

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Food Technology
 (Applicable from the academic session 2018-2019)

| | |
|--|---|
| Name of the Course: Food Packaging Technology | |
| Course Code: PC-FT 701 | Semester: VII |
| Duration: 6 months | Maximum Marks: 100 |
| Teaching Scheme | |
| Examination Scheme | |
| Theory: 3 hrs./ week | Mid Semester Exam.: 15 Marks |
| Tutorial: Nil | Assignment & Quiz: 10 Marks |
| Practical: Nil | Attendance: 5 Marks |
| Credit Points:3 | End Semester Exam: 70 Marks |
| Objective: | |
| 1 | To develop the knowledge about the basics of Packaging technology that exists in society. |
| 2 | To make the students equipped with understanding of criteria required for designing a successful packaging systems for any food product |
| 3 | To identify the risks associated with the overall process generation and implementation. |
| 4 | To acquire updated knowledge about the new technologies that are developing in packaging industries |
| Pre-Requisite: | |
| 1 | Basic Chemistry |
| 2 | Basic Food Microbiology |
| 3 | Basic knowledge of mathematics, physics and mechanics |

Details of Syllabus:

| Unit | Content | Hrs/ Unit | Marks / Unit |
|-------------|---|------------------|---------------------|
| 1 | Definition and Functions of packaging; Type of packaging materials; Selection of packaging material for different foods; Methods of packaging and packaging equipment. | 10 | |
| 2 | Mechanical strength of different packaging materials; Printing of packages; Barcodes & other marking; Interactions between packaging material and foods; Environmental and cost consideration in selecting packaging materials. | 7 | |
| 3 | Manufacture of packaging materials; Potential of bio-composite materials for food packaging; Packaging regulations as per FSSAI; Packaging and food preservation; | 8 | |
| 4 | Testing of packaging materials (PM) in food industries; Rigid and semi rigid containers; Flexible containers; Sealing equipment; Labelling and symbols used in packaging products; Aseptic and shrink packaging; Secondary and transport packaging. | 10 | |

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| 5. | Advances in Packaging Technologies; MAP, CAP, Active packaging, Intelligent Packaging, Nano-Packaging, Irradiated food Packaging. | 10 | |
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Text and Reference Books:

TEXT

1. Food Packaging: Principles and Practice by G. L. Robertson. Taylor & Francis Inc.
2. Food Packaging Technology by Richard Coles, Derek MC Dowell and Mark J. Kirwan. Blackwell Publishing, CRC press.
3. Food and Packaging Interactions by Joseph H. Hotchkiss, (ACS symposium series -365, April 5-10, 1987, American chemical society, Washington DC, 1988.)

REFERENCE

1. Packaging foods with plastics by winter A. Jenkins & James P Harrington – Technomic publishing co. Inc, Lancaster. Basel.
2. Flexible food packaging (Question & Answers) by Arthur Hirsch VNB – Van Nostrand Reinhold, New York (An AVI Book), ISBN 0-442-00609-8.
3. Food Packaging and Preservation (theory & practice) by M. Mathlouthi-Elsevier Applied science publisher, London and New York.
4. Food Packaging Materials (Aspect of Analysis & Migration of contaminants) by N.T. crosby applied science publishers LTD. London.
5. Plastics in Packaging by A.S Athlye, TMGH, New Delhi.
6. Packaging (specifications, purchasing & Quality Control) 3rd edition by Edmond A Leonard- Marcel Dekker, INC- New York & Basel.
7. Plastics in packaging by forwarded by H.B Ajmera & M.R Subramanium – Indian institute of packaging. Published by A.P.Vaidya, Secretary IIP, E2, MIDC, Industrial Area (Andheri (East), Bombay-400093.
8. Food Packaging- Stanley Sacharois & Roger C. Griffin- The AVI Publishing company Inc. 1970.
9. Principles of packaging development- Griffin & Sacharow. The AVI Publishing company, Inc. 1972.

Course Outcome:

After completion of the course the students will be able to:

CO1: To define, understand, and relate basic packaging technologies with respect to manufacturing methodologies, potential material development to address substantiated solution to practical food preservation and transportation problems.

CO2: Recognize the need, and to have the preparation for independent, life-long learning in the emerging areas of packaging technology in synergy with other technological applications.

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CO3: Interpret and demonstrate as a professional, who has comprehensive knowledge on regulatory requirements for food packaging and allied areas to meet societal needs within realistic constraints such as economic, environmental, ethical, legal, cultural, health and safety, feasibility, and sustainability.

CO4: Examine and analyze problems associated with difficulties related to packaging material, methodologies and food components to be packaged.

CO5: Create, develop and formulate appropriate packaging technologies with the aid of various tools with a view to work in real life situations and as independent entrepreneurs.

CO6: Communicate to defend effectively on professional activities in order to estimate and support societal awareness and need on packaging technology.

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|---|---|
| Name of the Course: Food Safety & Quality Management | |
| Course Code: PC-FT 702 | Semester: VII |
| Duration: 6 months | Maximum Marks: 100 |
| Teaching Scheme | |
| Theory: 3 hrs./ week | Examination Scheme |
| Tutorial: Nil | Mid Semester Exam.: 15 Marks |
| Practical: Nil | Assignment & Quiz: 10 Marks |
| Credit Points:3 | Attendance: 5 Marks |
| | End Semester Exam: 70 Marks |
| Objective: | |
| 1 | To develop the knowledge of students regarding quality control and management principles, tools and their application |
| 2 | To enable the students to be aware of the voluntary and mandatory food standards and certifications in place- globally and nationally |
| Pre-Requisite: | |
| 1 | Basic mathematics, basic biology, food preservation, quality control and assurance, |

Details of Syllabus:

| Unit | Content | Hrs/ Unit | Marks / Unit |
|------|---|-----------|--------------|
| 1 | Definition of quality, Quality specifications and quality attributes of different foods, Statistical quality control, Quality control programs: History and development, Total quality management (TQM), Quality assurance, Management Principles, ISO 9000 Family (QMS), principles and requirements | 12 | |
| 2 | Food Safety Management System ISO-22000 – Family, Key role, Principles of FSMS and requirements, HACCP- Prerequisites; GMP/C-GMP, GHP, GLP, Cleaning and Sanitation, Safety practices in the production areas, Pest Control, Withdrawal and Recall Procedures, traceability system, Principles and steps of HACCP Plan, Hazard Identification, Risk assessment, CCP Decision Tree, CAPA Plan, document and records, | 12 | |
| 3 | Mandatory and voluntary regulations world-wide, CODEX, FDA, WHO, EFSA, WTO, (TBT, SPSs), GATT. Role of regulatory authorities in India - functioning, legal acts and their enforcements- FSSAI (in detail), BIS, AGMARK, Legal Metrology Act, Industry Specific Regulations, ASCI, EPA, Export Quality Control and Inspection Act | 12 | |
| 4 | Certification, Certification procedures, Certifying bodies, Accrediting bodies, International bodies. GFSI benchmarking, FSSC 22000, BRC, SQF, IFS, FSMA, OSHA, | 5 | |

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| | Auditing procedures- types of audit, Surveillance; Mock audit, third party quality certifying audit, Auditors and Lead auditors. | | |
| 5 | Sampling procedure: tools and techniques, Bio-safety guidelines for research, environmental aspects of GMOs, handling and disposal of biowaste | 4 | |

Text and Reference Books:

Text Books

1. Total Quality Management, M.P. Poonia & S.C. Sharma, Khanna Publishing House (AICTE Recommended Textbook - 2018)
2. Total Quality Management, Poornima M. Charantimath, Pearson Education India
3. Total Quality Management for the Food Industries. WA Gould, Woodhead Publishing
4. Management and control of quality. James R Evans, William M Lindsey. Thomson South-western
5. Bioethics and Biosafety, M. K. Sateesh, I. K. International Pvt Ltd.

Reference Books

1. The Essentials of Quality Control Management, Peter N T Pang, Trafford publishing
2. Guide to Quality Management system for the food industry. Ralph Early

Course Outcome:

After completion of the course the students will be able to

CO1: Remember and relate principles of natural, biological science, and engineering fundamentals with basics food safety and quality management.

CO2: Understand the problems arising in quality control and quality assurance during food processing and interpret the tools and solutions that are being developed to solve such problems

CO3: Ability to apply food safety management principles with an understanding of the limitations in application of the same in food quality and safety maintenance in a food industry.

CO4: Analyze existing food laws and quality management techniques in relation to follow legal limits and supply safe food to consumers.

CO5: Evaluate and interpret data and apply resources to reach a sustainable solution in food safety and quality management system in industries.

CO6: Develop system tools to meet specific needs of food safety and maintain the effective quality of food during processing taking into consideration public health and safety, cultural, societal and environmental issues.

Special Remarks (If any): Nil

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| Waste Management and Utilization of Food Industries Waste | |
|--|---|
| Course Code: PE-FT 701A | Semester: VII |
| Duration: 6 months | Maximum Marks: 100 |
| Teaching Scheme | |
| Examination Scheme | |
| Theory: 3hr./ week | Mid Semester Exam.: 15 Marks |
| Tutorial: Nil | Assignment & Quiz: 10 Marks |
| Practical: Nil | Attendance: 5 Marks |
| Credit Points: 3 | End Semester Exam: 70 Marks |
| Objective: | |
| 1 | Student can learn about different type of wastes in different food and Fermentation industries, |
| 2 | Solid and liquid waste management, Isolation of value added products from different waste, biogas generation |
| 3 | Composting of solid waste and removal technology of different toxic metals from industrial effluents like bioremediation and membrane separation technology |
| Pre-Requisite: The following modules (or equivalents) should be preferably completed prior to, this module: | |
| 1 | Basic of Microbiology |
| 2 | Basic of Biochemical Engg |
| 3 | Basic separation process like Membrane separation technology |
| 4 | Mechanical operation and settling process |

Details of Syllabus

| Unit | Content | Hrs/ Unit | Marks / Unit |
|-------------|--|------------------|---------------------|
| 1 | Introduction: Classification and characterization of food industrial wastes from fruit and vegetable processing industry, beverage industry, fish, meat and poultry industry, sugar industry and dairy industry; Waste disposal methods – physical, chemical and biological; Economical aspects of waste treatment and disposal. | 6 | |
| 2 | Production of pectin, ethanol, natural gas, citric acid, activated charcoal, fibre extract from apple pomace, vitamins Production of citrus oil from peels of citrus fruits; Manufacture of candied peel and pectin from albedo of citrus fruits. Production of single cell protein by utilizing waste products, use of potato wastes | 9 | |
| 3 | Production of fish meal; Fish protein concentrate; Animal feed; Shell product; Glue from seafood processing waste. Texturized fish protein concentrate; Utilization of organs and glands of animal as human food. Production of human food from animal blood and blood protein; Marketable products like chitin, chitosan, fertilizer, nutritional enhancer animal feed from shells. | 6 | |

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| 4 | Treatment methods for liquid wastes from food process industries; Design of activated sludge process, Trickling filters, Rotating biological contactors UASB, Biogas plant. | 10 | |
| 5 | Treatment methods of solid wastes: Biological composting, drying and incineration; Design of solid waste management system: Landfill digester, Vermi-composting pit. | 8 | |
| 6 | Biofilters and bioclarifiers, Ion exchange treatment of waste water, Drinking-water treatment, Recovery of useful materials from effluents by different methods | 6 | |

References and Text Books:

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, John Wiley & 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; Oxford University Press.
8. O.P. Gupta, Elements of Solid Waste & Hazardous Management, Khanna Publishing House (AICTE Recommended Textbook – 2018)

Course Outcome:

CO1: Student can recall basic knowledge of Biochemistry and Microbiology as applied in reactor designing

CO2: They can understand the operation of different modern Food waste water treatment plant by gaining knowledge from this paper

CO3: They can make use of the knowledge of the subject in designing of different aerobic and anaerobic bioreactor

CO4: They can also assess the operational principle of municipal water and demineralized water plant.

CO5: The student can develop ideas about biogas generation by utilization of this organic waste by microorganisms, and how bio fuels generated from digestion of the waste can be utilized by concerned industries as basic ingredients of boiler fuel

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|--|---|
| Name of the Course: Nutraceuticals & Functional Foods | |
| Course Code: PE-FT 701B | Semester: VII |
| Duration: 6 months | Maximum Marks: 100 |
| Teaching Scheme | |
| Theory: 3 hrs./ week | Examination Scheme |
| Tutorial: Nil | Mid Semester Exam.: 15 Marks |
| Practical: Nil | Assignment & Quiz: 10 Marks |
| Credit Points:3 | Attendance: 5 Marks |
| | End Semester Exam: 70 Marks |
| Objective: | |
| 1 | To develop the understanding of the concept of Nutraceuticals & Functional Foods |
| 2 | To enable the students to learn about the health beneficial properties of Nutraceuticals & Functional Foods |
| | To enable the students to learn about the manufacturing processes, regulatory challenges and market trends of Nutraceuticals & Functional Foods |
| Pre-Requisite: | |
| 1 | Basic biology, food chemistry, biochemistry, nutrition, food processing, quality control and food regulations |

Details of Syllabus:

| Unit | Content | Hrs/ Unit | Marks / Unit |
|-------------|---|------------------|---------------------|
| 1 | Definitions of Functional Foods and Nutraceuticals, Types of functional foods and Nutraceuticals, Components like nutrients such as lipids, fibers, amino acids, spices, herbs, polyphenols and bioactive properties, Vitamins and Health, Minerals and Health, Concepts and of Probiotic, prebiotics, synbotics, Supplements like antioxidants and their biochemical functions | 10 | |
| 2 | Nutritional significance: Role of nutraceutical / functional foods in cardiovascular health, diabetes, obesity, immunity, neurodegenerative and age related muscular degeneration, stress management; Nutrition and nutraceuticals for targeted population such as children, woman, adults and elderly. | 10 | |
| 3 | Enrichment, value addition, fortification, supplementation, Sources, Significance, Fortification and Enrichment in different foods (MSG; Bakery and confectionary products e.g. bread, biscuit and cookies; Breakfast and ready to eat cereals; Infant formulas; Protein mixes; Vegetable Mixes; Dairy product e.g. ice cream; Beverages including diet beverages, Sports drink, Value addition | 10 | |

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| | in processed food products | | |
| 4 | Functional ingredients: Extraction / purification of lycopene, essential oils, isoflavonoids, prebiotics and probiotics glucosamine, phytosterols, and their stability in processing conditions, Manufacturing of dietary supplements in the form of liquid, rehydration powder, tablet, pill, capsule or mix | 10 | |
| 5 | Principles of toxicology and risk assessment of Nutraceuticals, Dosage levels; Adverse effects and toxicity of nutraceuticals, Regulatory and labeling issues, CODEX, FDA, FSSAI, Global nutraceuticals/Functional food market. Recent research and patents on nutra-ingredients. | 5 | |

Text and Reference Books:

1. Handbook of Nutraceuticals and Functional Foods, Robert E.C. Wildman, CRC Pres
2. Nutraceutical and Functional Food Components, Charis Galanakis, Academic Press
3. Functional Foods and Nutraceuticals (Food Science Text Series), Rotimi E. Aluko, Springer; 2012 edition

Course Outcome:

After completion of the course the students will be able to

CO1: Recall the fundamental concept of Nutraceuticals & Functional Foods to understand their origin, presence and functionality.

CO2: Comprehend the disease preventing and health enhancing properties of Nutraceuticals & Functional Foods.

CO3: Apply the basic knowledge to comprehend the manufacturing of various fortified, value-added functional foods and nutraceuticals in different forms for consumption

CO4: Analyze the toxicological aspect, related risks in formulating dosage and defining consumption patterns of Nutraceuticals & Functional Foods.

CO5: Evaluate regulatory and labelling issues related to manufacture, marketing and sale of Nutraceuticals & Functional Foods

CO6: Design value addition of foods incorporating Nutraceuticals & Functional ingredients.

Special Remarks (If any):

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|--|---|
| Name of the Course: Modelling and Simulation in Food Processing | |
| Course Code: PE-FT 701C | Semester: VII |
| Duration: 6 months | Maximum Marks: 100 |
| | |
| Teaching Scheme | Examination Scheme |
| Theory: 3 hrs./ week | Mid Semester Exam.: 15 Marks |
| Tutorial: Nil | Assignment & Quiz: 10 Marks |
| Practical: Nil | Attendance: 5 Marks |
| Credit Points: 3 | End Semester Exam: 70 Marks |
| Atleast 42hrs/Sem | |
| Objective: | |
| 1 | Modeling equation of a fermentation process |
| 2 | Modeling equation for absorption type mass transfer operation |
| 3 | Optimization of a multi variable process |
| Pre-Requisite: The following modules (or equivalents) should be preferably completed prior to, this module: | |
| 1 | Basic engineering mathematics |
| 2 | Basic knowledge on fermentation |
| 3 | Basic knowledge in mass transfer in column absorption process |
| 4 | Experimental design and multi variable process |

Details of Syllabus

| Unit | Content | Hrs/ Unit | Marks / Unit |
|-------------|--|------------------|---------------------|
| 1 | Introduction to mathematical modelling; Process analysis and simulation; Model building; Classification and uses of mathematical Models; Formulation of mathematical model and fundamental laws. | 10 | |
| 2 | Batch processes in food industry; Equilibration in batch processes; Steady state flow processes of non reacting systems; Mixing in flow processes | 10 | |
| 3 | Simultaneous heat and mass transfer in packed tower and immobilized enzyme system. | 5 | |
| 4 | Modelling, simulation and optimization of fermentation processes. | 5 | |
| 5 | Modelling and simulation of extrusion process | 5 | |
| 6 | Experimental design in multivariable Food processing | 5 | |
| 7 | Application of Fuzzy logic to sensory evaluation and ranking of foods. | 5 | |

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Text and Reference Books:

1. Text and reference books:

1. Process modeling, simulation and control: William L Luyben, TMH
2. Process analysis & simulation: Himmelblau, Kenneth & Birchoff, John Wills.

Course Outcome:

After completion of the course the students will be able to

- CO1: To understand about different independent and dependent variable in Food Processing operation
- CO2: To evaluate optimum process condition in Food Processing operation
- CO3: To develop experimental design for a multivariable process
- CO4: Development modeling equation in simultaneous heat and mass transfer process in dryer and absorption column

Special Remarks (If any):

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|--|---|
| Name of the Course: Project Engineering & Food Plant Layout | |
| Course Code: PE-FT 702A | Semester: VII |
| Duration: 6 months | Maximum Marks: 100 |
| Teaching Scheme | |
| Theory: 3 hrs./ week | Examination Scheme |
| Tutorial: Nil | Mid Semester Exam.: 15 Marks |
| Practical: Nil | Assignment & Quiz: 10 Marks |
| Credit Points:3 | Attendance: 5 Marks |
| | End Semester Exam: 70 Marks |
| Objective: | |
| 1 | To develop the knowledge of plant design and layout of specific food industries |
| 2 | To enable the students to learn about the regulations governing food plant design |
| 3 | To enable the students to learn how to scale up plant designs |
| Pre-Requisite: | |
| 1 | Basic mathematics, food processing, quality control and food regulations |

Details of Syllabus:

| Unit | Content | Hrs/ Unit | Marks / Unit |
|-------------|--|----------------------|-------------------------|
| 1 | Basic concepts of plant layout and design including basic understanding of equipment layout ventilation; Reference to bakery and biscuit, fruits, vegetable and beverage processing, and dairy industries; Miscellaneous aspects of plant layout and design like provision for waste disposal, and safety arrangements | 12 | |
| 2 | Design consideration for location of food plants; ISO, specific FSSAI requirements in food plant layout and design; Preparation of flow sheets for material movement and utility consumption in food plants | 12 | |
| 2 | Layout and designing aspects of pilot and semi-commercial food processing plants; Scale-up; Application of Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM) in project planning and monitoring Inspection Act | 12 | |
| 4 | Introduction to project engineering; Selection of construction materials; Specifications of processing equipments and accessories | 9 | |

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Text and Reference Books:

1. Manufacturing Facilities Design and Material Handling by Fred E. Meyers, and Matthew P. Stephens, 3rd Edition, Pearson
2. Prentice Hall, 2000
3. James M Moore, "Plant Layout and Design", Mcmillan & Co., (1959)
4. Bolz, Harold A George E., "Material Handling Handbook.
5. J M Apple, " Plant layout and Material Handling", John Willey & Sons, (1977)

Course Outcome:

After completion of the course the students will be able to

CO1: Ability to learn and solve plant layout problems and ability to produce material flow problems related with food processing industries.

CO2: Ability to understand and apply knowledge on laws and regulations related to food and allied areas in plant layout.

CO3: Ability to apply mathematical and engineering techniques for project management.

CO4: Ability to access and analyze plant layout techniques.

CO5: Ability to communicate effectively on professional activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, give and receive clear instructions, and to enhance awareness in relevant fields.

CO6: Ability to demonstrate knowledge and understanding of engineering and management principles, and apply these in one's own work taking into consideration the aspects of financial management.

Special Remarks (If any): Nil

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|--|--|
| Name of the Course: Food Toxicology | |
| Course Code: PE-FT 702B | Semester: VII |
| Duration: 6 months | Maximum Marks: 100 |
| Teaching Scheme | |
| Theory: 3 hrs./ week | Examination Scheme |
| Tutorial: Nil | Mid Semester Exam.: 15 Marks |
| Practical: Nil | Assignment & Quiz: 10 Marks |
| Credit Points:3 | Attendance: 5 Marks |
| | End Semester Exam: 70 Marks |
| Objective: | |
| 1 | To develop the knowledge of different type of food toxicants and food allergens |
| 2 | To enable the students to learn about the severity of health implications of the toxicants |
| | To enable the students to learn how to detect toxicants in food |
| Pre-Requisite: | |
| 1 | Basic food chemistry, food microbiology, food processing, quality control and food regulations |

Details of Syllabus:

| Unit | Content | Hrs/ Unit | Marks / Unit |
|-------------|---|------------------|---------------------|
| 1 | Terms and Scope of Food and Nutritional Toxicology, Toxicants in foods - Naturally occurring toxicants, nutrients, anti-nutritional compounds, contaminants, microbial toxins, toxicants formed during food processing, | 14 | |
| 2 | Dose–response relationship, Frequency response, Potency and toxicity, Reversibility of toxicity response, Hypersensitivity vs hyposensitivity Phases of toxicological effects , Exposure phase, Toxicokinetic phase, Toxicodynamic phase, acute toxicity, mutagenicity and genotoxicity, carcinogenicity, reproductive and developmental toxicity, neurotoxicity and behavioural effect, immunotoxicity. | 10 | |
| 3 | Impact of diet on the effects of toxicants, Biological factors that influence toxicity, toxin interaction and absorption with G.I.track microflora, Industrial microflora, blood, brain barrier, storage and excretion of toxins | 10 | |

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| 2 | Food allergens, chemistry of food allergens, celiac disease, food disorders associated with metabolism, lactose intolerance, symptoms and signs of allergic attack | 6 | |
| 4 | Quantitative and qualitative analysis of toxicants in foods; Biological determination of toxicants | 5 | |

Text and Reference Books:

1. Food Toxicology, Helferich, William and Carl K. Winter, CRC Press, 2001.
2. Food Hygiene and Toxicology, Vikas Alluwalia, Paragon International Publishers, 2007
3. Introduction to Food Toxicology, Shibamoto, Taka yuki and Leonard F. Bjeldanze, 2nd Edition. Academic Press, 2009.
4. Handbook of food toxicology by S. S. Deshpande
5. Nutritional and safety aspects of food processing by Tannenbaum SR
6. Microbiological safety of food by Hobbs BC, 1973,
7. Chemical toxicology of food by Galli, C.L, 1978
8. Food Allergy, Maleki, Soheila J. A. Wesley Burks, and Ricki M. Helm ASM Press, 2006.

Course Outcome:

After completion of the course the students will be able to

CO1: Able to recall the nature of food toxicants and the likelihood of their occurrences.

CO2: Able to understand the mechanisms of action of specific food toxicants.

CO3: Able to apply the knowledge of mechanism of interaction between toxicants and multiple food compounds to identify the vulnerability of food matrices.

CO4: Analyse the difference between food allergies and food toxicants.

CO5: Able to evaluate toxicants in food and their associated levels of toxicity with implications on health.

CO6: Devise strategies to eliminate or reduce presence of food toxicants, and create awareness in public and help to strengthen national safety policy of our food supply

Special Remarks (If any): Nil

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|---|--|
| Name of the Course: Food Security & Sustainability | |
| Course Code: PE-FT 702C | Semester: VII |
| Duration: 6 months | Maximum Marks: 100 |
| Teaching Scheme | |
| Theory: 3 hrs./ week | Examination Scheme |
| Tutorial: Nil | Mid Semester Exam.: 15 Marks |
| Practical: Nil | Assignment & Quiz: 10 Marks |
| Credit Points:3 | Attendance: 5 Marks |
| | End Semester Exam: 70 Marks |
| Objective: | |
| 1 | To develop the understanding of the need for Food Security and Sustainability |
| 2 | To enable the students to learn about the severity of depletion of natural resource and its effect on food security |
| | To enable the students to learn about the different practices, policies and initiatives to ensure food security and sustainability |
| Pre-Requisite: | |
| 1 | Environmental science, basic biology, agriculture, geography, microbiology, food processing, quality control and food regulations |

Details of Syllabus:

| Unit | Content | Hrs/ Unit | Marks / Unit |
|-------------|---|------------------|---------------------|
| 1 | Food Security and Sustainability - Definition, Elements, Prospects and Challenges, Food production and nutritional aspects, impact of depletion of water resources, Land Resources of India, Population and land, Land utilization, Net Area Sown, changes in cropping pattern, land degradation, Rainfall forecasting - Adequacy of Rainfall for crop growth – Rainfall, Drought and production instability – Irrigation potential – Available, created and utilized – River basins; Watersheds and Utilizable surface water – Utilizable water in future (Ground water & Surface water) | 15 | |
| 2 | Food –ecosystems, Factors affecting agriculture and crop yield, Indicators of Sustainable food availability, Population pressure and agricultural productivity, GMO, organic farming, vertical farming – principles and practices, Subsistence Food Production Practices, Security of foods of animal origin and its implications, | 10 | |
| 3 | Performance of major categories of food over the past decades, trends in food | 10 | |

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| | production, Decline in total factor productivity growth, Demand and supply projections, Impact of market force, , Sustainable food security indicators and index , Indicator of sustainability of food Security, Path to sustainable development. | | |
| 4 | International and National policies for Food Security and Sustainability, Schemes, initiatives and mass awareness programs by Government, PSUs, Case studies on CSR activities of different organisations related to Food Security and Sustainability | 10 | |

Text Books:

1. B.K.Desai and Pujari, B.T. Sustainable Agriculture : A vision for future, New India Publishing Agency, New Delhi, 2007.
2. Saroja Raman, Agricultural Sustainability – Principles, Processes and Prospects, CRC Press, 2013

Reference Books:

1. Swarna S.Vepa etal., Atlas of the sustainability of food security. MSSRF, Chennai, 2004.
- 2.Sithamparanathan, J., Rengasamy, A., Arunachalam, N. Ecosystem principles and sustainable agriculture, Scitech Publications, Chennai, 1999.
3. Gangadhar Banerjee and Srijeet Banerji, Economics of sustainable agriculture and alternate production systems, Ane Books Pvt Ltd., 2017
4. M.S.Swaminathan, Science and sustainable food security, World Scientific Publishing Co., Singapore, 2010.

Course Outcome:

After completion of the course the students will be able to

CO1: Recall the need for food and the nutritional security on global and national level

CO2: Comprehend the importance of utilization and preservation of land, water and other natural resources for Food Security and Sustainability.

CO3: Apply the basic knowledge and principles to aid in Food Security and Sustainability.

CO4: Analyze the different existing and proposed technologies to set up sustainable food eco-systems.

CO5: Evaluate food production trends to monitor and explore various avenues to cater to development of sustainable practices

CO6: Generate mass awareness and contribute at various levels as individuals or as active members of organizations to uphold the magnitude of Food Security and Sustainability

Special Remarks (If any):

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| | |
|---|------------------------------|
| Name of the Course: Entrepreneurship Development for Food Technologists | |
| Course Code: OE-FT 701A | Semester: VII |
| Duration: 6 months | Maximum Marks: 100 |
| Teaching Scheme | Examination Scheme |
| Theory: 3 hrs./ week | Mid Semester Exam.: 15 Marks |
| Tutorial: NIL | Assignment & Quiz: 15 Marks |
| Practical: Nil | Attendance: 5 Marks |
| Credit Points: 3 | End Semester Exam: 70 Marks |
| Atleast 45 hrs/Sem | |
| Objective: | |
| 1. Acquire knowledge in Entrepreneurship Development | |
| 2. Able to study and prepare the business plan for an any organization | |
| 3. Classify and study the organization structure between small, medium and large scale manufacturing industries | |
| Pre-Requisite: Fundamental knowledge of Project design, Project costing | |

Detailed Syllabus:

| Unit | Content | Hour |
|-------------|---|-------------|
| 1 | Entrepreneurship concept- Entrepreneurship as a Career- Entrepreneur Personality Characteristics- Knowledge- Skills- Attitude Requirement | 8 |
| 2 | Business Environment- Role of Family and Society- Entrepreneurship Development Training and Other Support Organizational Services- Central and State Government Industrial Policies and Regulations, MoFPI scheme and support to budding food entrepreneurs, Skill Development by Central Government, International Business. | 12 |
| 3 | Sources of Product for Business- Prefeasibility Study- Criteria for Selection of Product- Ownership- Capital- Budgeting Project Profile Preparation- Matching Entrepreneur with the Project- Feasibility Report Preparation and Evaluation Criteria | 9 |
| 4 | Finance and Human Resource Mobilization- Operations Planning- Market and Channel Selection- Growth Strategies- Product Launching | 8 |
| 5 | Monitoring and Evaluation of Business- Preventing Sickness and Rehabilitation of Business Units- Effective Management of small Business, Overview of Start-up food business and challenges | 8 |

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Text books:

- 1) Hisrich, “Entrepreneurship”, Tata McGraw Hill, New Delhi, 2005.
- 2) Saravanavel, P., ‘Entrepreneurial Development’, Ess Pee kayPublishing House, Chennai, 2005.
- 3) Khanka, S S., “Entrepreneurial Development”, S.Chand and Co Limited, New Delhi, 2001.
- 4) Jain, P C., “Handbook for New Entrepreneurs”, Second Edition, Oxford University Press, New Delhi, 2002.

Course Outcomes:

- CO1: Develop the Entrepreneurial skills for Food Technologists
- CO2: Understanding opportunities to set-up Food processing industries
- CO3: Acquire basic knowledge in Trade license and registration marks, Sources of finance, Selection of land and factory sheds
- CO4: Understanding
- CO5: Impart knowledge on Preparation of project report, Market feasibility reports , Techno-economic feasibility report

Special Remarks (If any):

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| | |
|---|---|
| Name of the Course: Supply Chain Management and Food Marketing | |
| Course Code: OE-FT 701B | Semester: VII |
| Duration: 6 months | Maximum Marks: 100 |
| Teaching Scheme | |
| Theory: 3 hrs./ week | Examination Scheme |
| Tutorial: Nil | Mid Semester Exam.: 15 Marks |
| Practical: Nil | Assignment & Quiz: 10 Marks |
| Credit Points:3 | Attendance: 5 Marks |
| | End Semester Exam: 70 Marks |
| Objective: | |
| 1 | To impart knowledge and understanding on supply chain management and its relevance to today's business decision making. |
| 2 | To enable students to be aware of marketing techniques, scheme and practices related to food products in place- and nationally and globally |
| Pre-Requisite: | |
| 1 | Basic understanding of management principles and tools |

Details of Syllabus:

| Unit | Content | Hrs/ Unit | Marks / Unit |
|-------------|---|------------------|---------------------|
| 1 | Supply Chain definition – Objectives – Types – Various definitions – Drivers – Need for SCM – SCM as a profession – SCM decisions and skills – Strategy formulation in SCM – Value in Supply Chain – Tradeoffs – CRM Strategy relationship matrix | 10 | |
| 2 | Strategic Sourcing – Source evaluation – collaborative perspective – Buyer Supplier Relationship – Partner Selection – develop of Partnership – importance of inventory – imbalances – uncertainties – inventory costs – inventory turnover | 12 | |
| 3 | Transportation Selection – Trade off – modes of transportation – models for transportation and distribution – factors affecting network effectiveness – 3 PL advantages – Indian transport infrastructure – IT solutions – EDI, e-Commerce, e-Procurement – Bar Coding and RFID technology | 12 | |
| 4 | Critical business processes and information systems – DBMS – benefits of ERP –information system and bull whip effect – SCM software packages – modeling concepts – Vendor analysis model – Coordinated SCM – Simulation modeling- Reverse Vs forward supply chain – types of reverse flows – collaborative SCM's and CPFR – agile systems – sources of variability – characteristics – | 5 | |

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| | | | |
|---|--|---|--|
| | supplier interface – internal processes | | |
| 5 | Supply Chain Mapping (based on quantification of customer sensitivity and risk), Supply Chain Management and profitability – quality management – mass customization and globalization – ethical Supply Chains – e-business and SCM – Balanced Score Card – Benchmarking, | 4 | |
| 6 | Food marketers act (Advertising law and regulation), Policy makers, food marketing practices, Product Development and Commercialization, Manufacturing Flow Management, Supplier Relationship Management regulation of food markets (e.g. food safety, false advertising, etc.), | | |

Text and Reference Books:

1. Mohanty R.P, S.G Deshmuki “Supply Chain Management” Biztantra, New Delhi 936 PAPER IV S

Reference Books

1. Jacobs F.R, Berry W.L, Whybark D.C, Vollmann T.E,. Manufacturing Planning and Control for Supply Chain Management: The CPIM Reference, Second Edition
2. Chopra S., Supply Chain Management: Strategy, Planning, and Operation (7th Edition) (What's New in Operations Management)

Course Outcome:

After completion of the course the students will be able to

CO1: Remember and relate principles of supply chain management principles to find the scope of food businesses

CO2: Understand the problems arising in a supply chain during food processing and interpret the tools and solutions that are being developed to solve such problems

CO3: Apply sequential strategic planning involved in managing effective production, operation and distribution and limitation of different processed foods

CO4: Analyze existing advertising law, regulation and policies in relation to supply of safe food to consumers.

CO5: Evaluate and interpret data and apply resources to optimize consumer preference for a category of food product and reach sustainable solution with effective supply chain mapping and traceability systems

CO6: Design and develop system tools to meet specific need of Food Product Development and Commercialization

Special Remarks (If any): Nil

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| | |
|---|---|
| Name of the Course: Smart Technologies | |
| Course Code: OE-FT 701 C | Semester: VII |
| Duration: 6 months | Maximum Marks: 100 |
| Teaching Scheme | |
| Theory: 3 hrs./ week | Examination Scheme |
| Tutorial: Nil | Mid Semester Exam.: 15 Marks |
| Practical: Nil | Assignment & Quiz: 10 Marks |
| Credit Points:3 | Attendance: 5 Marks |
| | End Semester Exam: 70 Marks |
| Objective: | |
| 1 | To impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-life IoT based projects |
| 2 | To impart knowledge about industrial robots for their control and design. |
| Pre-Requisite: | |
| 1 | Sensors, System Integration, Cloud and Network Security, Basic Engineering Mathematics, Automation and Control |

Details of Syllabus:

| Unit | Content | Hrs/ Unit | Marks / Unit |
|-------------|--|------------------|---------------------|
| 1 | Introduction to IoT Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT. | 4 | |
| 2 | Elements of IoT Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python/Node.js/ Arduino) for Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP. | 4 | |
| 3 | IoT Application Development and case studies Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices. | 8 | |

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|---|---|---|--|
| 4 | Introduction to Robotics Types and components of a robot, Robot Actuation Systems, Classification of robots, closed-loop and open loop control systems. Kinematics systems; Definition of mechanisms and manipulators, Social issues and safety. | 5 | |
| 5 | Sensors and Vision System Sensor: Contact and Proximity, Position, Velocity, Force, Tactile etc. Introduction to Cameras, Camera calibration, Geometry of Image formation, Vision applications in robotics | 5 | |
| 6 | Robot Control (6 Hours) Basics of control: Transfer functions, Control laws: P, PD, PID Non-linear and advanced controls | 7 | |
| 7 | Control Hardware and Interfacing Embedded systems: Architecture and integration with sensors, actuators, components, Programming for Robot Applications | 7 | |

Text and Reference Books:

1. Vijay Madiseti, ArshdeepBahga, Internet of Things, “A Hands on Approach”, University Press
2. Dr. SRN Reddy, RachitThukral and Manasi Mishra, “Introduction to Internet of Things: A practical Approach”, ETI Labs
3. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, CRC Press
4. Raj Kamal, “Internet of Things: Architecture and Design”, McGraw Hill
5. Cunopfister, “Getting Started with the Internet of Things”, O Reilly Media
6. Saha, S.K., “Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
7. Niku Saeed B., “Introduction to Robotics: Analysis, Systems, Applications”, PHI, New Delhi.
8. Mittal R.K. and Nagrath I.J., “Robotics and Control”, Tata McGraw Hill.
9. Mukherjee S., “Robotics and Automation”, Khanna Publishing House, Delhi.2018
10. Jeeva Jose, Internet of Things, Khanna Publishing House, 2018.

Course Outcome:

After completion of the course the students will be able to:

- CO1: Understand internet of Things and its hardware and software components
- CO2: Interface I/O devices, sensors & communication modules
- CO3: Remotely monitor data and control devices
- CO4: Develop real life IoT based projects
- CO5: Integrate mechanical and electrical hardware for a real prototype of robotic device.
- CO6: Select a robotic system for given application

Special Remarks (If any): Nil

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| | |
|---|--|
| Name of the Course: Nanoscience in Food Technology | |
| Course Code: OE-FT 702A | Semester: VII |
| Duration: 6 months | Maximum Marks: 100 |
| Teaching Scheme | |
| Theory: 3 hrs./ week | Examination Scheme |
| Tutorial: Nil | Mid Semester Exam.: 15 Marks |
| Practical: Nil | Assignment & Quiz: 10 Marks |
| Credit Points:3 | Attendance: 5 Marks |
| | End Semester Exam: 70 Marks |
| Objective: | |
| 1 | To learn about basis of nanomaterial science, preparation method and different types |
| 2 | To enable the students to learn about potential applications of nanomaterials in food research |
| Pre-Requisite: | |
| 1 | Basic knowledge of physics, mathematics, mechanics, electronics and chemistry |

Details of Syllabus:

| Unit | Content | Hrs/ Unit | Marks / Unit |
|-------------|---|------------------|---------------------|
| 1 | Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires, ultra-thin-films-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only) | 8 | |
| 2 | Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE, | 7 | |
| 3 | Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis (arc growth, laser ablation, CVD routes, Plasma CVD), structure-property relationships applications, Nanometal oxides- ZnO, TiO ₂ , MgO, NiO, nanoalumina, CaO, AgTiO ₂ , Ferrites, Nano clays functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications. | 10 | |

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| | | | |
|---|--|----|--|
| 4 | X-ray diffraction technique (XRD), Scanning Electron Microscopy (SEM) , Transmission Electron Microscopy (TEM) including high-resolution imaging, Surface Analysis techniques AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation. | 8 | |
| 5 | Nanotechnology in food processing: nanoprobes/nano-biosensors in food application: single cell detection of food-borne pathogens, toxins. Applications of Nano-composite materials in active/smart packaging, Nanoencapsulation: techniques and targeted controlled release of nutrient/ bioactives delivery systems, Inorganic NPs for bacterial inhibition, Nano-emulsion and liposomes: stability and applications in food industries. Safety issues and risk assessment studies of nanoparticles / nanomaterials, Legal/legislative/regulatory guidelines for use of nanomaterials in food products; concerns, limitation and challenges | 12 | |

TEXT BOOKS:

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale Charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCES:

1. G Timp, “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia, “The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

Course Outcome:

After completion of the course the students will be able to

CO1: Familiarize about the science of nanomaterials and nanoparticles

CO2: Comprehend the importance of nanoparticles and demonstrate the preparation of nanomaterials

CO3: Apply the knowledge acquired for characterization of different nanomaterials/nanoparticles

CO4: Analyze the risk assessment and safety issues of nanoparticles in food and packaging applications

CO5: Evaluate further area of research in food nanotechnology/nano encapsulation/ nano packaging

Special Remarks (If any):

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| | |
|--|---|
| Name of the Course: Flavor Technology | |
| Course Code : OE-FT 702B | Semester: VII |
| Duration: 6 months | Maximum Marks: 100 |
| Teaching Scheme | |
| Examination Scheme | |
| Theory: 3 hrs./ week | Mid Semester Exam.: 15Marks |
| Tutorial: Nil | Assignment & Quiz: 10 Marks |
| Practical: Nil | Attendance: 5 Marks |
| Credit Points: 3 | End Semester Exam: 70 Marks |
| Atleast 45hrs/Sem | |
| Objective: | |
| 1 | Able to define the class, function and uses of flavours in various food products |
| 2 | Able to relate extraction, isolation and identification of food flavours with respect to their food uses. |
| Pre-Requisite: | |
| 1 | At least 45 units of undergraduate study in a particular profession |

Details of Syllabus:

| Unit | Content | Hrs/ Unit | Marks / Unit |
|------|--|--------------|-----------------|
| 1 | Basics of flavour, smell , taste sensation, olfaction, flavor compounds, volatile flavor compounds, Classification: flavors : soild and liquid forms (water soluble form, oil soluble form, flavor emulsion form, spray dried form) | 10 | |
| 2 | Methods of flavour extraction, isolation, separation; Distillation, solvent extraction, enzymatic extraction, static headspace, dynamic headspace etc, flavor encapsulation | 10 | |
| 3 | Flavour characteristics : natural , nature identical and artificial materials Nature-identical flavoring substances, Artificial flavoring substances (Flavoring substances not identified in a natural product intended for human consumption, whether or not the product is processed), Guide line for flavoring agents as per FSSAI | 10 | |
| 4 | Principal types of flavorings used in foods, natural flavoring substances, Flavor constituents from Onion, garlic, cheese, milk, meat, vegetables, fruits; Flavor constituents of wine, coffee, tea, chocolate, spices and condiments | 5 | |
| 5 | Effect of processing on organoleptic quality of food, flavour precursors flavour development on cooking, microwave heating, roasting, baking, smoking, boiling, cooling, freezing, storage, Maillard reaction, caramalization, fermentation, Effect of storage , transportation , and environmental conditions on flavor compound | 10 | |

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Text and Reference Books:

1. Reineccius, G. Source Book of Flavors
2. Heath, H. B. Flavour chemistry and technology
3. Piggott, J. R., Paterson, A. Understanding Natural Flavors.
4. Morton, I. D., Macleod A. J. Food Flavor

Course Outcome:

After completion of the course the students will be able to

CO1: Able to relate the role of flavours in various food products

CO2: Able to apply their knowledge in extraction isolation and identification of different food flavouring components

CO3: Able to select suitable flavours in various food matrixes

CO4: Able to distinguish the changes of flavoring components during operations

Special Remarks (If any):

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| | |
|--|---|
| Name of the Course: Cryogenics | |
| Course Code: OE-FT 702C | Semester: VII |
| Duration: 6 months | Maximum Marks: 100 |
| Teaching Scheme | |
| Examination Scheme | |
| Theory: 3hrs./ week | Mid Semester Exam.: 15 Marks |
| Tutorial: | Assignment & Quiz: 10 Marks |
| Practical: Nil | Attendance: 5 Marks |
| Credit Points: 3 | End Semester Exam: 70 Marks |
| Atleast 45hrs/Sem | |
| Objective: | |
| 1 | Idea about ultra -rapid freezing |
| 2 | To get idea about Cryogenic fluid |
| 3 | Production cryogenic fluid by joule Thompson effect and adiabatic fluid |
| 4 | Storage of Cryogenic fluid |
| 5. | Application of Cryogenics in preservation and grinding of spices |
| Pre-Requisite: The following modules (or equivalents) should be preferably completed prior to, this module: | |
| 1 | Basic engineering mathematics |
| 2 | Basic knowledge heat transfer and mass transfer process |
| 3 | Basic knowledge of air separation plant and knowledge of distillation. |

Details of Syllabus

| Unit | Content | Hrs/ Unit | Marks / Unit |
|-------------|---|------------------|---------------------|
| 1 | Introduction to general cryogens, physical & thermo physical properties of cryogens, manufacture of cryogenic fluids. | 9 | |
| 2 | Design & functioning of air separation plants. Recent developments in the manufacture of cryogenic fluids. | 9 | |
| 3 | Storage & transport of cryogenic fluids. Handling of cryogens. Design of such vessels. | 7 | |
| 4 | Application of cryogens in preservation of food & biological materials, medicine & others. | 8 | |
| 5 | Design of liquid nitrogen freezer | 4 | |
| 6 | Calculation of cooling and freezing time of food | 4 | |
| 7 | Unsteady heat transfer, Gurnie Lurie and Tao's Chart | 4 | |

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Text and Reference Books:

Course Outcome:

After completion of the course the students will be able to

CO1: Construct the liquid nitrogen freezer

CO2: Apply numerical techniques to solve freezing time of Food

CO3: They can understand the operation of a air separation plant

CO4: Apply their knowledge in designing of refrigerated vehicle and total refrigeration load

CO5: Understand the concept of cryo-grinding

Special Remarks (If any):

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| | |
|--|--|
| Name of the Course: Product Development & Quality Assurance Lab | |
| Course Code: PC-FT 791 | Semester: VII |
| Duration: 6 months | Maximum Marks: 100 |
| Teaching Scheme | |
| Examination Scheme | |
| Theory: Nil | Maximum marks: 100 Marks |
| Tutorial: Nil | Continuous Internal Assessment: 40 Marks |
| Practical: 4 hrs./ week | External Assessment: 60 Marks |
| Credit Points: 2 | Distribution of marks: Experiments - 40 Marks Viva – 20 Marks |
| Course Outcomes: | |
| 1 | Ability to introduce a basic knowledge about the process for developing food products with market perspective |
| 2 | Ability to formulate a new product through scientific approach |
| 3 | Ability to apply advanced techniques for developing new products meeting regulatory standards |
| 4 | Ability to understand the importance of packaging and nutritional labeling of food products. |
| 5 | Ability to analyze impact of food composition, processing, packaging and storage on the overall food quality attributes. |
| 6 | Interpret and validate data collected through market analysis and practical research |
| Pre-Requisite: | |
| 1 | Basic analytical techniques |
| 2 | Basic food processing operations |
| 3 | Handling of glasswares, chemicals and equipments |
| 4 | Basic knowledge of solution preparation, chemical reactions |
| 5 | Spectrophotometric , titrimetric, gravimetric, volumetric principles |
| Practical: | |
| | 1) Intellectual skills- |
| | 2) Motor skills- Spectrophotometer, pH meter, Hot Air Oven/ Moisture Analyzer, Soxhlet Apparatus, Kjeldhal Unit, Viscometer, Turbidity Meter, Muffle Furnace, Laminar Air Chamber, Autoclave, Incubator, Colony Counter |
| | Glasswares, chemicals & consumables |

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| Laboratory Experiments: | |
|--------------------------------|---|
| 1 | Product Identification: Products/Processes Review, Project Feasibility, Design and Product Specification |
| 2 | Project Planning: Identifying Objectives, Identifying Tools/Methods, Use of Information/Communication Technology |
| 3 | Development of a food product prototype including product formulation and specifications |
| 4 | Selection and analysis of raw materials |
| 5 | Establishment of suitable process flow-diagram and development of HACCP plan for the processing line |
| 6 | Product testing (including sensory analyses) and shelf-life study |
| 7 | Project Presentation: Documentation and Report, Viva Voice |

Text and Reference Books:

TEXT

1. Brody, A.L. and J.B. Lord “Developing New Food Products for a Changing Market Place”, 2nd Edition, CRC / Taylor & Francis, 2008.
2. Side, Catherine “Food Product Development: Based on Experience”. Iowa State Press, 2002.

REFERENCE

1. Fuller, G. W. “New Food Product Development from Concept to Marketplace”, 3rd Edition. CRC Press, 2011
2. Lyon, D. H. “Guidelines for Sensory Analysis in Food Product Development and Quality Control”, Chapman and Hall, 1992.
3. MacFie, Hal “Consumer-led Food Product Development” Woodhead Publishers, 2007.

Special Remarks (If any): Nil

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| | |
|--|---|
| Name of the Course: Report and Seminar on Industrial Training | |
| Type of Course: Sessional | |
| Course Code: SI-FT 791 | Semester: VII |
| Duration: 6 months | Maximum Marks: 100 |
| Teaching Scheme | |
| Examination Scheme | |
| Theory: Nil | Maximum marks: 100 Marks |
| Tutorial: Nil | |
| Practical: Nil | |
| Credit Points: 3 | |
| Course Outcomes: | |
| 1 | Ability to relate different components of food science and technology, skills and scientific techniques followed in various food businesses/industries |
| 2 | Ability to understand hands on expertise in their relevant fields. |
| 3 | Ability to bridge the gap between academia and ever changing demand driven industrial business scenario to develop the need of industry with the polarization paradigm. |
| 4 | Ability to analyse the skills and knowledge required for a particular job function. |
| 5 | Ability to get exposure to advanced manufacturing and analytical tools to evaluate complex engineering problem |
| 6 | Ability to adopt basic industrial practices with ever changing food regulatory standards, ethics, legislation and food safety issues |

Details of Syllabus

The Industrial Training will be undertaken by each student during the summer recess after the completion of the 6th semester examination and prior to commencement of the 7th semester. A report on the training which is required to be submitted shall consist of:

1. A general overview of the plant.
2. The products & raw material sources of the plant.
3. Detail description of different processing lines and other equipment.
4. Scheduling of plant operations.
5. Conclusion.

A viva will be conducted after submission of the report and presentation of a seminar