQUES

SubjectCode: PFET1111

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: Principles and methods of fruit and vegetable preservation. Advanced techniques for fruits and vegetables preservation. Low cost methods of preservation. Use of additives in product development. Enzyme and its application in fruits and vegetables processing, Ripening of fruits and role of enzyme.

UNIT-II: Measurement of colour, texture and other physico-chemical characteristics of fruits and vegetables. Characterisation of fruit flavour, retention of flavour. Analyses and detection of contaminants and adulterants, Microbiology of fresh and processed products and its control.

UNIT-III: Fruit and vegetable juices, preparation of syrups, cordials and nectars, juice concentrates, pectin and related compounds, jams, jellies, marmalades, preserves, theory of gel formation. Pickles, chutneys and vinegar production, tomato products.

UNIT-IV: Fruits and Vegetables processing equipments, Factory sanitation and hygiene. Legislation of processed fruit and vegetable products. Utilisation of fruits and vegetables processing waste.

References:

1. Gustavo V. Barbosa-Cánovas, María S. Tapia and M. Pilar Cano, *Novel Food Processing Technologies*, CRC Press, 2005
2. Rachna Sehrawat, Khursheed A. Khan, Megh R. Goyal, Prodyut K. Paul, *Technological Interventions in the Processing of Fruits and Vegetables*



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3. ÖzlemTokuşoğlu, Barry G. Swanson, Improving Food Quality with Novel Food Processing Technologies

Subject: REFRIGERATION AND COLD CHAIN MANAGEMENT

SubjectCode: PFET1112

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: Refrigeration – Ton of refrigeration, refrigeration cycles, Vapour Compression and Vapour Absorption cycles, Refrigerants, characteristics of different refrigerants, Ozone Depletion Potentials, Green house Potential Refrigerants, use of non polluting refrigerants

UNIT-II: Design of cold storage and air conditioning systems - types of loads in cold storage and their calculations, design of cold storage for food products, construction of cold storage, equipment selection, insulating materials, vapor barriers, care and maintenance of cold storage, Cold Storage practices, Stacking and handling of materials, Optimum temperatures of storage for different food materials.

UNIT-III: Frozen storage and temperatures, insulation of freezer rooms: Freezing rates, ice crystal growth, crystal size and its effect on texture and quality of foods, Freezing equipment; Freezer types, Blast freezers, Contact Plate Freezers, conveyORIZED quick freezers, Individual quick freezing. Cryogenic Freezing, Freezingpractice for meat, poultry, fruits and vegetables

UNIT-IV: Cold chain system - Important Factors to consider, logistic supply- Protocols for Domestic, Sea and Airfreight; Product Temperature and Moisture monitoring, transportation via land, air and sea, Grocery stores and display cases, Storage and packaging

References:

1. Anand, M.L. “Refrigeration and Air-conditioning”, Asian Books,
2. Clive D.J.Dellino: Cold and Chilled Storage Technology Publisher: KluwerAcademic Publishers
3. Andrew D Althouse and others: Refrigeration and air Conditioning Goodheart – Willcox Company Inc. 1982
4. E.R.Hollowell: Cold Storage and Freezer Storage Manual AVI Publishing Co.
5. AurelGobaneu and GabrielaLaseha and others (1976) Cooling Technology in theFood Industry: Abacus Press, Tunbridge Wells, U.K.
6. Dellino, C.V.J “Cold and Chilled Storage Technology”, Chapman Hall India



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Subject: TECHNOLOGY OF FOOD FLAVORS AND SPICES

SubjectCode: PFET1113

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: Introduction to flavor and flavor profile. Natural and synthetic flavoring substances and their chemical characteristics. Olfactory perception of flavor- Classification of flavors, Flavor potentiators, Flavor components/constituents of fruit and vegetables, coffee, tea and cocoa bean, spices and condiments, Measurement of flavor

UNIT-II: Effect of storage, cooking condition, processing, transportation and environmental condition on flavor components. Extraction, isolation and characterization of flavoring compounds of plant sources, and their utilization and application in food industries; Recent developments in flavor research, processing and technology

UNIT-III: Total component analysis; methods, recent developments. Head space analysis; static and dynamic methods, basic principles, method and developments, Solid phase micro extraction of aroma components; Electronic Nose (E-nose) technology.

UNIT-IV: Scope of spice processing in India, Types, qualities. Uses and physiological effects; components, antimicrobial and antioxidant properties, Medicinal value of condiments and spice products. Major spices- Pepper, cardamom, ginger, chili and turmeric-Oleoresins and essential oils; method of manufacture; chemistry of the volatiles; enzymatic synthesis of flavour identicals; quality control; fumigation and irradiation of spices

References:

1. *Food Flavor and Chemistry: Explorations into the 21st Century*, (2005), Spanier, A.M *et al.*, RSC.
2. *Food Flavours – Biology and Chemistry*, (1997). Carolyn Fisher, Thomas R. Scott, RSC Publishin
3. *Handbook of Flavor Characterization (Food Science and Technology)*, Kathryn D. Deibler, Jeannine Delwiche, Marcell Dekker Inc.
4. *Spice Science and Technology*, (1998). Hirasu, K and Takemasa, M. Marcel Dekker,



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5. *Handbook on Spices*. National Institute of Industrial Research Board (NIIR), Asia Pacific Business Press Inc.

Subject: INSTRUMENTAL ANALYTICAL TECHNIQUES

Subject Code: PFET1114

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: Introduction to spectroscopic techniques, UV - Vis Spectrophotometry, Turbidimetry, Reflectance Spectrometry, Fluorescence, Phosphorescence Spectrometry.

UNIT-II: Principle, Instrumentation and analytical applications of following techniques; Atomic Absorption spectroscopy, Flame photometry, Inductively coupled plasma-Atomic Emission spectroscopy, Scanning Electron Microscopy

UNIT-III: Chromatography: Gas solid Chromatography, Gas liquid Chromatography, ion exchange chromatography, paper chromatography, thin layer chromatography, column chromatography, gel permeation chromatography, High performance liquid chromatography (HPLC)

UNIT-IV: Infrared spectrometry, Introduction to X-Ray techniques, XRF, Introduction to NMR spectroscopy and mass spectrometry, Electroanalytical techniques: Potentiometry, Voltametry, Polarography.

References:

1. Principles of Instrumental Analysis, Skoog, Holler, Nieman, Saunders College Publishing.
2. Instrumental Methods of Analysis, Willard, Merritt, Dean, Settle, Wadsworth Publishing Company.



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Elective-II (PFET112*) Subjects

CODE	SUBJECTS
PFET1121	Food Biotechnology
PFET1122	Functional Food and Nutraceuticals
PFET1123	Modern Separation and Purification Technologies in Food Processing
PFET1124	Advanced Food Process Equipment and Design
PFET1125	Advances in Muscle Foods and Poultry Processing

Subject: FOOD BIOTECHNOLOGY

SubjectCode: PFET1121

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: Advances in preservation of Food by various biotechnological processes. Technology on fermented foods for fruits, vegetables, cereals, legumes, milk, meat, fish etc. Role of lactic acid bacteria on preservation of food items.

UNIT-II: Extraction and clarification of fruit/vegetable juice by enzymes. Fermentative production of enzymes like amylase, proteases, pectinase, glucose isomerase, glucose oxidase, cellulase, xylanase, lipases etc.

UNIT-III: Purification of enzymes by downstream processing. Production of alcohol, lactic acid and acetic acid from various food materials. Bacteriocin production and uses in food preservation,

UNIT-IV: Biotechnological processes for manufacture of functional foods: nutraceuticals and probiotics. Biotechnological process for food fortification, prebiotics & oligosaccharides. Improvement of quality of food by biotechnological processes. Treatment of waste from food industries by biotechnological application.

References:

1. Anthony Pometto, Kalidas Shetty, GopinadhanPaliyath, Robert E. Levin, Food Biotechnology, CRC press
2. Byong H. Lee, Fundamentals of Food Biotechnology, Wiley



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3. Vinod K. Joshi, R. S. Singh, Food Biotechnology: Principles and Practices

Subject: FUNCTIONAL FOODS AND NUTRACEUTICALS

Subject Code: PFET1122

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: Introduction to Nutraceuticals as Science: Historical perspective, classification, scope & future prospects. Sources of Nutraceuticals. Properties, structure and functions of various Nutraceuticals: Glucosamine, Octacosanol, Lycopene, Carnitine, Melatonin and Ornithine alpha ketoglutarate. Use of proanthocyanidins, grape products, flaxseed oil as Nutraceuticals. Role of Probiotics and Prebiotics as nutraceuticals

UNIT-II: Food as remedies: Nutraceuticals bridging the gap between food and drug, Nutraceuticals in treatment for cognitive decline, Nutraceutical remedies for common disorders like Arthritis, Bronchitis, circulatory problems, hypoglycemia, Liver disorders, Osteoporosis, Psoriasis, Ulcers, obesity, immune enhancement, age-related macular degeneration, endurance performance and mood disorder etc.

UNIT-III: Manufacturing aspects of selected nutraceuticals such as lycopene, isoflavonoids, prebiotics and probiotics, glucosamine, phytosterols etc.; formulation of functional foods containing nutraceuticals – stability and analytical issues, labelling issues. Anti-nutritional Factors present in Foods

UNIT-IV: Functional foods, vitamin- and mineral-enriched products, products containing added fibre, and omega-3 fatty acids/oils. Fortified beverages with calcium or omega-3 oils, yogurts with probiotics and drinks with herb blends as well as omega-3 eggs.

References:

1. Rotimi E. Aluko, Functional Foods and Nutraceuticals, Springer
2. R.C. Wildman, Handbook of Nutraceuticals and Functional Foods, CRC Press



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Subject: MODERN SEPARATION AND PURIFICATION TECHNOLOGIES INFOOD PROCESSING

SubjectCode: PFET1123

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: Introduction: Separation process in chemical and Biochemical industries, Categorization of separation process, equilibrium and rate governed processes.

UNIT-II: Modern separation techniques e.g. Membrane based separation technique (MBSTs): Historical background, physical and chemical properties of membranes, Techniques of membrane preparation, membrane characterization, various types of membranes and modules. Membrane separation, supercritical extraction, liquid membrane,

UNIT-III: Osmosis and osmotic pressure. Working principle, operation and design of reverse osmosis, ultrafiltration, microfiltration, electrodialysis and pervaporation. Gaseous separation by membranes.

UNIT-IV: Ion Exchange: Basic principle and mechanism of separation, Ion exchange resins, regeneration and exchange capacity. Exchange equilibrium, affinity, selectivity and kinetics of ion exchange. Design of ion exchange systems and their uses in removal of ionic impurities from effluents. Introduction to foam separation, Ion-exchange foam separation, micellar separation, liquid membrane permeation and chromatographic separation.

References:

1. King, C. J. Separation Processes, (Tata McGraw-Hill)
2. Sourirajan, S. and Matsura, T. Reverse Osmosis and Ultra-filtration – Process Principles
3. Porter, M. C. Handbook of Industrial Membrane Technology, (Noyes Publication)
4. Hatton, T. A., Scamehorn, J. F. and Harvell, J. H. Surfactant Based Separation Processes, (Marcel Dekker Inc.)



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Subject: ADVANCED FOOD PROCESS EQUIPMENT AND DESIGN

Subject Code: PFET1124

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: Machine Design: Introduction to equipment or machine design, Basic requirements for machine elements and machines, classification of engineering materials, selection of materials for engineering purposes, mechanical properties of metals, Manufacturing considerations in machine design; introduction to load, stress, strain, Young Modulus of Elasticity or Stress modulus or Modulus of rigidity, Stress strain diagram, Factor of safety, Theories of failure under static load, Corrosion mechanism and its control.

UNIT-II: Riveted Joints: Introduction Riveted points, kinds of riveted joints, failures of riveted joints, strength of riveted joint, Riveted value, efficiency of riveted joint, assumption for design of riveted joint, Design of riveted joint, Numerical problems. **Welded Joints:** Introduction to welding, advantages of welded joints over riveted joints, disadvantages of welding joints, classification of welding processes, types of welded joints, strength of welded joints, numerical problems. **Shafts, Keys & Coupling:** Different types of shafts, failures in shafts, design of strength shafts and axels, Types of keys, strength of keys, types of shafts coupling & their designs

UNIT-III: Heat Exchangers: Concept of overall heat transfer coefficient, LMTD, efficiency of parallel and counter current flow heat exchanger, design of double pipe heat exchanger, design of hair pin heat exchanger, multitude finned inner tubes, design of shell and tube heat exchanger

UNIT-IV: Design of Pipes: Different types of pipes, fabrication method of different types of pipes, testing of piping material, colour codes, different types of piping pints, different types of flow regulators)

References:

1. M V Joshi, Process equipment design
2. DR Heldman and R P Singh : Food Engineering and Operations
3. R C Sachdeva: Fundamentals of Engg. Heat and Mass Transfer.



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Subject: ADVANCES IN MUSCLE FOODS AND POULTRY PROCESSING

SubjectCode: PFET1125

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: Composition, classification, and color of meat, slaughtering techniques, meat cuts, Nutritional value of meat, Meat microbiology and safety, Post mortem changes in meat; Conversion of muscle to meat; Freshness and quality assessment of raw and processed meat

UNIT-II: Meat and poultry processing- curing and smoking; Fermented meat products (sausages and sauces); Frozen meat & meat storage. Beef Mutton, Pork Sausages and other meat products, Meat plant hygiene – GMP and HACCP, Byproduct utilization in meat and poultry processing

UNIT-III: Nutritional and Functional characteristics of Egg. Manufacturing of egg white, Egg yolk and Whole Egg solids/powder.

UNIT-IV: Classification of fresh water fish and marine fish; Commercial handling, storage and transport of raw fish. Methods of processing and preservation of fish- Canning, Freezing, Drying, Smoking and Curing. Fish products – fish meal, fish protein concentrate etc.

References:

1. R. A. Lawrie, Lawrie's Meat Science, Woodhead Publishing Limited
2. Y. H. Hui, Wai-Kit Nip, Robert Rogers, Meat Science and Applications, CRC Press



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Subject: EMERGING FOOD PROCESSING TECHNOLOGY-I; BEVERAGES AND DAIRY

SubjectCode: PFET201

Credit: 06

L-T-P: 1-2-0

Syllabus Contents:

UNIT-I

Fruit Juices Squashes & Cordials: Equipment for fruit juices, double operations process, Pulping equipment, flash pasteurization, hurdle technology, fruit beverage -preparation & preservation, Straining, filtration & clarification - Preservation of fruit juices by addition of sugar, freezing, carbonation, filtration and others. Tea-Coffee-Production; processing of coffee beans into powder, instant coffee, decaffeination- Tea-Leaf processing, various classes of tea, changes during processing of tea leaves, instant tea

UNIT-II

Processing technologies of Wines; red & white table wine, sherry sparkling wine, desert wine vermouth wine, flavored wine, fruit wine etc. Non-bacterial & bacterial spoilage of wine, winery byproducts, Processing technologies of Beer –Brewing, raw material & manufacture, storage finishing & packaging, Brandy & whisky production - Composition & methods for manufacturing

UNIT-III

Composition of milk; Varieties of milk; Handling and storage of fresh milk. Rapid tests for milk purity, Pasteurization of milk; HTST and UHT techniques; Packaging of milk; Processing of milk products like evaporated milk, condensed milk, milk powder, ice cream, Infant food formula, and Indigenous dairy sweets.

UNIT-IV

Milk fermentation and fermented milk products such as- Yogurt, Curd, Cheese, Fermented milk beverages, and other, Milk plant hygiene and sanitation.

References:

1. Varman Alan, and Sakesland, Technology, Chemistry and Microbiology of food beverages, Springer (sie) Publisher, 2 nd edition, 2009 REFERENCES
2. Girdharilal and Siddappa, Preservation of Fruits and Vegetables, Kalyani Publishers, 2001.
3. W.V.Cruces, Commercial fruits and Vegetable products, Agrobios Publishers, 2009.



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Subject: EMERGING FOOD PROCESSING TECHNOLOGY-II; OILS, FATS, BAKERY AND CONFECTIONARY

Subject Code: PFET202

Credit: 06

L-T-P: 1-2-0

Syllabus Contents:

UNIT-I

Oils and Fats; Sources; chemical composition; physicochemical characteristics; functional and nutritional importance of dietary oils and fats, Post-harvest handling storage and processing of oilseeds for direct use and consumption. Extraction of oil by mechanical expelling and solvent extraction, Processing of other plant sources of edible oils and fats like coconut, cottonseed, rice bran, maize germ, etc.

UNIT-II

Refining: Clarification, degumming, neutralization (alkali refining), bleaching, deodorization techniques / processes. Blending of oils. **Processing of refined oils:** Hydrogenation, fractionation, winterization, inter-esterification etc. for obtaining tailor-made fats and oils. Production of butter, lard, tallow, margarine, Cocoa butter, peanut butter, etc., Specialty fats and designer lipids for nutrition and dietetics,

UNIT-III

Current status, growth rate, and economic importance of Bakery and Confectionary Industry in India. Bakery Products: Ingredients and Processing Technologies for breads, biscuits, cookies & crackers, cakes & other baked products. Equipments used, product quality, pertinent standards & regulations for above bakery products.

UNIT-IV

Confectionary Products: Hard-boiled candies, toffees, fruit drops, chocolates and other confections:- ingredients, equipments & processing technologies, product quality, Production & quality of chewing and bubble gums, cocoa products, breakfast cereals,

References:

1. Hamm, W. and Hamilton, R. J. Edible oil Processing, (CRC Press, 2000)
2. Lawson, H. Food oils and fats: technology, utilization, and nutrition, (Chapman & Hall, 1994)
3. Rajah, K. K. Fats in Food Technology, (Sheffield Academic Press, 2002)
4. Matz, S. A. Bakery Technology and Engineering, (CBS Publications, 2003)
5. Pyler, E. J. Baking Science and Technology, (Sosland Publishing Company, 2009)
6. Fereidoon Shahidi, Bailey's Industrial Oil and Fat Products, Wiley & Sons



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Subject: RECENT TRENDS IN FOOD SAFETY AND QUALITY MANAGEMENT

SubjectCode: PFET203

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: Advances in scientific basis of biological, chemical and physical hazards: Emerging toxicology, food allergens, and foodborne pathogens; Current scenario on major food safety research emphasis; Emerging areas of public health issues associated global food safety scenario

UNIT-II: Advances in food laws and regulations: FSSRs, amendments, and additions / supplements; Recently passed and/or enacted food laws and regulations (e.g. Trustea); Recent updates in pre-requisie programs for HACCP implementation – a food sector-wise overview

UNIT-III: Recent updates in global food safety standards and FSMS: ISO 22000, FSSC 22000, BRC Global Standards on Food Safety (Issue 7), etc.

UNIT-IV: Application of advanced technologies to ensure food safety and quality: On-line, rapid detection, and predictive modeling; Emerging personal hygiene and consumers' behavior towards food safety; Introduction to food safety audit and certification of FSMS

References:

1. BRC. 2016. *BRC Global Standards for Food Safety – Issue 7*
2. FSSA. 2011. *Food Safety and Standards Rule*
3. FSSC. 2010. *Food Safety System Certification 22000*. Foundation for Food Safety Certification
4. ISO. 2005. *Food Safety and Management System ISO 22000: 2005*
5. ISO. 2013. *Food safety management systems -- Requirements for bodies providing audit and certification of food safety management systems*
6. Sofos, J. N. Ed. 2013. *Advances in microbial food safety*. Woodhead Publishing



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Elective-III (PFET211*) Subjects

CODE	SUBJECTS
PFET2111	Utilization of Food Industry Byproducts
PFET2112	Novel Food Packaging and Regulations
PFET2113	Indigenous Fermented Foods and Beverages
PFET2114	Engineering Properties of Biological Materials

Subject: Utilization of Food Industry Byproducts

SubjectCode: PFET2111

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: Introduction about Food Industry Waste Utilization; Waste from rice mill industry – agricultural waste based furnace- types, design. Utilization of rice husk- cement preparation, ceramic materials. Utilization of rice bran - problems in processing of rice bran-stabilization methods of utilization- rice bran stabilizers-extraction of rice bran-refining uses of bran, bran oil and defatted bran.

UNIT-II: Fruit Industry Waste Utilization; Different sources of wastes from fruit and vegetable industries and their availability in India- Status and types of waste available- possible byproducts. Utilization of mango, citrus, apple, guava, grape waste-vinegar production. SCP production, organic acid production from vegetable waste. Utilization of moringa, potato, leafy vegetable waste.

UNIT-III: Tuber Crops Waste Utilization; Waste from tuber crops - effluent safe disposal- effluent treatment plant waste recycling plant - feasibility report for food industries using food waste and by products. Alcohol production from cane sugar industry waste.

UNIT-IV: Fish and Poultry Water Utilization; Fish industry by products- methods and production of fish meal, fish protein concentrate-fish and body oils. Poultry waste-recycling. Tapioca waste utilization- furfural production methods-paper making from cellulosic waste.

References:

1. P. N. Chereminnoff & A.C Morresi, "Energy from Solid Wastes" 1976,
2. Chakravarthy & De, "Agricultural Waste and By Product Utilisation".
3. Bor S. Luli (ed), "Rice Production and Utilisation"
4. E. Beagle, "Rice Husk Conversion to Energy".
5. Waldron, K. Handbook of Waste Management and Co-product Recovery in Food Processing, (Woodhead Publishing, 2007)



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Subject: Novel Food Packaging and Regulations

SubjectCode: PFET2112

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: Introduction To Food Packaging; Packaging requirements and problems - functions of package- design of packages for various foods. Development of protective packaging- shelf life studies using packaging materials-methods of shelf life estimation.

UNIT-II: Food Packaging Equipments: Equipment and method- packaging equipment for solid, liquid semi-liquid food, types of fillers; filler for glass bottle, paper bottle, pouches, plastic cup, thermoforming equipments, form-fill-seal equipment, sealing equipment, labelling, capping, canning and cartoning equipment.

UNIT-III: Food Safety and Standards Act, 2006 (FSSA) - Need, Scope and Definitions (Chapter I of FSSA, 2006)

UNIT-IV: Food Packaging Laws and Regulation; Nutritional Labelling and Health claims, Edible Oils Packaging (Regulation) Order, 1998. - Need, Scope, Functions & Enforcement

References:

1. Patricia and Curtis A, An operational Text Book, Guide to Food Laws and Regulations.
2. The Food Safety and Standards act, 2006 along with Rules & Regulations 2011, Commercial Law Publishers (India) Pvt. Ltd.



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Subject: Indigenous Fermented Foods and Beverages

SubjectCode: PFET2113

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: Introduction to traditional fermented foods of India, composition and nutritive values, microbial and biochemical diversity, quality and food safety challenges,

UNIT-II: Processing & Preservation methods of Traditional fermented foods: Idli, dosa, Vada, khamman, dhokla, Dahi (Curd), Srikhand.

UNIT-III: Processing & Preservation methods of Indigenous Alcoholic Beverages,

UNIT-IV: Industrialization, Socioeconomic Conditions and Sustainability of Traditional Fermented Foods.

References:

1. Handbook of Indigenous Fermented Foods. K.H. Steinkrus (Ed), Marcel Dekkar Inc. 2nd Edition, 1998.
2. The Food of India. P. Wickramasinghe, and C. Selva Rajah (Eds), Oberoi Group, Periplus, 1st Edition, 2001



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Subject: Engineering Properties of Biological Materials

SubjectCode: PFET2114

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: Importance of engineering properties of biological materials, Study of different physical and thermal characteristics of important biological materials like shape, size, volume, density, roundness, sphericity, surface area, specific heat, thermal conductivity, thermal diffusivity, etc. measurement of colour, flavour, consistency, viscosity, texture and their relationship with food quality and composition.

UNIT-II: Rheological characteristics like stress, strain time effects, rheological models and their equations. Aerodynamic characteristics and frictional properties. Application of engineering properties in handling processing machines and storage structures.

UNIT-III: Thermal, Electrical and Optical Properties; Specific heat, thermal conductivity, thermal diffusivity, electrical resistance and conductance, dielectric constant, reflectivity, transitivity and absorptivity of incident rays.

UNIT-IV: Applications; Application of engineering properties in process development as well as design and operation of equipment and structures associated with handling, processing and storage of raw as well as processed food products

Recommended Books

1. Rao, M. A., Rizvi, S. S. H. and Datta. A. K. Engineering Properties of Foods, (CRC Press, 2005)
2. Sahin S. and Sumnu, S. G. Physical Properties of Foods, (CRC Press, 2006)
3. Mohesenin, N. N. Thermal Properties of Foods and Agricultural Materials, (Gordon and Breach Science Publishers, 1980)



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Elective-IV (Open electives) (PFET212*) Subjects

CODE	SUBJECTS
PFET2121	Waste to energy
PFET2122	Nanomaterials Synthesis and Characterization Techniques
PFET2123	Cost management of engineering project
PFET2124	Industrial Safety
PFET2125	Environmental Engineering

Subject: WASTE TO ENERGY

SubjectCode: PFET2121

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT-II: Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods -Yields and application – Manufacture of pyrolytic oils and gases, yields and applications. Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers-Fluidized bed gasifiers – Design, construction and operation

UNIT-III: Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-IV: Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion -biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion -Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd.,
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I &II, Tata McGraw Hill Publishing Co. Ltd.,
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd.,
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons,



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Subject: NANOMATERIALS SYNTHESIS AND CHARACTERIZATION TECHNIQUES

Subject Code: PFET2122

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: NANODIMENSIONAL MATERIALS; 0D, 1D, 2D structures – Size Effects – Fraction of Surface Atoms – specific Surface Energy and Surface Stress – Effect on the Lattice Parameter – Phonon Density of States – the General Methods available for the Synthesis of Nanostructures – precipitative – reactive – hydrothermal/solvothermal methods – suitability of such methods for scaling – potential Uses

UNIT-II: PHYSICO-CHEMICAL METHODS OF NANOSTRUCTURED MATERIALS
Solution growth techniques of 1D-2D nano structures:- Synthesis of metallic, semiconducting and oxide nanoparticles – homo- and hetero-nucleation growth methods – template-based synthesis (electrochemical, electrophoretic, Melt and solution, CVD, ALD) – Gas Phase Synthesis of Nanopowders: – Vapor (or solution) – liquid – solid (VLS or SLS) growth – the Need for Gas/vapor State Processing – Main Stages of Gas Phase Synthesis – Applicability of the methods.

UNIT-III: CHARACTERIZATION OF NANOPHASE MATERIALS Fundamentals of the techniques – experimental approaches and data interpretation – applications/limitations of X-ray characterization: – X-ray sources – wide angle, extended x-ray absorption technique – Electron microscopy: SEM/TEM – high resolution imaging – defects in nanomaterials – Spectroscopy: – electron energy-loss mechanisms – electron filtered imaging – prospects of scanning probe microscopes – optical spectroscopy of metal/semiconductor nanoparticles

UNIT-IV: NANOSCALE PROPERTIES Magnetism:- Magnetic Moment in clusters/Nanoparticles – Magnetic Order – coercivity – Magnetocrystalline Anisotropy – thermal activation and Superparamagnetic effects – Electronics and Optoelectronics:- Quantum Confinement of Superlattices and Quantum Wells – Dielectric Constant of Nanoscale Silicon – Doping of a Nanoparticle – Excitonic Binding and Recombination Energies – Capacitance in a Nanoparticle – Diffusion in

References:

- 1) C. N. R. Rao, A. Müller, A. K. Cheetham, The Chemistry of Nanomaterials :Synthesis, Properties and Applications, Volume 1, Wiley-VCH, Verlag GmbH
- 2) Guozhong Cao, Nanostructures & Nanomaterials Synthesis, Properties G;Z: Applications, World Scientific Publishing Private, Ltd., Singapore (2004).
- 3) Carl C. Koch, Nanostructured Materials: Processing, Properties and Potential Applications, Noyes Publications, William Andrew Publishing Norwich, New York, U.S.A (2002).



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Subject: COST MANAGEMENT OF ENGINEERING PROJECT

SubjectCode: PFET2123

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: Introduction and Overview of the Strategic Cost Management, Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System, Inventory valuation, Creation of a Database for operational control, Provision of data for Decision-Making.

UNIT-II: Project: meaning, Different types, cost overruns centres, various stages of project execution: conception to commissioning, Project execution as conglomeration of technical and nontechnical activities, Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts; Types and contents.

UNIT-III: Cost Behaviour and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets.

UNIT-IV: Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.



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Subject: INDUSTRIAL SAFETY

SubjectCode: PFET2124

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and fire fighting, equipment and methods.

UNIT-II: Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT-IV: Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment, Types of faults in machine tools and their general causes.

UNIT-V: Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

References:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.



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Subject: ENVIRONMENTAL ENGINEERING

SubjectCode: PFET2125

Credit: 06

L-T-P: 3-0-0

Syllabus Contents:

UNIT-I: Wastes: types and sources, Water pollution: characterization of liquid wastes and effects, Stream sanitation, Treatment methods. Indian standards for drinking water, Water borne diseases and their control.

UNIT-II: Air Pollution: Composition, Classification and sources of air pollutants. Effects of air pollution on human, plant and animals, Air pollution control methods, equipment and safety. Salient features of the Air (Prevention and control of pollution) Act – 1981.

UNIT-III: Solid Wastes Management: Characterization, disposal methods. Environmental Acts and Regulations.

UNIT-IV: Noise Pollution: Measurement of sound, Sources, Effects and control of noise pollution. Introduction to: “The environment (Protection) Act – 1986.

References:

1. H.S. Peavy, D.R. Rowe and G. Tchbanoglous, Environmental Engineering, McGraw Hill
2. M. L. Davis, Water and waste water Engineering, Mc Graw Hill education (India) Pvt. Ltd.
3. H.C. Parkins, Air Pollution, McGraw-Hill Pub.
4. L.W. Canter, Environmental Impact Assessment, McGraw Hill Pub.
5. M.L. Davis and D.A. Cornwell, Introduction to Environmental Engineering,
6. Metcalf and Eddy, (Revised by G. Tchobanoglous Wastewater Engineering:



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Subject: Emerging Food Processing Technologies-I; Beverages and Dairy Lab

SubjectCode: PFET271

Credit: 02

L-T-P: 0-0-2

Syllabus Contents:

Total ContactHours: 24

List of Experiments:

1. Estimation of and comparison of MF and MSNF contents in various types of milk.
2. Analysis of raw milk quality through platform tests.
3. Evaluation of bacteriological standards of raw milk.
4. Detection of adulteration of milk and milk products.
5. Pasteurization of milk and checking the efficiency of pasteurization in Liquid Milk.
6. Development of new milk products and studying the changes in the quality characteristics during storage period.
7. Determination of aqueous extraction of tea/coffee
8. Determination of caffeine in beverages
9. Preparation of RTS beverage
10. Preparation of artificial lemon juice
11. Detection of sodium benzoate in beverage
12. Development of a novel beverage: Ideation and justification



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Subject: Emerging Food Processing Technologies-II; Fats, Oils, Bakery & Confectionary Lab

Subject Code: PFET272

Credit: 02

L-T-P: 0-0-2

Syllabus Contents: 30

Total Contact Hours:

1. Determination of Specific Gravity
2. Determination of Refractive Index
3. Determination of Flash Point
4. Determination of Color
5. Determination of unsaponifiable matter
6. Determination of Acid Value, Saponification Value, Iodine value, Peroxide value
7. Determination of Reichert Meisel and Polanski value
8. Determination of Cloud Point of Palmolein
9. Separation of Cholesterol by Reverse phase thin layer Chromatography
10. Test for Refined Winterized Salad Oil – Cold Test
11. Study of Physiochemical properties of wheat flour and bakery products like Moisture content, Gluten content, Ash content, Protein content, SDS-Sedimentation test, Alcoholic acidity, Water absorption capacity, Yeast activity, Dough raising capacity etc.
12. Study of sophisticated instruments used in the quality evaluation of wheat flour- Farinograph, Extensigraph, Alveograph, Amylograph, Mixograph, Amylograph, RVA, Texture analyzer etc.
13. Preparation and study of characteristics of bakery products like biscuits, breads, cakes, cookies etc.
14. Study of equipment used in production of confectionary products- confectionary moulder, mixer/blender, extruder etc.
15. Preparation and study of characteristics of confectionary products like chocolates, candy, toffee, frost, gum etc.