

II Year– I Semester

Course Code	Title of the Course	Category	Periods per week			Total	Max. marks		Total Marks	Credits
			L	T	P		Sess.	End Exam		
			23FP211	MOOCs-I	OE		0	0		
23FP212	MOOCs-II	OE	0	0	0	0	100	—	100	3
23FP213	Dissertation Phase-I	PR	0	0	20	20	100	—	100	10
Total			0	0	20	20	300	—	300	16

II Year–II Semester

Course Code	Title of the course	Category	Periods per week			Total	Max. Marks		Total Marks	Credits
			L	T	P		Sess.	End Exam		
			23FP221	Dissertation Phase-II	PR		0	0		
Total			0	0	32	32	100	100	200	16

The prerequisite for submission of the M. Tech thesis is that one should communicate his/her work to any referred journal or Publication in a conference/journal.

FOOD MICROBIOLOGY

Course Code – Category: 23FP111– PC

L T P E O
3 0 0 1 6

Credits : 3

Sessional Marks : 40

End Exam: 3 Hours

End Exam Marks: 60

Prerequisites: Nil

Course Objectives:

- To acquaint with major groups of microorganisms in food
- To understand the sources of food contamination and their spoilage
- To gain knowledge in various fermented foods and probiotics
- To know various food borne diseases and their prevention
- To know aseptic practices in preparation, processing and packaging of food products in production plants.

Course Outcomes:

At the end of the course, student will be able to

- Identify main types of microorganisms in food
- Summarize type of spoilage of different foods and apply methods for the prevention of decay
- Select suitable cultures for food fermentation and produce fermented foods
- Infer different food borne diseases and apply methods to prevent such diseases
- Maintain hygiene and sanitation in food production industries

UNIT I

9L +3T

History and scope of food microbiology; Types of micro-organisms associated with food- mold, yeast, and bacteria; Sources of contamination - Air, Water, Soil, Sewage, Post processing contamination; Factors influencing the growth of microorganisms in foods

UNIT II

9L+3T

Contamination and Spoilage of different kinds of foods–Cereals and cereal products, vegetables and fruits, meat and meat products, fish, egg, poultry, milk and milk products.

UNIT III

9L + 3T

Food fermentation: Traditional fermented foods of India and other Asian countries based on milk, meat and vegetables; Production of alcoholic beverages -Beer, production of vinegar, production of cheese; oriental fermented foods; Probiotics and Nutraceuticals

UNIT IV

9L +3T

Food borne diseases- intoxication and infections -Botulism, Staphylococcal intoxication; Salmonellosis, Mycotoxins, *E.coli* O157:H7, *Campylobacter jejuni*, *Bacillus cereus*, *Shigella* sp., Norwalklike viruses, *Hepatitis A*, Algal toxins.

UNIT V**9L + 3T**

Food, Sanitation and control: Microbiology in food Sanitation – bacteriology of water supplies, sewage and waste treatment and disposal, Good manufacturing practices, Hazard Analysis and Critical Control points (HACCP), Health of Employees

TEXT BOOKS:

1. Food Microbiology, M R Adams And M O Moss, New Age International, New Delhi
2. Food Microbiology; WC Frazier; Tata McGraw Hill, Delhi
3. Modern Food Microbiology; James M Jay; CBS Publishers, Delhi

REFERENCE BOOKS:

1. Microbiology; Pelczar, Chan And Krieg; Tata Mc Graw Hill, Delhi
2. Basic Food Microbiology; Bannett, Chapman And Hall
3. Essentials Of Microbiology; K. S. Bilgrami; CBS Publishers, Delhi
4. BanwartGJ.,1987, Basic Food Microbiology, CBS Publishers , Delhi

FOOD BIOCHEMISTRY

Course Code – Category: 23 FP112– PC

L	T	P	E	O
3	0	0	1	6

Credits: 3

Sessional Marks: 40

End Exam: 3 Hours

End Exam Marks: 60

Prerequisites: Nil

Course Objectives:

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Course Outcomes:

At the end of the course, student will be able to

UNIT I

9L + 3T

Carbohydrates: classification, structure and chemical properties of monosaccharides, disaccharides and polysaccharides (cellulose, starch, fructans, galactans, hemi-cellulose, pectic substances, carageenan); changes in carbohydrates during processing.

Utilization of carbohydrates in body metabolism of carbohydrates and disorder in metabolism.

UNIT II

9L + 3T

Proteins: Classification, structure and properties of proteins, Changes in proteins during processing, Proteins from plant and animal sources.

Utilization of proteins in body proteins, products of protein metabolism. Disorders in metabolism, clinical proteins associated with excess and deficiency of proteins.

UNIT III

9L + 3T

Lipids: Classification, structure, physical and chemical properties of Lipids. Changes during food processing.

Utilization of fats, biosynthesis of fatty acids and fats, clinical disorders associated with fats.

UNIT IV

9L + 3T

Vitamins: Sources, physiological role and deficiency disorders of vitamins A, D, E, K, Vitamin C and B-complex vitamins –Thiamine, riboflavin, niacin, pantothenic acid,

lipoic acid, pyridoxine, biotin, folic acid and Vitamin B₁₂; Functions and deficiency disorders of minerals.

UNIT V

9L + 3T

Nutrition: Functions and energy of foods, basal energy metabolism, dietary allowances and standards for different age groups. Assessment of nutritional quality of foods, Effect of processing on nutritive value of food.

Enzymes: Classification, Michaelis-Menten equation, factors affecting enzymes action, Enzyme inhibition. Enzymes in food processing, enzymatic spoilage, Biochemical deterioration during storage.

TEXTBOOKS:

1. Food: Facts and Principles-N. Shakuntala Manay, Shadksharawamis.
2. Fundamentals of Nutrition-L Loyd Mc Donald
3. Fundamentals of Biochemistry by J. L. Jain,

REFERENCE BOOKS:

- 1 Principles of Biochemistry-Lehninger
2. Food Science-B. Srilakshmi

PLANTFOODTECHNOLOGY

(Fruits, Vegetables, Cereals & Pulses)

Course Code – Category:23 FP113 (A) - PE- I

L T P E O
3 0 0 1 6

Credits: 3

Sessional Marks: 40

End Exam: 3 Hours

End Exam Marks: 60

Prerequisites: Nil

Course Objectives:

- To know the composition of major fruits and vegetables and their preservation
- To understand canning operations of fruits and vegetables
- To know milling process of cereals and pulses
- To gain knowledge in preparation of fruit and vegetable juices, jam, jellies and specialty products

Course Outcomes:

At the end of the course, student will be able to

- Use appropriate methods to reduce post harvest losses and spoilage of fruits and vegetables
- Summarize various steps in canning of fruits and vegetables
- Outline the milling and processing of cereals and pulses
- Illustrate preparation of fruit and vegetable juices, various food ingredients like jam, jellies, Marmalades, Ketchup, Sauce etc.

UNIT I

9L + 3T

Production of fruits and vegetables in India., Composition of each of the major fruits and vegetables produced in the country - Mangoes, Pineapple, Guava, Papaya, Grapes among fruits ; Beans, Carrot, Tomatoes, Potato, Onion, Brinjal among vegetables. Causes for heavy losses. Spoilage factors, post harvest field operations including methods to reduce the post harvest losses, General methods of preservation of fruits and vegetables

Learning Outcomes:

UNIT II

9L + 3T

Canning of fruits and vegetables: Reception, sorting and storage operations for fruit and vegetables. Preparation of fruits and vegetables for canning Washing, peeling, grating, slicing, dicing, deseeding, Blanching -Importance of blanching operations, Batch and continuous blanching, Hot water and steam blanching. Canning operations–Precautions in canning operations, Spoilage of canned foods. Common machinery for operations like Peeling, Slicing/Dicing, Pulping, Grating and canning process.

Learning Outcomes:

UNIT III

9L + 3T

Storage of cereals, Infestation measures; Drying of grains, Processing of rice and rice products. Milling of wheat and production of wheat products, including flour and semolina. Milling of barley, oat, coarse grains including sorghum, ragi and millets

Milling and Processing of Maize:

Dry milling of maize: Storage and drying, Pre-cleaning, cleaning equipment, De-germination and De-husking, Roller milling, Sifting, Purifying, Aspiration, Pneumatics in maize mill.

Products of milling - Flour, Semolina, Brewers' grits etc and their applications. Wet milling of Maize: Modern methods of processing, Cleaning, Steeping,

De-germination, Bran and Fibre separation, Gluten and Starch Separation, Starch conversion into other value added products –Acid Hydrolysis, Enzyme Hydrolysis, Isomerization processes. Processing for Dextrose, Malto-Dextrin and other products. Extraction and refining of Corn oil in brief.

Learning Outcomes:

UNIT IV

9L + 3T

Milling of Pulses:

Major Pulses grown in the country and their application, Traditional milling process-merits and demerits. Drying of legumes - Sun drying, Traditional Processing steps – Pre-cleaning, Pitting, Oil application, Conditioning, De-husking and splitting- Machinery and equipment employed, mass balance, losses during milling. Modern milling process - Process flow chart -Mechanical hot air drying and conditioning - merits and demerits, De-husking in Pulse Pearler, Water conditioning, splitting of pulses in Pulse splitter, Merits and demerits. Mini dhal mill -working principle - advantages and disadvantages. Grinding of split pulses, pulse flour products, their applications, and equipment used.

Learning Outcomes:

UNIT V

9L + 3T

Production and preservation of fruits and vegetable juices, preservation of fruit juice by hurdle technology. Preparation of Jam, Jelly and marmalade, pickles, vinegar and tomato product. Juice and pulp extraction – various extractors used to include Hydraulic Press -Hot and Cold Break processes - Clarification, Clarification centrifuges – Decanters and de-sludgers. Preparation and packaging of pulps, Jams, Jellies, Marmalades, Squashes Pickles, Puree, Ketchup, Sauce. Specialty products - Fruit Bars, Fruit juice concentrates

Learning Outcomes:

TEXT BOOKS:

1. Lal, G., Siddappa, G. and Tondon G.L.: Preservation of Fruits and Vegetables, Indian Council of Agricultural Research, New Delhi. (1986).
2. Vijaya Khader, “Text book of Food Science and Technology”, ICAR, New Delhi(2001).
3. N L Kent and ADEvers, “Kent’s Technology of Cereals: An Introduction for students of Food Science and Agriculture”, 4thEd., Wood head Pub. Ltd., Cambridge,UK(1994).

REFERENCE BOOKS:

1. Dauthy, M.E.: Fruit and Vegetable Processing. International Book Distributing Co. Lucknow, India. (1997)
2. Hamson, L.P: Commercial Processing of Vegetables. Noyes Data Corporation, New Jersey(1975)
3. Jagtiani J., Chan,H.T. and Sakal,W.S.: Tropical Fruit Processing, Academic Press, London. (Ed. 1988)
4. Srivastava, R. P., and Sanjeev Kumar: Fruit and vegetable preservation; principles and practices.: International Book Distributing Co., Lucknow. 1998
5. A. K. Thompson(2003):Fruit and Vegetables–Harvesting, handling and storage. 2ndedition Black well Publishing.
6. Girdharilal(1996) Preservation of Fruits and Vegetables. ICAR, New Delhi

ANIMAL PRODUCT TECHNOLOGY

(Meat, Poultry & Fish)

Course Code – Category: 23FP113 (B)– PE-I

L T P E O
3 0 0 1 6

Credits: 3

Sessional Marks: 40

End Exam: 3 Hours

End Exam Marks: 60

Unit I

9L + 3T

Sources of meat and meat products in India, its importance in national economy. Chemical composition and microscopic structure of meat. Effect of feed, breed and management on meat production and quality. Slaughtering of animals and poultry, inspection and grading of meat.

Unit II

9L + 3T

Factors affecting post-mortem changes, properties and shelf life of meat. Meat quality evaluation. Mechanical deboning, meat tenderization. Aging, pickling and smoking of meat. Meat plant sanitation and safety, by-product utilization.

Unit III

9L + 3T

Poultry: classification, composition, preservation methods and processing. Structure, composition, nutritive value and functional properties of eggs and its preservation by different methods. Processing of egg products. Factors affecting egg quality and measures of egg quality.

Unit VI

9L + 3T

Types of fish, composition, structure, post-mortem changes in fish. Handling of freshwater fish. Canning, smoking, freezing and dehydration of fish. Preparation of fish products, fish sausage and home makings.

Unit – V

9L + 3T

Fish products - production of fish meal, fish protein concentrate, fish liver oil and fish sauce and other important byproducts; Quality control of processed fish; Fish processing industries in India.

Text Books:

1. Lawrie, R.A. 1975. Meat Science, 2nd Edn. Pergamon Press, Oxford UK.
2. Vijaya Khader, 2001, "A Textbook of Food Science and Technology", ICAR, New Delhi
3. Modern Dairy Products, Lampert LH; 1970, Chemical Publishing Company.

References:

1. Developments in Dairy Chemistry – Vol 1 & 2; Fox PF; Applied Science Pub Ltd.
2. Milk & Milk Processing; Herrington BL; 1948, McGraw-Hill Book Company.
3. Portsmouth, J.I. 1979, Commercial Rabbit Meat Production. 2nd Edn. SaigaSurvey, England.

INSTRUMENTATION AND CONTROL IN FOOD INDUSTRY

Course Code – Category: 23 FP 113(C) – PE

L T P E O
3 0 0 1 6

Credits: 3

Sessional Marks: 40

End Exam: 3 Hours

End Exam Marks: 60

Prerequisites: Nil

Course Objectives:

- To understand the use of process instrumentation and control devices in food industries
- To know different measurements in food processing like moisture, turbidity, temperature, flow, viscosity, pH etc.
- To recognize control systems used in food dehydration and freezing
- To recognize importance of computer-based monitoring and control systems in food industries

Course Outcomes:

At the end of the course, student will be able to

1. Classify and select a transducer used in food processing
2. Identify the instrumentation used for food properties like moisture content, humidity, turbidity, temperature etc.
3. Select a suitable instrumentation method for food analysis
4. Implement Control systems in Food Dehydration and Drying
5. Explain the importance of computer-based monitoring and control in food processing

UNIT I

9L + 3T

Introduction to Process Instrumentation and Control: An Industrial Process; Process Parameters; Process Instrumentation and Control

Measuring and Controlling Devices: Role of Transducers in Food Processing; Classification of Transducers; Selection of Transducers; Actuating and Controlling Devices

Learning Outcomes:

- Summarize the important process parameters and their instrumentation required in food industries
- Select the suitable transducers in food processing

UNIT II

9L + 3T

Measurements in Food Processing: Moisture Content Measurement; Moisture Release During Drying of Food; Humidity in the Food Processing Environment; Turbidity and Color of Food; Food and Process Temperature Measurement; Food Flow Metering

Learning Outcomes:

- Find the suitable methods to measure moisture content and humidity in food processing.
- Identify the methods to measure turbidity, color and temperature of the food.

UNIT III**9L + 3T**

Measurements in Food Processing: Viscosity of Liquid Foods; Brix of Food; pH Values of Food; Food Enzymes; Flavor Measurement; Food Texture and Particle Size; Food Constituents Analysis

Learning Outcomes:

- Find the properties of foods like viscosity, brix and pH etc.
- Explain the food particle size and constituent analysis

UNIT IV**9L + 3T**

Controllers and Indicators: Temperature Control in Food Dehydration and Drying; Electronic Controllers; Flow Ratio Control in Food Pickling Process; Atmosphere Control in Food Preservation; Timers and Indicators in Food Processing; Food Sorting and Grading Control

Learning Outcomes:

- Select controllers for temperature and flow in food dehydration
- Summarize use of timers and indicators in food processing

UNIT V**9L + 3T**

Computer-Based Monitoring and Control: Discrete Controllers; Adaptive and Intelligent Controllers; Remote Data Acquisition with PCs; Signal Interfacing; Examples of Computer-Based Measurement and Control

Learning Outcomes:

- Illustrate the different types of controllers like discrete, adaptive etc.
- Exemplify computer based measurement and control

TEXT BOOK:

1. Measurement and Control in Food Processing- Manabendra Bhuyan; CRC Press, Taylor & Francis Group, 2007
2. Fundamentals of Industrial Instrumentation and Process Control - William C. Dunn; McGraw-Hill, 2005

REFERENCE BOOKS:

1. Industrial Instrumentation – Donald P Eckman; John Wiley & Sons Inc, 1950
2. Chemical Process Control: An Introduction to Theory & Practice - G. Stephanopoulos; PHI, 1983

PRINCIPLES OF FOOD SCIENCE AND PRESERVATION

Course Code – Category: 23FP114 (A) – PE-II

L T P E O
3 0 0 1 6

Credits: 3

Sessional Marks: 40

End Exam: 3 Hours

End Exam Marks: 60

Prerequisites: Nil

Course Objectives: To understand the quality and processing food and preservation of food to prevent spillage

Course Outcomes:

At the end of the course, student will be able to

- Understand organisms the importance of the processing and formulation bottleneck
- Understand the needs for preservation and mechanisms of preservation
- Apply preservation principles in product design
- Calculate the efficacy of a heat process and interpret its key parameters (D, Z, and F values)
- Enhance the effectiveness of preservation methods and the efficiency of production

UNIT I

9L + 3T

INTRODUCTION: Sources of food- plant, animal and microbial origin; Different groups of food; properties of food-physical, mechanical, thermal and sensory; Biochemical changes during processing of foods. Scope and importance of food processing.

Learning Outcomes:

UNIT II

9L + 3T

LOW TEMPERATURE PROCESSING: Chilling and freezing: Freezing - Phase diagram, ice crystal formation, comparison of freezing and thawing. Freezing methods: air freezing, plate freezing, liquid immersion freezing and cryogenic freezing. Freeze concentration of liquid foods.

Learning Outcomes:

UNIT III**9L + 3T**

HIGH TEMPERATURE PROCESSING: Methods of applying heat to foods-sterilization, Blanching, Pasteurization. Basic concepts in thermal destruction of microorganisms -D, Z, F values. Sterilization-methods and equipments, UHT, Aseptic processing and packaging.

Learning Outcomes:**UNIT IV****9L + 3T**

DRYING AND DEHYDRATIONS: Theory and mechanism of drying-water activity and its effect on the keeping quality, sorption isotherms and their use, factors affecting rate of drying, methods of drying of various food products, batch and continuous drying, spray dryer, fluidized bed dryer, Freeze drying and vacuum drying.

Learning Outcomes:**UNIT V****9L + 3T**

PRESERVATION: Introduction to food spoilage; Preservation of foods by use of sugar, salt, chemicals, smoking, pickling, curing, fermentation, baking, extrusion and canning, and Packaging-CAP, MAP. Hurdle technology

Learning Outcomes:**TEXT BOOK:**

1. B. Sivasankar. "Food Processing and Preservation". PHI Learning Private Limited. 2015.
2. Fellows, P.J. "Food Processing Technology: Principles and Practice". Wood head Pub. Ltd, 2nd Edition, 2002.

REFERENCE BOOKS:

1. M. Shafeiur Rahman (1999). Handbook of Food Preservation, Marcel Dekker, Inc.
2. Khetarpaul N. "Food Processing and Preservation". Dya Publishing House, New Delhi.2005.

PLANTATION CROPS, SPICES & CONDIMEN TTECHNOLOGY

(Herbs, Plantation Crops, Spices, Condiments)

Course Code – Category:23 FP 114(B) – PE-II

L T P E O
3 0 0 1 6

Credits: 3

Sessional Marks: 40

End Exam: 3 Hours

End Exam Marks: 60

Prerequisites: Nil

Course Objectives:

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Course Outcomes:

By the end of the course, student will be able to

UNIT I

9L + 3T

Plantation Crops-Description of various types of Plantation crops, viz., coconut, arecanut, coffee, tea, cocoa etc. Processing and preservation methods. Value-added products shelf-stable products viz., coconut water bottling, desiccated coconut powder, coffee concentrate, instant coffee powder, instant tea powder, cocoa processing.

Learning Outcomes:

UNIT II

9L + 3T

Leafy vegetables - Description of various types of leafy vegetables, viz., hibiscus, curry leaves, coriander leaves, etc. Their composition, nutritive value, health benefits. Preservation methods and packaging techniques.

Learning Outcomes:

UNIT III

9L + 3T

Spices & Condiments - Description of various types of spices and condiments, their composition, functional properties, flavouring agents. Nutritive value of spices and their health benefits.

Intermediate Moisture Products – Intermediate Moisture Products viz., ginger paste, ginger – garlic paste, tamarind paste, tamarind concentrate. Their importance in culinary preparations. Flavour retention and packaging methods.

Learning Outcomes:

UNIT IV

9L + 3T

Spice Powders & Curry Powders: Their importance in culinary preparations, their preparation methods, grinding and packaging methods for spice powders like chilli powder, turmeric powder, ginger powder, garlic powder; and Masala Powders for chicken masala, meat masala, biryani masala, chat masala etc. Importance of Cryogenic grinding of spices.

Spice Oils – Concept and importance of spice oils from spices like and condiments like clove, cardamom, cinnamon etc. Their application in food processing, and extraction methods of spice oils by various techniques, viz., solvent extraction, steam distillation etc.

Learning Outcomes:

UNIT V

9L + 3T

Herbs–Description of various types of herbs, viz., Basil, Chives, Cilantro, Dill, Coriander, Mint, Oregano, Parsely, Chives, Borage and Avocada leaves, Rose marry, Saga, Tarragon, Thyme, Winter savory and bolbo leaves, Papalo, Pipicha and Safflower. Their nutritive value & health benefits, their processing and Postharvest handling. Packaging methods for processed products.

Learning Outcomes:

TEXT BOOK:

1. Spices & Condiments, J S Pruthi, National Book Trust, New Delhi(2001).
2. Spices: Morphology, History, Chemistry., J W Parry, Chemical Publishing Co., New York (1969).
3. Leafy Spices, V Prakash, CRC Press, Florida(1990).

REFERENCE BOOKS:

FUNCTIONAL FOODS AND NEUTRACEUTICALS

Course Code – Category: 23FP 114 (C) – PE-II

L T P E O
3 0 0 1 6

Credits: 3

Sessional Marks: 40

End Exam: 3 Hours

End Exam Marks: 60

Prerequisites: Nil

Course Objectives:

- To understand what are functional foods and nutraceuticals
- To know potential health benefits of functional foods
- To understand other food components with potential benefits
- To know non nutrient effect of specific nutrients

Course Outcomes:

By the end of the course, student will be able to

- Classify functional foods
- Summarize health benefits of functional foods
- Infer the mechanism of functional foods
- Outline the applications of functional foods in the industry

UNIT I

9L + 3T

Introduction to Functional Foods and Nutraceuticals: Definition, History and Classification, Perceived Effects of Functional Foods; Introduction to Probiotics, Prebiotics and Synbiotics; Probiotics: Taxonomy and Important Features of Probiotic Microorganisms, Health Effects of Probiotic Microorganisms, Probiotics in Various Foods, Quality Assurance of Probiotics and Safety.

Learning Outcomes:

UNIT II

9L + 3T

Prebiotics: Non Digestible Carbohydrates/ Oligo saccharides, Dietary Fiber, Resistant Starch, Gums

Learning Outcomes:

UNIT III**9L + 3T**

Polyphenols: Flavonoids, Catechins, Isoflavones, Tannins; Phyto estrogens, Phytosterols, Glucosinolates;
Pigments: Carotenoids, Lycopene, Curcumin

Learning Outcomes:**UNIT IV****9L + 3T**

Organo-sulphur Compounds, Introduction to Anti-nutritional Factors, Phytates, Enzymes, Protease inhibitors, Amylase inhibitors, Saponins, Haemagglutinins,

Learning Outcomes:**UNIT V****9L+ 3T**

Active Biodynamic Principles in Spices, Condiments and Plant extracts: Resveratrol, Kaempferol, Quercetin, Cinnamaldehyde, Crocin, Lutoline; Capsaicin, Piperine, Gingerol, Eugenol, Rosemarinic acid, Apigenine, Thymoquinone; Fenugreek and Diosgenin.

Learning Outcomes:**TEXT BOOKS:**

1. Wildman, R. E. (2016). *Handbook of Nutraceuticals and Functional Foods*. CRC Press
2. Gibson, G. R. and Williams, M. C. (2001). *Functional Foods Concept to Product*. CRC Press.

REFERENCE BOOKS:

1. Vattem, D.A. and MaitinV.(2016). *Functional Foods, Nutraceuticals and Natural Products, Concepts and Applications*. DEStech Publications, Inc
2. Gupta, R. C. (2016). *Nutraceuticals: Efficacy, Safety and Toxicity*. Academic Press.

RESEARCH METHODOLOGY & IPR

Course Code – Category: 23FP 115–MC

L T P E O
2 0 0 1 6

Credits: 2

Sessional Marks: 40

End Exam: 3 Hours

End Exam Marks: 60

Course Outcomes: At the end of this course, students will be able to

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

CO\PO	PO1	PO2	PO3	PSO1
CO1		3		2
CO2		3		2
CO3		3		2
CO4		3		2
CO5		3		2

CO- Course Outcome; PO- Program Outcome; PSO-Program Specific Outcome;
Level- 1: Low, 2: Medium, 3: High

SYLLABUS

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, analysis, interpretation, Necessary instrumentations.

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

Unit-III: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit-IV: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit-V: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

REFERENCES:

1. *Stuart Melville and Wayne Goddard, "Research Methodology: An Introduction for Science & Engineering Students"*
2. *Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"*
3. *Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"*
4. *Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.*
5. *Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.*
6. *T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008*

FOOD MICROBIOLOGY LAB

Course Code – Category: 23 FP 116 – PC

L T P E O

Credits: 2

0 0 3 0 0

Sessional Marks: 50

End Exam: 3 Hours

End Exam Marks: 50

1. Preparation of bacterial smears, simple staining, differential staining, spore staining, staining of molds and yeast
2. Estimation of microbial count of air
3. Microbiological quality of processed milk.
4. Microbiological quality of dehydrated foods.
5. Microbial examination of water.
6. Milk pasteurization
7. Direct microscopic examination of foods.
8. Estimation of total microbial count of (a) milk products (b) fruits and vegetable products (c) meat, fish and poultry products (d) canned foods.

RECOMMENDED BOOKS:

1. Neelima Garg. Laboratory Manual of Food Microbiology. 2010. I. K. International.
2. James G. Cappuccino and Natalie Sherman. Microbiology -A Laboratory Manual, The Benjamin Cummings Publishing Co.

FOOD BIOCHEMISTRY LAB

Course Code – Category: 23 FP 117 – PC

L T P E O

0 0 3 0 0

Credits: 2

Sessional Marks: 50

End Exam: 3 Hours

End Exam Marks: 50

1. Estimation of carbohydrates
2. Estimation of proteins
3. Estimation of aminoacids
4. Estimation of vitamins
5. Estimation of minerals
6. Estimation of
 - a) Iodine value
 - (b) Saponification value
 - (c) Acid value
 - (d) RM value
 - (e) K value of fats and oils.
7. Measurement of Food Color by Tintometer/spectrophotometer
8. Estimation of Water activity of food sample
9. Estimation of amount of preservatives in fruit juice sample.
10. Estimation of crude fat to determine the oil in pickle sample.

RECOMMENDED BOOKS:

1. Sathe, A.Y. A First course in Food Analyses. 1999, New Age International Publisher, New Delhi
2. Jacobs, Norris B.: The chemical analysis of foods and food Products, CBS Publisher, New Delhi.

UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS

Course Code – Category: 23FP 118–AC

L T P E O
2 0 0 1 6

Credits: 0

Sessional Marks: 40

Course Objectives:

1. To create an awareness on Engineering Ethics and Human Values.
2. To instill Moral and Social Values and Loyalty
3. To appreciate the rights of others.
4. To create awareness on assessment of safety and risk

Course outcomes: By the end of the semester, the student will be able to:

CO1	Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field
CO2	Identify the multiple ethical interests at stake in a real-world situation or practice
CO3	Articulate what makes a particular course of action ethically defensible
CO4	Assess their own ethical values and the social context of problems
CO5	Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human subjects
CO6	Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research

SYLLABUS

Unit I: HUMAN VALUES

Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others – Living Peacefully –Caring –Sharing –Honesty -Courage-Cooperation–Commitment – Empathy –Self Confidence -Character –Spirituality-Case Study.

LEARNING OUTCOMES:

1. learn about morals, values & work ethics.
2. learn to respect others and develop civic virtue.
3. develop commitment
4. learn how to live peacefully

Unit II: ENGINEERING ETHICS

Senses of 'Engineering Ethics-Variety of moral issues –Types of inquiry –Moral dilemmas –Moral autonomy – Kohlberg's theory-Gilligan's theory-Consensus and controversy –Models of professional roles, Theories about right action-Self-interest -Customs and religion –Uses of Ethical theories –Valuing time –Case Study.

LEARNING OUTCOMES:

1. learn about the ethical responsibilities of the engineers.
2. create awareness about the customs and religions.
3. learn time management
4. learn about the different professional roles.

Unit III: ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as Social Experimentation –Similarities between standard and social Experimentations-Framing the problem –Determining the facts –Codes of Ethics – Clarifying Concepts –Application issues –Common Ground - General Principles –Utilitarian thinking respect for persons-Case study.

LEARNING OUTCOMES:

1. Demonstrate knowledge to become a social experimenter.
2. Provide depth knowledge on framing of the problem and determining the facts.
3. Provide depth knowledge on codes of ethics.
4. Develop utilitarian thinking

UNIT IV: ENGINEERS RESPONSIBILITY FOR SAFETY AND RISK

Safety and risk –Assessment of safety and risk –Risk benefit analysis and reducing risk-Safety and the Engineer- Designing for the safety-Intellectual Property rights(IPR).

LEARNING OUTCOMES:

1. create awareness about safety, risk & risk benefit analysis.
2. engineer's design practices for providing safety.
3. provide knowledge on Intellectual Property Rights.

UNIT V: GLOBAL ISSUES

Globalization –Cross culture issues-Environmental Ethics –Computer Ethics –Computers as the instrument of Unethical behavior –Computers as the object of Unethical acts –Autonomous Computers-Computer codes of Ethics – Weapons Development -Ethics and Research –Analyzing Ethical Problems in research- Case Study.

LEARNING OUTCOMES:

1. Develop knowledge about global issues.
2. Create awareness on computer and environmental ethics.
3. Analyze ethical problems in research.
4. Give a picture on weapons development.

Text Books:

1. M.Govindarajan, S.Natarajanand, V.S.SenthilKumar “Engineering Ethics includes Human Values” -PHI Learning Pvt. Ltd-2009
2. Harris, Pritchard and Rabins “Engineering Ethics”, CENGAGE Learning, India Edition, 2009.
3. Mike W. Martin and Roland Schinzinger “Ethics in Engineering” Tata McGraw-Hill–2003.
4. Prof.A.R.Aryasri, DharanikotaSuyodhana “Professional Ethics and Morals” Maruthi Publications.
5. A.Alavudeen, R.KalilRahman and M.Jayakumaran “Professional Ethics and Human Values” – Laxmi Publications.
6. Prof.D.R.Kiran “Professional Ethics and Human Values”
7. PSR Murthy “Indian Culture, Values and Professional Ethics” BS Publication

FOOD PROCESS ENGINEERING - I

Course Code – Category: 23 FP 121 – PC

L T P E O
3 0 0 1 6

Credits: 3

Sessional Marks: 40

End Exam: 3 Hours

End Exam Marks: 60

Prerequisites: Nil

Course Objectives:

- To understand and use material and energy balances in to food applications
- To know fluid rheological properties and various pumps used for food applications
- To understand size reduction and mixing used in food industries
- To know different mechanical separation processes used in food industries

Course Outcomes:

At the end of the course, student will be able to

1. Use material balance principles for dilution, concentration and dehydration problems
2. Find the enthalpy changes in foods during freezing using energy balance principles
3. Choose a suitable pump for food applications by identifying the fluid flow properties
4. Select a suitable grinding and mixing methods for food applications
5. Implement the physical separation of food materials by filtration, sedimentation and sieving

UNIT I

9L + 3T

Material Balances: Basic Principles; Material balance problems involved in Dilution, Concentration, and Dehydration; Blending of Food Ingredients; Multistage Processes; Gases and Vapours - Equations of State for Ideal and Real Gases; Psychrometrics - Properties of air-vapor mixtures; Use of psychrometric chart to evaluate complex air conditioning processes

Learning Outcomes:

- Execute material balance problems involving dilution and concentration
- Evaluate the properties of air-vapor mixture using psychrometric chart

UNIT II

9L + 3T

Energy Balances: Thermodynamics; Vapor-Liquid Equilibrium; Energy Balance - General Principles; Enthalpy Changes in Foods During Freezing; Properties of Saturated and Superheated Steam; Heat Balances

Learning Outcomes:

- Identify the energy exchange between components within a system or between a system and its surroundings using the thermodynamic relations
- Compute the heat balance and enthalpy changes in food applications

UNIT III

9L + 3T

Flow of Fluids: The Concept of Viscosity; Rheology; Continuous Viscosity Monitoring and Control; Flow of Falling Films; Transportation of Fluids; Fluid Flow Regimes; Mechanical Energy Balance: The Bernoulli Equation; Pumps

Learning Outcomes:

- Identify the rheological properties of fluids and classify flow regimes
- Select different types of pumps used for transportation of fluids

UNIT IV

9L + 3T

Size Reduction: Grinding and cutting – Laws of Grinding; grinding equipment; Emulsification.

Mixing: Characteristics of mixtures; Measurement of mixing; Particle mixing; Liquid mixing; Mixing equipment

Learning Outcomes:

- Illustrate different grinding and cutting methods with equipment used
- Find suitable mixing equipment based on characteristics of mixtures

UNIT V

9L + 3T

Mechanical Separations: Mechanical Sieving; The velocity of particles moving in a fluid; Sedimentation; Centrifugal separations; Filtration – Constant-rate Filtration; Constant-pressure Filtration; Filtration Equipment.

Learning Outcomes:

- Utilize terminal velocity concept in the sedimentation and centrifugal separations
- Illustrate the mechanical separation by different filtration methods

TEXT BOOK:

1. Fundamentals of Food Process Engineering - Romeo T. Toledo; Rakesh K. Singh; Fanbin Kong; 4th Ed., Springer 2018
2. Unit operations in Food Processing – R.L.Earle; 2nd Ed., Pergamon press, 1983

REFERENCE BOOKS:

1. Fundamentals of Food Engineering – D. G. Rao, Prentice-Hall of India, New Delhi, 2010
2. Unit operations of chemical engineering – W L McCabe, J C Smith and P Harriot, 7th Ed., McGraw-Hill Inc., New York, 2017.

FOOD PROCESS ENGINEERING - II

Course Code – Category: 23FP 122 – PC

L T P E O
3 0 0 1 6

Credits: 3

Sessional Marks: 40

End Exam: 3 Hours

End Exam Marks: 60

Prerequisites: FPE-I

Course Objectives:

- To understand and use heat transfer equipment in to food applications
- To know importance of evaporation and crystallization in food industries
- To understand refrigeration principles used for food packing and storage
- To know different separation processes like absorption, distillation, drying etc. used in food industries

Course Outcomes:

At the end of the course, student will be able to

1. Select a good heat exchange equipment with the help of heat transfer principles
2. Identify the importance of evaporation and crystallization in food industries
3. Use refrigeration principles for storage and packing of food products
4. Implement different mass transfer operations using phase equilibria for food applications
5. Identify suitable drying equipment under given conditions using drying principles

UNIT I

9L + 3T

Heat Transfer: Mechanisms of Heat Transfer – Conduction, Convection and Radiation; Steady-State Heat Transfer and Unsteady state heat transfer; Heat Transfer Coefficients; Heat Exchange Equipment – Double Pipe, Shell and Tube, Plate type and Finned heat exchangers.

Learning Outcomes:

- Exemplify mechanisms of heat transfer and steady state and unsteady state heat transfer
- Choose a suitable heat exchanger for the given application

UNIT II

9L + 3T

Evaporation: Boiling Point Elevation; Single-Effect Evaporator; Improving the Economy of Evaporators - Multiple-Effect Evaporation, Vapor Recompression; Evaporation of Heat-Sensitive Materials; Evaporation Equipment

Crystallization: Nucleation; Crystal growth; Rate of Crystal Growth; Crystallization Equipment

Learning Outcomes:

- Identify a proper evaporator using the evaporation principles
- Summarize the importance of crystallization in the food applications

UNIT III**9L + 3T**

Refrigeration: Refrigeration Cycle; Mechanical Refrigeration System; Refrigeration Load; Commodity Storage Requirements; Controlled Atmosphere Storage; Modified Atmosphere Packaging

Learning Outcomes:

- Explain refrigeration cycle and refrigeration systems
- Implement the principles of refrigeration for storage and packing

UNIT IV**+ 3T**

Contact-Equilibrium Processes: phase distribution; Gas-Liquid Equilibria; Solid-Liquid Equilibria; Equilibrium-Concentration Relationships; Mass transfer Operations – Absorption, Distillation and Extraction (Principles only)

Learning Outcomes:

- Represent different phase equilibria like gas-liquid, solid-liquid etc. and their relationships
- Explain the important mass transfer operations like absorption, distillation and extraction

UNIT V**9L + 3T**

Drying: Basic Drying Theory; Mass Transfer in Drying; Equilibrium Moisture Content; Drying rate curves; Drying Times from Drying Rate Data; Spray Drying; Freeze Drying; Drying Equipment

Learning Outcomes:

- Calculate drying time for batch drying using drying rate data
- Indicate different types of drying and their equipment used

TEXT BOOK:

1. Fundamentals of Food Process Engineering - Romeo T. Toledo; Rakesh K. Singh; Fanbin Kong; 4th Ed., Springer, 2018
2. Unit operations in Food Processing – R.L.Earle; 2nd Ed., Pergamon press, 1983

REFERENCE BOOKS:

1. Fundamentals of Food Engineering – D. G. Rao, Prentice-Hall of India, New Delhi, 2010
2. Unit operations of chemical engineering – W L McCabe, J C Smith and P Harriot, 7th Ed., McGraw-Hill Inc., 2017.

NOVEL FOOD PACKAGING TECHNOLOGY

Course Code – Category: 23FPT123 (A) – PE

L T P E O
3 0 0 1 6

Credits: 3

Sessional Marks: 40

End Exam: 3 Hours

End Exam Marks: 60

Prerequisites: Nil

Course Objectives: To study the functions of packaging as well as influence of various factors on food

Course Outcomes:

At the end of the course, student will be able to

- Understand the principles of various food packaging techniques with strength and optimized materials.
- Testing of packaging in various containers with wrapping as per packaging standards of food.
- Apply Unit Operations and Unit Processes in food process industries.
- CO4 Explain about the packaging technologies for various kinds of foods
- CO5 Apply the manufacturing techniques in the production of value added food products
- under aseptic conditions in food process industries

UNIT I

9L + 3T

Introduction to principals of food packaging, Types of packaging. Functions of packaging; Type of packaging materials; Selection of packaging material for different foods. Selective properties of packaging film; Methods of packaging and packaging equipment.

Mechanical strength of different packaging materials; Printing of packages. Barcodes & other marking; Interaction between packaging material and foods; Environmental and cost consideration in selecting packaging materials.

Learning Outcomes:

UNIT II

9L + 3T

Testing of packaging; Rigid and semi rigid containers; Flexible containers; Sealing equipment; Labelling; Aseptic and shrink packaging; Secondary and transport packaging.

Food packaging and law, shelf life testing, modern and traditional packaging material, physical and chemical properties, production, storage and recycling of packaging materials, regulation and equipment analysis of various existing packaging system and standards.

Learning Outcomes:

UNIT III

9L + 3T

Active and intelligent packaging techniques: Active packaging techniques, intelligent packaging techniques, Current use of novel packaging techniques, Consumers and novel packaging.

Oxygen, ethylene and other scavengers: Oxygen scavenging technology, Selecting the right type of oxygen scavenger, Ethylene scavenging technology, Carbon dioxide and other scavengers.

Antimicrobial food packaging: Antimicrobial agents, Constructing an antimicrobial packaging system, Factors affecting the effectiveness of antimicrobial packaging.

Non-migrating bioactive polymers (NMBP) in Food Packaging: Advantages of NMBP, Inherently Bioactive synthetic polymers: types and application, Polymers with immobilized bioactive compounds, Applications of polymers with immobilized bio active compounds.

Time- temperature indicators (TTIs): Defining and classifying TTIs, Requirements for TTIs, The development of TTIs, Maximizing the effectiveness of TTIs, Using TTIs to monitor shelf-life during distribution.

Learning Outcomes:

UNIT IV

9L + 3T

The use of freshness indicator in packaging: Compounds indicating the quality of packaged food products, Freshness indicators, Pathogen indicators, Other methods for spoilage detection.

Packaging-flavour interactions: Factors affecting flavour absorption, The role of the food matrix, The role of differing packaging materials, Flavour modification and sensory quality.

Moisture regulation: Silica gel, Clay, Molecular sieve, Humectant salts, Irreversible adsorption.

Developments in modified atmosphere packaging (MAP): Novel MAP gases, Testing novel MAP applications, Applying high oxygen MAP.

Recycling packaging materials: The recyclability of packaging plastics, Improving their cyclability of plastics packaging, Testing the safety and quality of recycled material, using recycled plastics in packaging.

Learning Outcomes:

UNIT V

9L + 3T

Green Plastics for food packaging: The problem of plastic packaging waste, The range of biopolymers, Developing novel biodegradable materials.

Integrating intelligent packaging, storage and distribution: The supply chain for perishable foods, The role of packaging in the supply chain, Creating integrated packaging, storage and distribution: alarm systems and TTIs.

Testing consumer responses to new packaging concepts: New packaging techniques and the consumer, Methods for testing consumer responses, Consumer attitudes towards active and intelligent packaging.

Learning Outcomes:

TEXT BOOK:

1. A handbook of Food Packaging, F A Paine and H Y Paine, Blackie & Sons Ltd., Glasgow, UK, (1983).
2. Modern Food Packaging, Published by Indian Institute of Packaging, Mumbai (1998).
3. A Textbook of Food Science and Technology, ICAR, New Delhi (2001).

REFERENCE BOOKS:

1. Food Packaging and Preservation (theory & practice) by M. Mathlouthi Elsevier Applied science publisher, London and New york.
2. 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.
3. Food and Packaging Interactions by Joseph H. Hotchkiss, (ACS symposium series-365, April 5-10, 1987, American chemical society, Washington DC, 1988.)
4. Packaging foods with plastics by winter A. Jenkins & James P Harrington –Technomic publishing co. Inc, Lancaster. Basel.
5. Flexible food packaging (Question & Answers) by Arthur Hirsch VNB – VanNostrand Reinhold, New York (An AVI Book), ISBN 0-442-00609-8.

APPLIED MATHEMATICS IN FOOD PROCESSING

Course Code – Category: 23 FP 123 (B) – PE-III

L T P E O
3 0 0 1 6

Credits: 3

Sessional Marks: 40

End Exam: 3 Hours

End Exam Marks: 60

Prerequisites: Nil

Course Objectives:

- To study numerical methods and their applications in Food processing
- To develop analytical thinking in solving complex problems.
- To solve problems with numerical analysis techniques

Course Outcomes:

At the end of the course, student will be able to

1. Implement Root finding methods for solution on non-linear algebraic equations.
2. Use Interpolation and regression methods to solve problems.
3. Apply Numerical differentiation and Integration to solve problems.
4. Solve system of linear algebraic equations by Matrix methods
5. Solve problems involving ODE

UNIT I

9L + 3T

Introduction to Numerical approach, Approximation and Concept of Error & Error Analysis

Solution of Algebraic and Transcendental Equations: Bisection method, Iteration method, Newton-Raphson methods, False position method

Learning Outcomes:

At the end of this unit, student will be able to

- Apply error analysis to find the error in subsequent steps of numerical methods
- Estimate solutions of algebraic and non-algebraic equations using appropriate numerical method

UNIT II

9L + 3T

Interpolation and Regression: Interpolation with equally spaced: Newton's polynomials – Forward difference and Backward difference, Interpolation with unequally spaced: Lagrange polynomials and Newton's divide difference polynomial.

Regression: least square curve fitting – linear, multi linear, curve fitting by second degree polynomial

Learning Outcomes:

At the end of this unit, student will be able to

- Apply Newton's polynomials and Lagrange polynomials for interpolation
- Implement the least square regression analysis for curve fitting

UNIT III

9L + 3T

Numerical Differentiation: Newton Forward Difference method and Backward difference method,

Numerical Integration: Trapezoidal rule, Simpson's rule,

Learning Outcomes:

At the end of this unit, student will be able to

- Implement numerical methods for numerical differentiation
- Apply Trapezoidal and Simpson's rule for numerical integration

UNIT IV

9L + 3T

Numerical Linear Algebra: Introduction to Matrix and Matrix properties, Solution of Linear systems:

Direct Methods – Gauss elimination method, Gauss – Jordan method LU decomposition method,

Iterative Methods – Jacobi's method and Gauss – Seidel method

Learning Outcomes:

At the end of this unit, student will be able to

- Solve linear algebraic equations using Direct methods
- Solve linear algebraic equations using Iterative methods

UNIT V

9L + 3T

Numerical solution of ordinary differential equations: Solution by Taylor's series, Euler Method,

Modified Euler method, Runge-Kutta Methods-4th order

Learning Outcomes:

At the end of this unit, student will be able to

- Characterize ODE's

- Implement numerical methods to solve ODE

Text Books:

1. Sastry, S. S., "Introductory Methods of Numerical Analysis", 5th Ed., PHI Learning Pvt. Ltd., 2012
2. Gupta, S. K., "Numerical Methods for Engineers, New Academic Science, 2012

Reference Books:

1. S.C. Chapra & R.P. Canale, "Numerical Methods for Engineers with Personal Computer Applications", 5th Ed., McGraw Hill Book Company, 2006.
2. R.L. Burden & J. D. Faires, "Numerical Analysis", 7th Ed., Brooks Coles, 2000.
3. Atkinson, K. E., "An Introduction to Numerical Analysis", John Wiley & Sons, 1978.
4. Press, W. H. et al., "Numerical Recipes in C: The Art of Scientific Computing, 3rd Edition, Cambridge University Press, 2007.

POST HARVEST TECHNOLOGY & COLD CHAIN MANAGEMENT

Course Code – Category: 23FP 123 (C) – PE-III

L T P E O
3 0 0 1 6

Credits: 3

Sessional Marks: 40

End Exam: 3 Hours

End Exam Marks: 60

Unit I

9L + 3T

Importance & scope of post harvest management of fruits and vegetables in Indian economy. Morphology, structure and composition of fruits and vegetables; maturity indices and standards for selected fruits and vegetables; methods of maturity determinations.

Harvesting and handling of important fruits and vegetables, Harvesting tools and their design aspects ; Field heat of fruits and vegetables and primary processing for sorting and grading at farm and cluster level; factors affecting post harvest losses; Standards and specification for fresh fruits and vegetables.

Unit II

9L + 3T

Post harvest physiological and biochemical changes in fruits and vegetables; ripening of climacteric and non-climacteric fruits; regulations, methods; Storage practices: CA and MA, hypobaric storage, pre-cooling and cold storage, Zero energy cool chamber; Commodity pretreatments- chemicals, wax coating, prepackaging, VHT and irradiation.

Physiology post harvest disorders – chilling injury and disease; prevention of post harvest diseases and infestation; Handling and packaging of fruits and vegetables; Post Harvest handling system for fruits and vegetables of regional importance citrus, mango, banana, pomegranate, tomato, papaya and carrot etc., packaging house operations; principles of transport and commercial transport operations.

Unit III

9L + 3T

Fundamentals of Freezing: Glass transition in frozen foods and biomaterials, Microbiology of frozen food, thermophysical properties of frozen food, freezing loads and freezing time calculations, innovations in freezing process.

Facilities for the cold chain: Freezing methods and equipment, cold storage design and maintenance, transportation of frozen foods, retail display equipment and management, house hold refrigerators and freezers, monitoring and control of cold chain.

Unit IV**9L + 3T**

Quality and safety of frozen foods: Quality and safety of frozen meat and meat products, quality and safety of frozen poultry and poultry products. Quality and safety of frozen fish, shell fish and related products, Quality and safety of frozen vegetables, Quality and safety of frozen fruits, Quality and safety of frozen dairy products, Quality and safety of frozen ready meal Quality and safety of frozen bakery products, Quality and safety of frozen eggs and egg products.

Unit V**9L + 3T**

Monitoring and measuring techniques for quality and safety: Chemical measurements, sensory analysis of frozen foods, food borne illnesses and detection of pathogenic micro organisms, shelf life prediction of frozen foods. Packaging of frozen foods.

Text books:

1. Lal, G., Siddappa, G. and Tondon G.L. : Preservation of Fruits and Vegetables, Indian Council of Agricultural Research, New Delhi(1986).
2. Vijaya Khader, "Textbook of Food Science and Technology", ICAR, New Delhi (2001).
3. S Cohen and J Roussel, Strategic Supply Chain Management : The five disciplines for top performance, McGraw-Hill Co, (2004).

Reference book:

1. N Lewis, The Cold Chain, Hamish Hamilton (1988).

DAIRY AND AQUACULTURE TECHNOLOGY

Course Code – Category: 23FP 124 (A) – PE-IV

L T P E O

3 0 0 1 6

Credits: 3

Sessional Marks: 40

End Exam: 3 Hours

End Exam Marks: 60

Unit I

Physico-chemical properties of milk and milk constituents. Fluid milk processing, packaging and distribution. Common dairy processes – cream separation (standardization), pasteurization, sterilization and homogenisation. UHT processing of milk.

Unit II

Process technology for manufacture of evaporated milk, condensed milk, dried milk, malted milk, infant and baby foods, ice cream, cheese, butter, fermented milk and indigenous dairy products.

Unit III

Nutritional Aspects of Fish and Fishery Products. Miscellaneous Products-Crabs, Shrimp and Mollusks. Fishery Byproducts-Fish Meal and Oil.

Unit IV

Principles of Preservation and Processing. Chilling and Freezing-physical aspects, Methods of Freezing, Typical Frozen Products. Drying of Fish- Fundamentals, Salting. Methods of Drying, Smoking, Typical Dry Products.

Unit V

Quality control in aquaculture and dairy technology: Laws and standards in Fishery Industry. Methods and procedures for sampling and testing of milk and milk products. Laws and standards for milk and milk products .

Text Books:

1. P. Sinha. Fish processing and preservation. 2011. APH publishing.
2. De Sukumar. Outlines of dairy technology. 2001. Oxford.
3. Hersh doerfer. Quality control in food industry. Volume 2. 1986

Reference Books:

1. Eiri board. Hand Book Of Milk Processing Dairy Products And Packaging Technology.2008. Engineers India Research Institute.
2. C.D. Khedkar • S.D. Kalyankar . Shital S. Deosarkar • M.R. Patil. Handbook of Dairy Science. IK Publishers.
3. Kilbourn. Fish preservation and refrigeration. 2009. Bibliolife.
4. M. Clute. Food industry quality control systems. 2008. CRC Press.
5. Britz, Trevor J.Robinson, Richard K. Advanced Dairy Science and Technology2008. Wiley-Blackwell

BEVERAGE & SNACK FOOD TECHNOLOGY

Course Code – Category: 23FP 124 (B) – PE-IV

L T P E O
3 0 0 1 6

Credits: 3

Sessional Marks: 40

End Exam: 3 Hours

End Exam Marks: 60

Unit- I

9L + 3T

Types of beverages and their importance; status of beverage industry in India; Manufacturing technology for juice- based beverages; synthetic beverages; technology of still, carbonated, low calorie and dry beverages; isotonic and sports drinks.

Unit –II

9L + 3T

Role of various ingredients of soft drinks, carbonation of soft drinks. Specialty beverages based on tea coffee ,cocoa, spices, plant extracts, herbs, nuts, dairy and imitation dairy based beverages.

Alcoholic beverages- type, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer technology of brewing process, equipment used for brewing and distillation, wine and related beverages, distilled spirits.

Unit –III

9L + 3T

Packaged drinking water- definition, types, manufacture and quality evaluation and raw and processed water, methods of water treatment, BIS quality standards of bottled water; mineral water, natural spring water, flavoured water, carbonated water.

Technology for grain based snacks: whole grains – roasted, toasted, puffed, popped, and flakes, coated grains- salted, spiced and sweetened.

Unit –IV

9L + 3T

Flour based – batter and dough products; savoury and farsons; formulated chips and wafers, papads, instant premixes of traditional Indian snack foods.

Technology for fruit and vegetable based snacks: Chips, wafers; Technology for coated nuts- salted, spiced and sweetened chikkis. Extruded snack foods:

Unit-V

9L + 3T

Formulated and processing technology, colouring, flavouring and packaging. Equipments for frying, baking and drying, toasting, roasting and flaking, popping, blending, coating, chipping .

Text books:

1. Extrusion of Food, Vol 2; Harper JM; 1981, CRC Press
2. Bakery Technology & Engineering; Matz SA; 1960; AVI Pub.

BAKERY & CONFECTIONRY TECHNOLOGY

Course Code – Category: 23 FP124 (C) – PE-IV

L T P E O

3 0 0 1 6

Credits: 3

Sessional Marks: 40

End Exam: 3 Hours

End Exam Marks: 60

Unit- I

9L + 3T

Introduction to baking; Bakery ingredients and their functions; Machines & equipment for batch and continuous processing of bakery products. Bakery and confectionary industry ; raw materials and quality parameters; dough development; methods of dough mixing; dough chemistry; rheological testing of dough- Farinograph, Mixograph, Extensograph, Amylograph/ Rapid Visco Analyzer, Falling number, Hosney's dough stickiness tester and interpretation of the data.

Unit- II

9L + 3T

Technology for the manufacture of bakery products – bread, biscuits, cakes and the effect of variations in formulation and process parameters on the quality of the finished product; quality consideration and parameters; Staling and losses in baking.

Unit- III

9L + 3T

Chocolate Processing Technology, Compound coatings & Candy Bars, Tempering technology, Chocolate hollow figures, Chocolate shells, Enrobing technology, Manufacture of candy bars, Presentation and application of vegetable fats. Production of chocolate mass.

Unit- IV

9L + 3T

Sugar confectionery manufacture, General technical aspects of industrial sugar confectionary manufacture, Manufacture of high boiled sweets- Ingredients, Methods of manufacture- Types- Center- filled, lollipops, coextruded products. Manufacture of gums and jellies- Quality aspects.

Quality characteristics of confectionery ingredients; technology for manufacture of flour, fruit, milk, sugar, chocolate and special confectionery products; colour, flavor and texture of confectionery; standards and regulations ; machineries used in confectionery industry.

Unit- V

9L + 3T

Manufacture of Miscellaneous Products, caramel, Toffee and fudge- Liquorices paste and aerated confectionery, Lozenges, sugar panning and Chewing gum, Count lines Quality aspects, fruit confections.

Objectives and importance of extrusion in food product development; Components and functions of an extruder; Classification of extruder; Advantages and disadvantages of different types of extrusion; Change of functional properties of food components during extrusion; Pre and post extrusion treatments; Use of extruder as bioreactor; Manufacturing process of extruded products; Application of extrusion technologies in food industries.

Text Books:

1. Extrusion of Food, Vol 2; Harper JM; 1981, CRC Press.
2. Bakery Technology & Engineering; Matz SA; 1960; AVI Pub.

References:

1. Up to-date Bread Making; Fance WJ & Wrogg BH; 1968, Maclasen & Sons Ltd.
2. Modern Cereal Chemistry; Kent-Jones DW & Amos AJ; 1967, Food Trade Press

FOOD STANDARDS AND REGULATIONS

Course Code – Category: 23 FP 124 (D)– PE-IV

L T P E O
3 0 0 1 6

Credits: 3

Sessional Marks: 40

End Exam: 3 Hours

End Exam Marks: 60

Prerequisites:

Course Objectives:

Course Outcomes:

At the end of the course, student will be able to

UNIT I

9L + 3T

Concepts and trends in food legislation, International and federal standards: Codex alimentations, ISO series, food safety in USA.

Legislation in Europe: Directives of the official journal of the EU, council regulations, food legislation in UK. Regulating methods for food analysis, case studies. Enforcers of Food Laws Approval Process for Food Additives Nutritional Labeling.

Indian perspective- Histroy-PFA act-1954. Food safety and Standards Act-2006.FoodSafety and Managenent Systems- FSMS-22000.

Learning Outcomes:

UNIT II

9L + 3T

Quality factors: appearance, texture and flavor, Appearance factors – size and shape, colour ad gloss, consistency. Textural Factors – measuring texture, texture changes. Flavour Factors – influence of colour and texture on flavor. Taste Panels.

Learning Outcomes:

UNIT III

9L + 3T

Food – related hazards – biological hazards, chemical hazards, physical hazards, trace chemicals. Microbiological considerations in food safety.

Food laws: Federal Food Drug and Cosmetic Act (1938), Good Manufacturing Practices (Code of GMP), Fair Packaging and Labeling Act (1966), Federal Meat Inspection Act (1906).

Learning Outcomes:

UNIT IV

9L + 3T

International Food, Standards and Codex Alimentarius, HACCP and ISO 9000 series, FPO, Agmark, BIS, FAO, WTO, TBT, GATT AND Traceability issues. .

Learning Outcomes:

UNIT V

9L + 3T

Concept of property, rights, duties and their correlation; History and evaluation of IPR; Copyrights and related rights. Distinction among Various forms of IPR. Patent rights/protection and procedure; Infringement or violation; Remedies against in fringement; Indian Patent Act 1970 and TRIPS; Geographical indication and Industrial design

Learning Outcomes:

TEXT BOOK:

1. Santaniello, Evenson, Ziberman, Carlson – Agriculture and Intellectual Property Rights, Univ. Press, 1998.
2. S. K. Chakraborty : Values and Ethics in Organization, OUP
3. A. N. Tripathi : Human Values, New Age International

REFERENCE BOOKS:

1. Economic Reforms and Food Security: The Impact of Trade and Technology in South Asia by Suresh Chandra Babu, Haworth Press
2. Intellectual property rights in Agricultural Biotechnology; Edited by Erbisch, Maredia; CABI

FOOD PROCESSING LAB-1

Course Code – Category: FPT 125 – PC

L T P E O
0 0 3 0 0

Credits: 2

Sessional Marks: 50

End Exam: 3 Hours

End Exam Marks: 50

Prerequisites: Nil

Course Objectives:

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Course Outcomes:

By the end of the course, student will be able to

Any 10 experiments of the following:

1. Mechanical operations
 - a. Size reduction
 - b. Mechanical Sieving
 - c. Sedimentation
 - d. Froth flotation
2. Heat transfer operations
 - a. Double pipe heat exchanger
 - b. Heat transfer in forced convection
 - c. Heat transfer in natural convection
 - d. Heat transfer by radiation
3. Fluid flow operations
 - a. Bernoulli's experiment
 - b. Orifice meter
 - c. Centrifugal pump
 - d. Reciprocating pump

FOOD PROCESSING LAB-II

Course Code – Category: 23FPT 126 – PC

L T P E O
0 0 3 0 0

Credits: 2

Sessional Marks: 50

End Exam: 3 Hours

End Exam Marks: 50

Prerequisites: Nil

1. Mass transfer operations
 - a. Simple distillation
 - b. Batch drying
 - c. Liquid-Liquid equilibria
 - d. Solid-Liquid equilibria
2. Instrumentation and Control systems
 - a. Temperature measurement
 - b. Temperature control
 - c. Flow control
3. Chemical Reaction Engineering
 - a. Batch Reactor
 - b. Plug Flow Reactor
 - c. Continuous Stirred Tank Reactor
 - d. RTD Studies in PFR
 - e. Estimation of Glucose using DNS reagent

ENGLISH FOR RESEARCH PAPER WRITING

Course Code – Category: 23FP128 – AC

L	T	P	E	O
2	0	3	0	0

Credits: 0

Sessional Marks: 40

COURSE OBJECTIVES:

Students will be able to:

1. Understand how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title
4. Ensure the good quality of paper at very first-time submission

COURSE OUTCOMES:

By the end of the course, the student will be able to:

1. Develop writing skills and level of readability.
2. Critically analyse the content and draft an outline of the abstract.
3. Review the literature, discuss and learn methodology, write effective results, and conclusions.
4. Demonstrate good writing skills and draft good quality paper using appropriate vocabulary and grammatically correct sentences.

SYLLABUS

UNIT I: PLANNING AND PREPARATION

Reading: Reading the content, understanding the key words and theme.

Grammar: Arranging the word order in sentences, breaking up long sentences, structuring paragraphs and sentences, concision of content, removing redundancy, avoiding ambiguity and vagueness.

Learning Outcomes

At the end of the module, the learners will be able to

- Learn how to understand the text content
- Structure the sentences
- Concise the sentences and write well structured paragraphs on specific topics

UNIT-II: ABSTRACT PREPARATION

Analysing the content- getting clarity on who did what, highlighting the findings, hedging and criticising the material. Drafting- Writing abstracts and introductions of paper, learning Paraphrasing and checking Plagiarism.

Learning Outcomes

At the end of the module, the learners will be able to

- Learn how to Analyse and high light the findings.
- Write abstracts and introductions of paper
- Paraphrase the paper content
- Check Plagiarism

UNIT-III: DISCUSSION AND CONCLUSIONS

Review of the Literature- Using methods to find results. Participating in discussions and bring out effective, conclusions. Learn the tips to draft the appropriate title of a paper. Define the purpose and scope and its contribution to the field of research.

Learning Outcomes

At the end of the module, the learners will be able to

- Review the literature
- Discuss the work to bring out effective conclusions.
- Draft a title of a paper
- Identify the scope and its contribution to the field of research

UNIT-IV: WRITING SKILLS AND QUALITY

Vocabulary- Use of appropriate vocabulary; nouns, synonyms and phrases to write methods, results, discussion and Conclusions. Grammar- Using grammatically correct sentences, using correct form of verbs- subject verb agreement, noun pronoun agreement and punctuations. Proof reading the research paper and submitting the quality work on time.

Learning Outcomes

At the end of the module, the learners will be able to

- Use appropriate vocabulary to write methods, results, discussion and Conclusions.
- Use grammatically correct sentences
- Proof read the research paper
- Submit the quality research paper on time

Reference Books:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011