Semester I

Assessment and Grading:

Assessment in this course will be multifaceted and may include the following components:

Examinations: Regular quizzes, mid-term exams, and a comprehensive final exam will assess your understanding of course materials.

Assignments: Homework assignments, research papers, or case studies will be assigned to reinforce theoretical knowledge and analytical skills.

Class Participation: Active engagement in class discussions, presentations, and group activities will be considered in the evaluation.

Grading Criteria (Note: These percentages are subject to adjustment based on the course structure):

Examinations: 80%

Class Participation: 5%

Assignments: 10%

Attendance: 5%

Feedback and Assessment Criteria:

- Constructive feedback will be provided on assignments and exams to help you understand your performance and areas for improvement.
- Clear assessment criteria, rubrics, and expectations will be provided at the beginning of the course to guide your work.
- Please feel free to seek clarification on grading and assessment-related questions throughout the course.
- Students with special needs may contact the concerned teacher before hand.

FT23101CR

Food Microbiology and Biotechnology (4+0+0)

Course Description:

The course "Food Microbiology and Biotechnology" at the master's level in Food Science and Technology is a comprehensive exploration of the intricate relationship between microorganisms and the food we consume. This course delves into the multifaceted world of food microbiology, where students will uncover the vital roles microorganisms play in food production, preservation, and biotechnological innovation. Throughout the course, students will engage in theoretical learning, practical laboratory work, and critical discussions to develop a profound understanding of the complex interplay between microbes and food.

Unit I

- Brief history of Food Microbiology. Microbial Growth Curve.
- Factors affecting microbial growth: intrinsic and extrinsic factors.
- Types of microbes associated with foods & their characteristics: Bacteria, yeast, Fungi.
- Biochemical changes caused by microorganisms: Degradation of different food components.

Learning Outcomes:

By the end of this unit, students should be able to:

- Describe the historical development of food microbiology and its significance in the food industry.
- Explain the microbial growth curve and its relevance to food processing and preservation.
- Identify intrinsic and extrinsic factors influencing microbial growth in food.
- Classify various types of microbes commonly associated with foods and describe their characteristics.
- Analyse the biochemical changes caused by microorganisms, focusing on the degradation of different food components.

Unit II

- Microorganisms associated with spoilage of milk, cereal, meat, fruit and vegetables & their products. Spoilage of canned products.

- Detection of Food spoilage using biosensors.
- Food borne diseases: Listeriosis, Salmonellosis, Shigellosis, Yersiniosis, Diseases caused by *Clostridium perfringens*, *Bacillus cereus*, *Escherichia coli*.
- Food intoxication: Staphylococcal intoxication, Botulism,
- Toxicants from molds: Aflatoxins, ochratoxins, patulin, Luteoskyrin, Pencillic acid.

Learning Outcomes:

By the end of this unit, students should be able to:

- Identify microorganisms responsible for the spoilage of various food products and describe their characteristics.
- Evaluate methods for detecting food spoilage using biosensors.
- Analyse the major foodborne diseases and their causative agents.
- Discuss food intoxications caused by specific bacteria and toxins.
- Recognize the toxins produced by molds and their implications for food safety.

Unit III

- Introduction to Genetic Engineering, Recombinant DNA Technology, Vectors, Ti Plasmid
- SCP: Sources, substrate requirement, Production,
- GM crops: Bt Corn, Bt Brinjal & Golden Rice.
- Antisense RNA & Gene silencing
- Genetic manipulation of industrially important yeast and Lactic Acid Bacteria.

Learning Outcomes:

By the end of this unit, students should be able to:

- Explain the principles of genetic engineering and recombinant DNA technology.
- Understand the role of vectors and Ti plasmids in genetic modification.
- Analyze the production of Single Cell Protein (SCP) and its applications.
- Evaluate genetically modified (GM) crops, including Bt Corn, Bt Brinjal, and Golden Rice.
- Describe the concepts of antisense RNA and gene silencing in biotechnology.

- Discuss the genetic manipulation of industrially important yeast and Lactic Acid Bacteria (LAB).

Unit IV

- Fermentation- types of fermentation, Fermenters
- Waste utilization in industrial microbiology
- Biocolor: Technology of production, sources (Microbial & plant) and applications
- Bio-preservatives – types and applications
- Enzyme immobilization- methods and advantages. Industrial application of enzymes.

Learning Outcomes:

By the end of this unit, students should be able to:

- Define fermentation and categorize different types of fermentation processes.
- Explain the principles of waste utilization in industrial microbiology.
- Describe the technology of Biocolor production, sources (microbial & plant), and its applications.
- Classify various types of bio-preservatives and discuss their applications in food preservation.

References:

1. Frazier, W.C. (2014). Food Microbiology. McGraw Hill Education (India) Private Ltd.
2. Jay, J. (2012). Modern Food Microbiology. Springer Science & Business Media.
3. George J. Banwart. (2012). Basic Food Microbiology. Springer Science & Business Media, 2012
4. Pommerville, J.C. Alcoms. (2021). Fundamentals of microbiology. Jones & Bartlett Learning
5. Stainier. (1979). Introduction to Microbiology. Prentice-Hall
6. Ray, B., & Bhunia, A. (2013). Fundamentals of Food microbiology. CRC Press, 2013
7. Pelczar, Smith & Chan. (2009). Microbiology. Tata McGraw-Hill Education
8. Joshi, V. K. and Sing., R.K. (2012). Food Biotechnology principles & Practices. I. K. International Publishing House Pvt. Ltd., New Delhi, Banglore, India

9. Byong H. Lee. (2015). Fundamentals of Food Biotechnology. JohnWiley & Sons, Ltd
10. Buchanan, Jones, G. (2007). Biochemistry and molecular biology of plants. I.K. International Pvt. Ltd.
11. Adrian, S., Nigel W. S., Mark, R.F. (2008). Plant Biotechnology: The genetic manupilation of plants. Second Edition, Oxford University Press.

FT23102CR

Food Chemistry (4+0+0)

Course description

The "Food Chemistry" course at masters' level provides an in-depth exploration of the fundamental principles and concepts underlying the chemistry of food. It examines the chemical properties and interactions of key food components, including water, carbohydrates, proteins, lipids, and food additives. Through theoretical and practical approaches, students will gain a comprehensive understanding of how these chemical elements influence the composition, quality, safety, and sensory attributes of food products. This course serves as a foundation for advanced studies in food science and technology and equips students with the knowledge and skills necessary to analyze and manipulate food chemistry in the food industry.

UNIT I

- Water- solute interactions.
- Carbohydrates- Classification, Structure and functional properties of mono, oligo & poly-saccharides.
- Non- Enzymatic browning (NEB): Chemistry and factors affecting NEB.
- Polysaccharide solubility, viscosity and stability.
- Starch structure. Gelatinization and pasting properties.
- Industrially important polysaccharides like cellulose, pectic substances, Guar gum, locust bean gum, Xanthan gum, Carrageenans, & beta- glucan.

Learning outcomes:

By the end of this unit, students should be able to:

- Describe the role of water-solute interactions in food systems.
- Classify carbohydrates and explain the structural and functional properties of mono, oligo, and poly-saccharides.
- Analyse the chemistry of Non-Enzymatic Browning (NEB) reactions and identify factors affecting NEB.
- Evaluate polysaccharide solubility, viscosity, and stability, with a focus on starch structure and gelatinization properties.

- Recognize the industrial importance of polysaccharides like cellulose, pectic substances, gums (e.g., Guar gum, Xanthan gum), carrageenans, and beta-glucan.

UNIT II

- Amino acid- Classification, structure and properties.
- Proteins: Classification, structure and forces involved in stability of protein structure.
- Protein denaturation, thermodynamics of denaturation and denaturing agents.
- Functional properties including hydration, solubility and interfacial properties.
- Nutritional properties of proteins: protein quality, digestibility, evaluation of protein nutritive value.

Learning Outcomes (CLO):

By the end of this unit, students should be able to:

- Classify amino acids and describe their structure and properties.
- Categorize proteins, explain their structure, and identify the forces involved in stabilizing protein structures.
- Analyze protein denaturation, understand the thermodynamics of denaturation, and discuss denaturing agents.
- Evaluate the functional properties of proteins, including hydration, solubility, and interfacial properties.
- Assess the nutritional properties of proteins, including protein quality, digestibility, and methods for evaluating protein nutritive value.

UNIT III

- Lipids: Classification, and nomenclature of saturated and unsaturated fatty acids.
- Physical properties of triacylglycerols - rheological, density, thermal and optical properties. Physicochemical transition of lipids – supercooling, nucleation, crystal growth, post crystallization events. Polymorphism in lipids.
- Isolation, purification and modification of lipids.
- Mechanism of oxidative rancidity and role of Prooxidants and antioxidants in lipid oxidation.

- Food lipids and health: Trans- fatty acids, omega fatty acids

Learning Outcomes:

By the end of this unit, students should be able to:

- Classify lipids and understand the nomenclature of saturated and unsaturated fatty acids.
- Analyze the physical properties of triacylglycerols, including rheological, density, thermal, and optical properties.
- Explain the physicochemical transitions of lipids, including supercooling, nucleation, crystal growth, and post-crystallization events.
- Describe the isolation, purification, and modification of lipids in food systems.
- Investigate the mechanisms of oxidative rancidity and the roles of prooxidants and antioxidants in lipid oxidation.
- Assess the impact of food lipids on health, including trans-fatty acids and omega fatty acids.

UNIT IV

- Food Additives: Definition, classification and safety aspects.
- Commonly used food additives like antioxidants, antimicrobials, colorants and artificial sweeteners
- Food Flavors: Molecular mechanism of flavor perception. Taste substances and nonspecific saporous sensations: Sweet, bitter, sour, salty, astringency, Kokumi, pungency, and cooling.
- Flavoring substances associated with fruits and vegetables, milk, spices and processed products.
- Encapsulation, retention and controlled release of flavor and aroma compounds.

Learning Outcomes:

By the end of this unit, students should be able to:

- Define food additives, classify them, and discuss safety aspects.
- Identify commonly used food additives, such as antioxidants, antimicrobials, colorants, and artificial sweeteners.

- Explain the molecular mechanism of flavor perception and describe taste substances and nonspecific saporous sensations.
- Recognize flavoring substances associated with fruits and vegetables, milk, spices, and processed products.
- Understand the principles of encapsulation, retention, and controlled release of flavor and aroma compounds in food systems.

References:

1. Owen R. Fennema. (2007). Food Chemistry. CRC Press
2. Meyer. (1960). Food Chemistry. Reinhold Publishing Corporation.
3. Wong. (2018). Mechanism & Theory in Food Chemistry. Springer International Publishing
4. Belitz, H. D. (2009). Food Chemistry. Springer Science & Business Media
5. John M. deMan. (2018). Principles of Food Chemistry. Springer International Publishing
6. Joshi, V. K. and Sing., R.K. (2012). Food Biotechnology principles & Practices. I. K. International Publishing House Pvt. Ltd., New Delhi, Banglore, India
7. Andrew J Taylor. (2010). Food Flavor Technology. Wiley Blackwell Publishing Ltd
8. Branen, A.L., Davidson, P.M., and Salminen, S. (2001). Food Additives. CRC Press

FT23103CR

Food Processing Technology (4+0+0)

Course Description:

The "Food Processing Technology" course at the master's level delves into advanced principles and practices in food preservation and processing. This comprehensive course explores various technologies and methods used in the food industry to extend shelf life, enhance food quality, and ensure food safety. Students will gain insights into traditional and cutting-edge food processing techniques, as well as their applications and significance in the modern food manufacturing landscape.

UNIT I

- Principles of Food Preservation
- Food Dehydration: Drying curves, factors affecting food dehydration, effect of dehydration on food quality. Types of driers.
- Evaporation: Single and multiple effect evaporators, Types of evaporators.
- Significance of water activity in shelf stability of foods. Intermediate moisture foods.
- Thermal processing: blanching, pasteurization, sterilization. Aseptic processing.

Learning outcomes:

By the end of this unit, students should be able to:

- Understand principles of food preservation and their significance.
- Analyze drying curves and factors affecting food dehydration.
- Examine the impact of dehydration on food quality.
- Differentiate between types of driers used in food processing.
- Grasp the significance of water activity in determining shelf stability.
- Describe intermediate moisture foods.
- Master thermal processing techniques like blanching, pasteurization, sterilization, and aseptic processing.

UNIT II

- Food Irradiation– Principle, mechanism and applications in foods. Safety concerns.

- Refrigeration and freezing: Principle of refrigeration, freezing curve. Types of freezers, Freezing and chilling injuries.
- Membrane processing–types of membranes, equipments, applications in foods, Advantages.
- Minimally processed foods– Preservation and packaging of minimally processed foods.
- Chemical preservatives.

Learning outcomes:

By the end of this unit, students should be able to:

- Explain principles and mechanisms of food irradiation.
- Assess applications of food irradiation and associated safety concerns.
- Describe principles of refrigeration, freezing curves, and types of freezers.
- Evaluate potential freezing and chilling injuries in food products.
- Understand membrane processing techniques, types of membranes, and equipment.
- Discuss advantages of membrane processing in food production.
- Analyze preservation and packaging methods for minimally processed foods.
- Understand the use and role of chemical preservatives in food processing.

UNIT III

- High Pressure Processing of Foods: Concept of high-pressure processing, effects of pressure on microorganisms and its application in food processing.
- Ultrasonic in Food Processing: Properties and generation of ultrasonic, Cavitation, Ultrasonics as a processing technique.
- Cold plasma for Food Processing – Principle and generation of cold plasma. Application of cold plasma Technology.
- Pulse electric field - Principle, PEF system, Mechanism of microbial inactivation, Factors effecting pulse electric field efficiency. Applications of PEF.

Learning outcomes:

By the end of this unit, students should be able to:

- Investigate the concept and applications of high-pressure processing of foods.
- Understand properties and generation of ultrasonic waves and their applications.
- Explain principles and generation of cold plasma for food processing.
- Describe pulse electric field (PEF) principles, components, and applications.

Unit IV

- Ohmic heating – principles and applications.
- Microwave processing–mechanism, equipment and applications.
- Supercritical Fluid Extraction: Properties of super critical fluids, Principle and applications in Food Processing.
- Micronization in food processing- techniques and benefits

Learning outcomes:

By the end of this unit, students should be able to:

- Grasp the principles and applications of ohmic heating.
- Analyze the mechanism, equipment, and applications of microwave processing.
- Understand properties of supercritical fluids and their applications in food processing.
- Explore micronization techniques and their benefits in food processing.

References:

1. P. Fellows. (2022). Food Processing Technology. Woodhead Publishing
2. Desrosier. The Technology of Food Preservation. AVI Publishing Company, 1959
3. Potter, N.N. (2013). Food Science. Springer Science & Business Media
4. Introduction to Food Science and Technology by Stewart. Elsevier 2012
5. Handbook of Food Preservation by M. Shafiur Rahman. CRC Press 2020
6. Novel Food Processing Technologies by Gustavo V. Barbosa-Canovas, Maria S. Tapia, M. Pilar Cano. CRC Press 2004

FT23104CR

Food Packaging (3+0+1)

Unit I

- Definition and functions of packaging.
- Types of packaging used in foods-chemistry and applications.
- Properties of packaging materials - Barrier properties - gas transmission rate (GTR) and water vapour transmission rate (WVTR); Mechanical properties. Migration
- Metals: Tinplate containers, tinning process, Low tin steels, tin free steel (TFS). Can-manufacturing, types and lacquering.

Learning outcomes:

By the end of this unit, students should be able to:

- Define packaging and its functions in the context of the food industry.
- Describe different types of packaging materials used in the food industry.
- Analyze the chemistry of packaging materials and their applications.
- Understand the properties of packaging materials, including barrier properties, gas transmission rate (GTR), water vapor transmission rate (WVTR), and mechanical properties.
- Examine migration issues related to packaging materials.
- Explore metals used in food packaging, such as tinplate, tinning processes, low tin steels, and tin-free steel (TFS).
- Understand can manufacturing processes, types of cans, and lacquering techniques.

Unit II

- Glass and paper packaging.
- Plastics: Polymer processing methods.
- Innovative technologies in food packaging: active packaging & intelligent packaging.
- Biodegradable and Edible packaging. Concept of green plastics and nanosensors.

Learning outcomes:

By the end of this unit, students should be able to:

- Explain modified and controlled atmospheric packaging principles, designs, and applications.
- Utilize shelf-life assessment and prediction methodologies for food products.
- Identify specific packaging requirements for dairy, cereal, meat, spices, fruits, and vegetables.
- Understand food packaging regulations and labeling practices.

Unit III

- Modified and controlled atmospheric packaging: Design and application.
- Shelf –life assessment and prediction methodologies.
- Packaging requirements- Dairy, cereal, meat, spices, fruit & vegetable.
- Food packaging- regulations and labeling.

Learning outcomes:

By the end of this unit, students should be able to:

- Explain modified and controlled atmospheric packaging principles, designs, and applications.
- Utilize shelf-life assessment and prediction methodologies for food products.
- Identify specific packaging requirements for dairy, cereal, meat, spices, fruits, and vegetables.
- Understand food packaging regulations and labeling practices.

Unit IV (Practical)

1. Identification of films
2. Determination of WVTR and OTR of packages
3. Determination of shelf life of packaged foods
4. Porosity of tinplate
5. Shrink and vacuum packaging of different foods.

Learning outcome:

By the end of this unit, students should be able to:

- Identify different packaging films used in the food industry.

- Determine water vapor transmission rates (WVTR) and oxygen transmission rates (OTR) of food packages.
- Evaluate the shelf life of packaged food products.
- Assess the porosity of tinplate materials.
- Gain practical experience in shrink and vacuum packaging techniques for various food products.

References:

1. Food Packaging Principles by Gorden Robertson. CRC Press 2005
2. Handbook of Food Packaging by Paine and Paine. (2012). Springer Science & Business Media
3. Food Packaging- Science & Technology by Lee. (2008). Taylor & Francis
4. Innovations in Food Packaging by Jung M. Han. (2014). Academic Press
5. Principles of Food Packaging by Saccharow and Griffin. AVI Publishing Company, 1980
6. Innovations in Food Packaging by Jung H. Han. Elsevier, 2005

FT23101DCE

Food Engineering (3+0+1)

Unit I

- Material and energy balance: Basic principles, total mass and energy balance, numerical problems based on dilution, concentration, dehydration, and energy balance.
- Modes of heat transfer- conduction, convection and radiation.
- Thermal process calculations- D value, Z value, F value for canned foods.
- Heat Exchangers: Design, types and applications.

Learning outcomes:

By the end of this unit, students should be able to:

- Apply the principles of material and energy balance in food engineering.
- Solve numerical problems related to dilution, concentration, dehydration, and energy balance.
- Understand the modes of heat transfer, including conduction, convection, and radiation.
- Perform thermal process calculations, including D value, Z value, and F value for canned foods.
- Describe the design, types, and applications of heat exchangers.

Unit II

- Types of evaporators- Design of Single effect and multiple effect evaporators.
- Refrigeration– Principle, refrigeration cycle, Thermodynamics of refrigeration
- Psychometric charts and their application.
- Rheological studies: Viscosity, Newtonian and non-Newtonian fluids, Storage and loss Modulus and its applications in foods. Concept of Farinograph, Amylograph, Rheometer, and texture analyzer.

Learning outcomes:

By the end of this unit, students should be able to:

- Differentiate between various types of evaporators and design single effect and multiple effect evaporators.

- Explain the principles of refrigeration, the refrigeration cycle, and the thermodynamics of refrigeration.
- Utilize psychometric charts for food engineering applications.
- Analyze rheological properties, including viscosity, Newtonian and non-Newtonian fluids, and storage and loss modulus.
- Understand the concepts and applications of Farinograph, Amylograph, Rheometer, and texture analyzer.

Unit III

- Size reduction – Elastic stress limit, yield point, Kicks law, Rittengers law, Bonds law.
- Equipment for fibrous, dry and liquid foods.
- Mixing – Theory of solids mixing, theory of liquids mixing, equipment for low, medium and high viscosity foods.
- Separation Processes: Sedimentation, Filtration, Centrifugal Separation.

Learning outcomes:

By the end of this unit, students should be able to:

- Evaluate size reduction processes using concepts such as elastic stress limit, yield point, Kicks law, Rittengers law, and Bonds law.
- Identify equipment suitable for processing fibrous, dry, and liquid foods.
- Describe the theory of solids mixing and the theory of liquids mixing.
- Select appropriate equipment for low, medium, and high viscosity foods.
- Understand separation processes, including sedimentation, filtration, and centrifugal separation.

Unit IV

- To study drying rate characteristics of different food materials.
- Determination of freezing curve and freezing time of selected food material.
- Demonstration of steam distillation.
- To study particle size by using sieve analysis.

Learning outcomes:

By the end of this unit, students should be able to:

- Study the drying rate characteristics of different food materials.
- Determine freezing curves and freezing times for selected food materials.
- Perform steam distillation demonstrations.
- Conduct particle size analysis using sieve analysis techniques.

References:

1. Introduction to Food Engineering by R.P. Singh and D.R. Heldman. Academic Press, 2013
2. Fundamentals of Food Process Engineering by R.T. Toledo. Springer Science & Business Media, 2007
3. Industrial Engineering and Management by O. P. Khanna. Dhanpat Rai, 1980
4. Food Processing Technology by P. Fellows. (2022). Woodhead Publishing

FT23102DCE

Experiments in Food Chemistry (Practical) (0+0+2)

1. Preparation and standardization of solution.
2. Proximate analysis of foods.
3. Qualitative tests for Carbohydrates
4. Protein separation and characterization using SDS-PAGE electrophoresis
5. Smoke, Flash and Fire points of oils and fats
6. Determination of free fatty acids
7. Peroxide value and TBA for measuring lipid oxidation
8. Estimation of Total phenolic content
9. Pasting properties of starches using RVA.
10. Sensory methods for measuring food attributes- Difference tests and Rating tests.
11. Determination of adulterants in milk, ghee, edible oil, chillies, honey.

References

1. Handbook of Analysis and Quality Control for Fruit and Vegetable products by Ranganna. Tata McGraw-Hill, 1986
2. Food Analysis by S. Suzanne Nielsen. (2017). Springer Science & Business Media
3. Chemical Analysis of Foods and Food Products by Jacobs, Morris B. (1939). New York,: D. Van Nostrand company, inc.
4. Physical Properties of Food by R.Jowitt & Fescher. (1983)
5. Sensory Evaluation Practices by Stone. (2012). Elsevier Science

FT23103DCE

Experiments in Microbiology (Practical) (0+0+2)

1. Microscopy.
2. Techniques of inoculation.
3. Staining techniques-gram staining, Positive staining, Negative staining.
4. Enumeration of micro-organisms– TPC, Yeast and mould count, ANPC.
5. PCR
6. Production of biocolors
7. Identification of bacteria on the basis of:
    a. Cultural characteristics
    b. Morphological characteristics
    c. Biochemical characteristics -Indole Test/ MVIC test, Starch-hydrolysis, Oxidase Test, TSI test, Coagulase test, Catalase test

References

1. Textbook of Practical Microbiology by Subhash Chandra Parija. Elsevier 2016
2. Laboratory Manual in Microbiology by Gunasekaran. (2007). New Age International (P) Limited
3. Bergey's Manual of Systematic Bacteriology. (2012). Springer New York.

FT23001GE

INTRODUCTORY LIPID TECHNOLOGY (2+0+0)

UNIT 1

- Lipids-classification and sources
- Nomenclature of saturated and unsaturated fatty acids
- Physicochemical properties of Lipids.
- Extraction and rendering of lipids- Physical and chemical refining
- Hydrogenation, interesterfication and Winterization of oils

UNIT II

- Chemistry of frying of oils- physical and chemical changes. Decomposition products
- Mechanism of Lipid oxidation
- Factors affecting lipid oxidation
- Role of prooxidants and antioxidants
- Fat replacements

References

1. Food Lipids: Chemistry, nutrition and biotechnology by Casimer C. Akoh and David B. Min (2017). CRC Press
2. Fats and oils by Richard D-O' Brien. (2008). CRC Press
3. Food Chemistry, Third Edition. Hong Kong: Taylor & Francis, 1996.
4. Bailey's Industrial Oil and Fat Products, 7 Volume Set. United Kingdom: Wiley, 2020.

FT23002OE

ELEMENTARY FOOD PROCESSING (2+0+0)

Unit – I

- Status of Indian food industry– Exports scenario of fruits, vegetables, spices, and their processed products; Driving forces for food industry and constraints
- Causes of food spoilage.
- Thermal Processing – Canning, Sterilization, Pasteurization, Asceptic processing.
- Preservation by low temperature- Refrigeration and Freezing

Unit–II

- Concept of water activity; Intermediate moisture foods.
- Fermentation– Types, nutritional importance of fermented foods.
- Hurdle Technology
- Controlled atmospheric storage – Principle, design considerations, effects of CA storage on food quality.

References:

1. Fellows, P.J. Food Processing Technology: Principles and Practice. United Kingdom: Elsevier Science, 2009.

2. Desrosier, J. N.. Technology of Food Preservation. India: CAB Publishers., 1998.

3. Potter, Norman N. Food Science. United States: Avi Publishing Company, 1973.

4. Stewart, George. Introduction to Food Science and Technology. United States: Elsevier Science, 2012.

Assessment and Grading:

Assessment in this course will be multifaceted and may include the following components:

Examinations: Regular quizzes, mid-term exams, and a comprehensive final exam will assess your understanding of course materials.

Assignments: Homework assignments, research papers, or case studies will be assigned to reinforce theoretical knowledge and analytical skills.

Class Participation: Active engagement in class discussions, presentations, and group activities will be considered in the evaluation.

Grading Criteria (Note: These percentages are subject to adjustment based on the course structure):

Examinations: 80%

Class Participation: 5%

Assignments: 10%

Attendance: 5%

Feedback and Assessment Criteria:

- Constructive feedback will be provided on assignments and exams to help you understand your performance and areas for improvement.
- Clear assessment criteria, rubrics, and expectations will be provided at the beginning of the course to guide your work.
- Please feel free to seek clarification on grading and assessment-related questions throughout the course.
- Students with special needs may contact the concerned teacher beforehand.

FT23201CR

Semester II

Food Analysis and Quality Assurance (4+0+0)

Course description

The "Food Analysis and Quality Assurance" course at the master's level is designed to provide an in-depth understanding of the principles and techniques used in food analysis and quality control. This comprehensive course covers various analytical methods and quality assessment approaches employed in the food industry to ensure the safety, quality, and compliance of food products with national and international standards. Students will gain practical insights into instrumental analysis, sensory evaluation, and quality management systems.

Unit I

- Principle and interferences of Flame photometry.
- Atomic absorption spectroscopy – Principle, working, instrumentation and applications. ICP.
- X-ray analysis of foods– Properties, production & detection, x- ray tubes, detectors sources, application in food industry.
- Mass spectroscopy– Instrumentation and interpretation.

Learning outcomes:

By the end of this course, students should be able to:

- Understand the principles and potential interferences of Flame photometry.
- Explain the principles, working, instrumentation, and applications of Atomic absorption spectroscopy.
- Discuss the role of X-ray analysis in food quality assessment, including properties, production, detection, sources, and applications.
- Describe the instrumentation and interpretation of Mass spectroscopy.

Unit II

- Chromatography– Principles of different chromatographic separations. Instrumentation and working of HPLC &GC.
- Nuclear magnetic resonance (NMR) – Principle, Components, Interpretation of NMR spectra, application of NMR.
- Immunoassays and Nucleic acid-based techniques: ELISA & PCR.

- Tri stimulus color system & hunter color lab CDM

Learning outcomes:

By the end of this course, students should be able to:

- Differentiate between various chromatographic separations and understand the principles behind them.
- Examine the instrumentation and operation of High-Performance Liquid Chromatography (HPLC) and Gas Chromatography (GC).
- Interpret Nuclear Magnetic Resonance (NMR) spectra and assess their applications in food analysis.
- Explore Immunoassays and Nucleic acid-based techniques, including Enzyme-Linked Immunosorbent Assay (ELISA) and Polymerase Chain Reaction (PCR).
- Understand the Tri-stimulus color system and its application in food color assessment using the Hunter color lab CDM.

Unit III

- Objectives, importance and functions of quality control.
- Methods of quality assessment-Subjective & objective methods.
- Statistical quality control-X & R charts, steps for developing control charts.
- National & international Food laws– Food Safety and Standards Act 2006, Codex Alimentarius Commission, grades and standards. Labeling of foods.

Learning outcomes:

By the end of this course, students should be able to:

- Recognize the objectives, importance, and functions of quality control in the food industry.
- Differentiate between subjective and objective methods of quality assessment.
- Apply Statistical Quality Control techniques, such as X & R charts, and understand the steps for developing control charts.
- Discuss national and international food laws, including the Food Safety and Standards Act 2006 and Codex Alimentarius Commission, and their impact on food quality and labeling.

Unit IV

- General hygiene and sanitation in food industry– GMP, HACCP, QMS

- Sensory evaluation and panel screening
- Sensory evaluation methods/training– Difference tests (Paired comparison, Duo Trio, Triangle), Rating (ranking, single sample, two-sample, multiple samples, hedonic), sensitivity threshold test.
- **Quality evaluation of foods** – Fruits, vegetables, cereals, dairy products, meat, poultry, egg and processed food products.

Learning outcomes:

By the end of this course, students should be able to:

- Demonstrate knowledge of general hygiene and sanitation practices in the food industry, including Good Manufacturing Practices (GMP), Hazard Analysis and Critical Control Points (HACCP), and Quality Management Systems (QMS).
- Conduct sensory evaluation and panel screening to assess the sensory attributes of food products.
- Apply various sensory evaluation methods, including difference tests (Paired comparison, Duo Trio, Triangle), rating (ranking, single sample, two-sample, multiple samples, hedonic), and sensitivity threshold tests.
- Evaluate the quality of different food categories, such as fruits, vegetables, cereals, dairy products, meat, poultry, eggs, and processed food products.

References:

1. Principles of Sensory Evaluation of Foods by M.A. Amerine, R. M. Rangborn and E.B. Roessler 2013, Elsevier.
2. Quality Control in Food Industry 1st Edition - January 1, 1968, Hershoerfer
3. Fundamentals of Quality Control for the Food Industry by Amihud Kramer, Bernard A. Twigg,1962
4. Food Quality Evaluation by Eram S. Rao,Variety Book Publishers' Distributors, 2013
5. Pomeranz, Y. and Meloan, C.E. (2000) Food Analysis: Theory and Practice. 3rd Edition, AN Aspen Publication, Silver Spring.
6. Nielsen, S. Suzanne, ed. Food analysis laboratory manual. New York, NY, USA:: Kluwer Academic/Plenum Publishers, 2003.

7. Paré, J. R. J., and J. M. R. Bélanger, eds. *Instrumental methods in food analysis*. Elsevier, 1997.

FT23202CR

Fruit and vegetable Technology (4+0+0)

Course Description:

The "Fruit and Vegetable Technology" course at the master's level explores the science and technology behind the postharvest handling, processing, and preservation of fruits and vegetables. This comprehensive course delves into the key aspects of fruit and vegetable quality, including maturity, ripening, and nutritional assessment, and covers various methods for extending the shelf life of horticultural produce. Students will gain knowledge of cold chain management, storage techniques, processing methods, and preservation approaches essential for the fruit and vegetable industry.

UNIT-I

- Fruit maturity and ripening indices. Postharvest changes in fruits and vegetables.
- Post-harvest losses in fruit and vegetable
- Non-destructive techniques for assessing the nutritional quality of Fruits and Vegetables.
- Ethylene biosynthesis, mode of action, ethylene management.
- Handling of fresh fruits and vegetables.

Learning Outcomes:

By the end of this course, students should be able to:

- Understand the concepts of fruit maturity and ripening indices and postharvest changes in fruits and vegetables.
- Analyze the factors contributing to postharvest losses in fruit and vegetable handling.
- Evaluate non-destructive techniques for assessing the nutritional quality of fruits and vegetables.
- Explain the biosynthesis of ethylene, its mode of action, and ethylene management in postharvest fruit and vegetable storage.
- Demonstrate proper handling practices for fresh fruits and vegetables.

UNIT-II

- Cold chain management.
- Storage: Definition & functions. Types of storage: low cost and high-cost storage systems

- Controlled atmospheric storage: structural design of storage room and gas control systems.
- Monitoring Volatiles during storage of fruits and vegetables.
- Physiology and biochemistry of fresh cut fruits.
- Coating of fresh horticulture produce

Learning outcomes:

By the end of this course, students should be able to:

- Implement cold chain management practices to maintain fruit and vegetable quality.
- Define storage and its functions, distinguishing between low-cost and high-cost storage systems.
- Design controlled atmospheric storage rooms and manage gas control systems.
- Monitor volatile compounds during the storage of fruits and vegetables.
- Examine the physiology and biochemistry of fresh-cut fruits and explore the concept of coating fresh horticultural produce.

UNIT-III

- Principles and methods of preservation of fruits and vegetables.
- Preparation and preservation of Jam, Jellies, Marmalades. Theories of gel formation.
- Fruit & vegetable alcoholic and non-alcoholic beverages: Preparation & preservation of juice, cordial, Squash, crush, nectar, RTS.
- Canning: Principle and Process.

Learning outcomes:

By the end of this course, students should be able to:

- Apply the principles and methods of preservation to fruits and vegetables.
- Prepare and preserve various products such as jams, jellies, marmalades, and understand the theories of gel formation.
- Produce fruit and vegetable-based alcoholic and non-alcoholic beverages, including juice, cordials, squash, crush, nectar, and ready-to-serve (RTS) beverages.
- Describe the principles and processes involved in canning fruits and vegetables.

UNIT-IV

- Preserve, candied and crystallized fruits and vegetables.
- Tomato Processing- Juice, ketchup, puree, paste.

- Browning reactions and discoloration during processing.
- Enzymes used in fruit and vegetable industry.

Learning outcomes:

By the end of this course, students should be able to:

- Create preserved, candied, and crystallized fruits and vegetables.
- Process tomatoes into juice, ketchup, puree, and paste.
- Analyze browning reactions and discoloration phenomena during processing.
- Examine the enzymes used in the fruit and vegetable processing industry and their applications.

Reference:

1. Postharvest Technology of Fruits and Vegetables, Harvesting, Handling and Storage, 2nd Edition by A.K. Thompson,2003
2. Postharvest Technology of Fruits & Vegetables by Verma & Joshi 2000. Indus publications, New Delhi
3. Yahia, Elhadi M., and Armando Carrillo-Lopez, eds. Postharvest physiology and biochemistry of fruits and vegetables. Woodhead publishing, 2018.
4. An introduction to Postharvest Technology by RBH Wills. 2003
5. Preservation of fruits & Vegetables by Siddappa etal 1999. ICAR, New Delhi
6. Preservation of Fruits& Vegetables by Srivastava & Kumar, 1996. Intl. Book publishing Co. Lucknow
7. Handbook of Vegetables and Vegetable Processing by Y. H. Hui 2011. Wiley Blackwell
8. Handbook of Fruits and Fruit Processing by Y. H. Hui 2006. Wiley Blackwell

FT23203CR

Technology of Meat, Fish & Poultry (4+0+0)

Course Description:

The "Technology of Meat, Fish & Poultry" course at the master's level provides a comprehensive understanding of the meat, fish, and poultry industry, with a special focus on the context of Jammu and Kashmir (J&K). This course explores the sources, composition, and nutritive value of meat, covering topics such as ante-mortem handling, slaughterhouse operations, and meat inspection. Additionally, it delves into the structure and functions of muscle, postmortem changes, and factors affecting meat quality. The course also covers poultry and egg processing, as well as fish composition, preservation, and processing techniques. Students will gain insights into traditional meat products and modern preservation methods.

UNIT-I

- Scope of meat industry with special reference to J&K
- Sources, composition and nutritive value of meat.
- Ante-mortem handling and inspection of meat animals.
- Slaughtering and processing equipment: Plant location and facilities; stunning methods; sticking/bleeding; dressing methods; offal inspection and processing.
- Structure and functions of muscle: Microstructure, contraction and relaxation mechanism, muscle metabolism.

Learning Outcomes:

By the end of this course, students should be able to:

- Understand the scope of the meat industry, particularly in the context of J&K.
- Analyze the sources, composition, and nutritive value of meat.
- Demonstrate knowledge of ante-mortem handling and inspection of meat animals.
- Explain the processes and equipment used in slaughtering and meat processing, including stunning, sticking/bleeding, dressing, and offal inspection.
- Comprehend the microstructure, contraction, relaxation mechanism, and metabolism of muscle tissue.

UNIT-II

- Postmortem changes in muscle: Biochemical alterations, physical alterations-rigor mortis; shortening; unusual patterns of postmortem metabolism. Factors affecting post mortem changes in meat.
- Eating quality of meat: Colour, WHC, flavour, tenderness and texture. Meat quality evaluation.
- Meat tenderization and aging.
- Mechanical deboning
- Principles of various preservation techniques: Refrigeration, freezing, curing, smoking, canning, dehydration and irradiation of meat.
- Traditional meat products

Learning Outcomes:

By the end of this course, students should be able to:

- Analyze the postmortem changes in muscle, including biochemical and physical alterations such as rigor mortis and shortening.
- Evaluate factors influencing postmortem changes in meat.
- Assess meat quality, including color, water-holding capacity (WHC), flavor, tenderness, and texture.
- Understand meat tenderization and aging processes.
- Examine the concept of mechanical deboning.
- Discuss the principles of various meat preservation techniques, including refrigeration, freezing, curing, smoking, canning, dehydration, and irradiation.
- Explore traditional meat products.

UNIT-III

- Poultry slaughtering, carcass evaluation and cutting.
- By product utilization of poultry.
- Structure composition, nutritive value and functional properties of egg.
- Factors affecting egg quality
- Methods of preservation.

Learning Outcomes:

By the end of this course, students should be able to:

- Describe poultry slaughtering processes, carcass evaluation, and cutting techniques.
- Examine the byproduct utilization of poultry.
- Analyze the composition, structure, nutritive value, and functional properties of eggs.
- Identify factors that affect egg quality.
- Discuss methods of egg preservation.

UNIT-IV

- Composition and structure of fish.
- Post mortem changes in fish
- Preservation of fish by freezing, glazing, canning, smoking, freezing, irradiation and dehydration.
- Surmi- Chemistry, preparation and microbiology.
- Technology of production of fish products- fish sausage, fish meal and fish oil.

Learning Outcomes:

By the end of this course, students should be able to:

- Understand the composition and structure of fish.
- Analyze postmortem changes in fish.
- Explore various preservation methods for fish, including freezing, glazing, canning, smoking, freezing, irradiation, and dehydration.
- Examine surimi chemistry, preparation, and microbiology.
- Discuss the technology of producing fish products such as fish sausage, fish meal, and fish oil.

References:

1. Lawre. R. A. & Ledward, D. A. (2006). Lawres Meat Science 7th Ed. Woodhead Publishing Company, Cambridge, England.
2. Thornton's meat hygiene by J. F. Gracey. Bailliere Tindall, 7th edn,1982
3. Aberle, Elton D.., Forrest, John C.., Gerrard, David E.., Mills, Edward W.. Principles of Meat Science. United States: Kendall Hunt Publishing Company, 2020.

4. Lawrie, R. A.. Meat Science. United Kingdom: Elsevier Science, 2013..
5. Pearson, A.M.., Gillett, T.A.. Processed Meats. Netherlands: Springer, 1996..
6. Hall, G. M.. Fish Processing Technology. United Kingdom: Springer US, 2012.
7. Fish Processing Technology by GopalkumarK,New Delhi Indian Council of Agricultural Research 2006.

FT23204CR

Skill development in Fruits and Vegetables (Practical) (0+0+2)

Course Description:

This practical course is designed to provide hands-on experience and develop skills in various aspects of handling, processing, and preserving fruits and vegetables. Students will gain knowledge in quality evaluation, canning, dehydration, preparation and preservation of various fruit and vegetable products, and analysis techniques. Through a combination of practical exercises and laboratory work, students will acquire the skills necessary for the efficient handling and processing of fruits and vegetables.

1. Quality evaluation of fruits and vegetables (color, TSS, acidity, texture etc)
2. Canning of fruits & vegetables.
3. Testing of can, cut out analysis.
4. Preparation and analysis of syrups and Brines.
5. Experimental dehydration of fruits and vegetables (Dehydration and rehydration ratio) using solar drier, vacuum assisted microwave drier, cabinet drier.
6. Preparation and preservation of juices.
7. Preparation and preservation of squashes and RTS.
8. Preparation and preservation of Jam, Jellies and marmalades.
9. Preparation and preservation of pickle and vinegar.
10. Preparation of tomato ketchup and sauce.

Learning outcomes:

Upon completion of the unit the student should be able to:

- Evaluate the quality of fruits and vegetables based on attributes such as color, Total Soluble Solids (TSS), acidity, and texture.
- Demonstrate the complete canning process for fruits and vegetables, including preparation, sealing, and sterilization.
- Conduct tests on canned products, including can inspection and cut-out analysis, to ensure quality and safety.
- Prepare and analyze syrups and brines for fruit and vegetable preservation.

- Perform experimental dehydration of fruits and vegetables, calculating dehydration and rehydration ratios using various drying methods such as solar drying, vacuum-assisted microwave drying, and cabinet drying.
- Create and preserve juices, squashes, and Ready-to-Serve (RTS) beverages.
- Develop and preserve a variety of products, including jams, jellies, marmalades, pickles, vinegar, and tomato ketchup and sauce, following recommended preservation techniques and safety measures.

References:

1. Ranganna, S.. Hand Book of Analysis And Quality Control For Fruit And Vegetable Products. India: Tata McGraw-Hill Publishing Company Limited, 2005.
2. Preservation of fruits & Vegetables by Siddappa etal 1999. ICAR, New Delhi.
3. Manual of AOAC, 1990.

FT23205DCE

Skill development in Meat technology (Practical) (0+0+2)

Course Description:

This practical course is designed to provide students with hands-on experience and practical skills in meat technology. Students will learn about the entire meat processing chain, from slaughtering and dressing of meat animals to the preparation and preservation of various meat and fish products. They will also gain expertise in evaluating the quality and freshness of meat and fish. Through a combination of practical exercises and laboratory work, students will acquire the skills necessary for meat and fish processing and preservation.

1. To study slaughtering and dressing of meat animals.
2. Study of post-mortem changes.
3. Meat cutting and handling.
4. Preparation of various meat products such as: Meat pickle & cured meat
5. Preparation and evaluation of traditional meat products.
6. Slaughtering of poultry.
7. Determination of meat to bone ratio in Chicken.
8. To evaluate freshness of fish.
9. To determine meat to bone ratio of fish.
10. Dressing of fish and calculation of dressing percentage.
11. Preparation of fish products such as fish cutlets, pickle, curry, tandoori fish.
12. Experiments in dehydration, freezing, canning, smoking and pickling of fish and meat.
13. Preservation of eggs.

Learning outcomes:

Upon completion of the unit the student should be able to:

- Demonstrate proficiency in the entire meat processing chain, including slaughtering, dressing, and cutting of meat animals.
- Understand and analyze post-mortem changes in meat to ensure product quality and safety.
- Master the preparation of a diverse range of meat products, including meat pickles, cured meats, and traditional meat products.

- Effectively evaluate the quality and freshness of both meat and fish through sensory and analytical techniques.
- Apply proper techniques for dressing poultry and calculating meat-to-bone ratios in both chicken and fish.
- Develop expertise in handling and processing fish, including dressing, calculation of dressing percentages, and creating various fish products.
- Explore a variety of preservation techniques, including dehydration, freezing, canning, smoking, and pickling, for both meat and fish products.

References:

1. Lawre. R. A. & Ledward, D. A. (2006). Lawres Meat Science 7th Ed. Woodhead Publishing Company, Cambridge, England.
2. Aberle, Elton D.., Forrest, John C.., Gerrard, David E.., Mills, Edward W.. Principles of Meat Science. United States: Kendall Hunt Publishing Company, 2020
3. Lawrie, R. A.. Meat Science. United Kingdom: Elsevier Science, 2013
4. Pearson, A.M.., Gillett, T.A.. Processed Meats. Netherlands: Springer, 1996..

FT23206DCE

PLANTATION CROPS & SPICES (2+0+0)

Course Description:

This course provides a comprehensive understanding of plantation crops and spices, their significance in the national economy, and their role in the export industry. Students will explore the chemical composition, processing methods, and various products derived from plantation crops such as tea, coffee, and cocoa. Additionally, they will delve into the world of spices, including their classification, quality specifications, and the processing of major and minor spices in India. Extractives of spices, such as oleoresins and essential oils, as well as simple seasoning blends, will also be covered.

UNIT –I

- **Plantation Crops:** Definition and role of plantation crops in national economy and export potential.
- **Tea:** Composition and processing of tea. Tea products such as tea concentrate, decaffeinated tea and flavoured tea. *Kashmiri kehwa.*
- **Coffee:** Chemical composition,processing, roasting and brewing of coffee. Coffee products such as decaffeinated coffee and instant coffee.
- **Cocoa:** Chemical composition, processing of cocoa and cocoa beverages.

Learning outcomes:

Upon completing Unit I, students will be able to:

- Define plantation crops and explain their significance in the national economy and export potential.
- Describe the composition and processing of tea, including the production of tea products like tea concentrate, decaffeinated tea, flavored tea, and Kashmiri kehwa.
- Explain the chemical composition of coffee and detail its processing, roasting, brewing techniques, along with the production of decaffeinated coffee and instant coffee.
- Understand the chemical composition and processing of cocoa and cocoa beverages.

UNIT II

- **Spices:** Definition, classification and functions.
- Quality specifications for spices.
- **Major & minor spices of India:** Chemical composition, processing, uses and special attributes of different spices like saffron, chillies, cumin, coriander, turmeric, fennel, fenugreek, pepper, cinnamon, cloves, ginger, mint and cardamom.
- **Extractives of spices:** oleoresins and essential oils. Simple seasoning blends.

Learning outcomes:

Upon completing Unit II, students will be able to:

- Define spices, classify them, and explain their functions.
- Identify quality specifications for spices.
- Analyze the chemical composition, processing methods, and uses of major and minor spices in India, including saffron, chillies, cumin, coriander, turmeric, fennel, fenugreek, pepper, cinnamon, cloves, ginger, mint, and cardamom.
- Describe the extraction processes for spice products like oleoresins and essential oils.
- Create simple seasoning blends using various spices.

References

- Chakraverty, A.; Mujumdar, A. S.; Raghavan, G. S. V.; Ramaswamy, H., 2003. Handbook of postharvest technology: cereals, fruits, vegetables, teas, and spices. Marcel Dekker Inc. New-York/Basel
- Purseglove, J. W. *et al* (1998). Spices 'Vol. I and II. Logman publishers.
- Peter, K. V. (2004). Handbook of Herbs and Spices Vol. I and II. Woodhead Publishing Limited, Cambridge, England.
- Raghavan, S. (2007). Handbook of Spices, Seasonings and Flavourings. CRC Press (Taylor and Francis Group).
- Voilley, A. &Etivant, P. (2003). Flavour in Food. Woodhead Publishing Limited, Cambridge, England.
- Ho, C-T., Lin, J-K., & Shahidi, F. (2009). Tea and Tea products. CRC Press (Taylor and Francis Group).

FT23207DCE

Statistics and Computer Applications (2+0+0)

Course Description:

This course introduces students to the fundamental concepts of statistics and its practical application using statistical software tools. In Unit I, students will learn about sampling techniques, measures of dispersion, correlation, regression, hypothesis testing, and analysis of variance. Unit II will provide an introduction to statistical software such as R, SPSS, Mini-tab, and MS Excel, enabling students to analyze data and draw meaningful conclusions using these tools.

Unit I

- Sampling: Steps and techniques, size of sample. Sampling and non- sampling errors.
- Measures of dispersion: Quartile deviation, Mean Deviation, Standard deviation,
- Correlation and regression
- Testing of hypothesis: Chi- square, t-test and F- test
- Analysis of variance: Concept and assumptions, Computation of one way and two way analysis of Variance

Learning outcomes:

By the end of this unit, the student should be able to:

- Understand the steps and techniques involved in sampling, including sample size determination.
- Identify and differentiate between sampling and non-sampling errors.
- Calculate and interpret measures of dispersion, including quartile deviation, mean deviation, and standard deviation.
- Analyze and interpret correlation and regression relationships between variables.
- Apply hypothesis testing techniques, including Chi-square, t-test, and F-test.
- Grasp the concept and assumptions behind analysis of variance and perform computations for one-way and two-way analysis of variance.

Unit – II

- Introduction to statistical software
- R software
- SPSS and Mini-tab

- MS Excel

Learning outcomes:

Upon completing Unit II, students will be able to:

- Gain an introduction to statistical software and its relevance in data analysis.
- Utilize R software for statistical data analysis, including data manipulation and visualization.
- Familiarize themselves with SPSS and Mini-tab for performing various statistical analyses.
- Master the use of MS Excel as a versatile tool for data analysis, visualization, and hypothesis testing.

References

1.Gupta, S. C. Fundamentals of Statistics. India: HIMALAYA Publishing House, 2013.

2. Mann, Prem S.., Lacke, Christopher Jay. Introductory Statistics. United Kingdom: Wiley, 2010.

3. Gupta, S. P.. Statistical Methods. India: Sultan Chand & Sons, 2011.

4. Hays, William Lee. Statistics. United Kingdom: Harcourt Brace College Publishers, 1994.

FT23208DCE

Recent Developments in Food Science and Technology (2+0+0)

Course Description:

This course explores the latest advancements in food science and technology, focusing on innovative techniques, emerging trends, and their impact on the food industry. In Unit I, students will delve into micro and nano encapsulation techniques for retaining and controlling the release of bioactive compounds, nanotechnology applications in food processing and packaging, the concept of nano sensors, and the role of artificial intelligence in food science. In Unit II, the course will cover alternative proteins for meat, dairy, and egg products, the production and processing of cultured meat, 3D food printing, personalized nutrition, and the crucial topic of food sustainability.

Unit I

- Micro and nano encapsulation techniques for retention and controlled release of bioactive compounds like Microfluidization, electrospinning, Spray drying, extrusion, Coacervation, freeze drying, wet milling and emulsification.
- Nanotechnology applications in food processing and packaging.
- Concept of nano sensors.
- Artificial intelligence in food science.

Learning outcomes:

Upon completing Unit I, students will be able to:

- Understand and apply various micro and nano encapsulation techniques, including Microfluidization, electrospinning, Spray drying, extrusion, Coacervation, freeze drying, wet milling, and emulsification, for the retention and controlled release of bioactive compounds.
- Explore the applications of nanotechnology in food processing and packaging.
- Comprehend the concept of nanosensors and their role in food science.
- Evaluate the impact and utilization of artificial intelligence in food science, from product development to quality control.

Unit II

- Alternate proteins for Meat, dairy and egg.
- Production and processing of cultured meat.
- 3D food printing and personalized nutrition.
- Food sustainability

Learning outcomes:

Upon completing Unit II, students will be able to:

- Analyze the use of alternative proteins in the context of meat, dairy, and egg products, considering their nutritional, environmental, and ethical implications.
- Understand the production and processing methods involved in cultured meat production.
- Explore the technology and applications of 3D food printing, including its role in personalized nutrition.
- Discuss the principles of food sustainability and its importance in modern food systems.

References

1.Handbook of Food Preservation, Second Edition. India: Taylor & Francis, 2007.

2. Alternative Proteins: Safety and Food Security Considerations. United States: CRC Press, 2022.

FT23002GE

Encapsulation Technology in Food Systems (2+0+0)

Course Description:

This course delves into the intricate field of encapsulation technology within food systems. It explores the requirements for effective encapsulation systems and the selection of appropriate wall materials for microencapsulation of bioactive compounds, flavors, and probiotics. In Unit I, students will learn various micro and nano encapsulation techniques, including Liposomes, Microfluidization, electrospinning, Spray drying, extrusion, Coacervation, freeze drying, wet milling, and emulsification. The course also addresses release kinetics of bioactive compounds. In Unit II, students gain insights into industry perspectives on the advantages and disadvantages of different bioactive and flavor delivery systems, as well as properties and applications of various probiotic delivery systems.

UNIT 1

- Requirements for encapsulation systems
- Wall materials used for microencapsulation of bioactive compounds, flavors and probiotics
- Micro and nano encapsulation techniques of bioactive compounds, flavors and probiotics like Liposomes, Microfluidization, electrospinning, Spray drying, extrusion, Coacervation, freeze drying, wet milling and emulsification.
- Release kinetics of bioactive compounds

Learning outcomes:

Upon completing Unit I, students will be able to:

- Identify and explain the essential requirements for effective encapsulation systems.
- Recognize and select appropriate wall materials for the microencapsulation of bioactive compounds, flavors, and probiotics.
- Understand and apply various micro and nano encapsulation techniques, including Liposomes, Microfluidization, electrospinning, Spray drying, extrusion, Coacervation, freeze drying, wet milling, and emulsification.
- Analyze release kinetics to predict the controlled release of bioactive compounds.

UNIT II

- An industry perspective on the advantages and disadvantages of different bioactive delivery systems
- An industry perspective on the advantages and disadvantages of different flavor delivery systems
- Properties and applications of different probiotic delivery systems

Learning outcomes:

Upon completing Unit II, students will be able to:

- Assess the advantages and disadvantages of different bioactive delivery systems from an industry perspective.
- Evaluate the pros and cons of various flavor delivery systems in the context of the food industry.
- Describe the properties and applications of different probiotic delivery systems and their relevance in food products.

References

1. Garti, N., McClements, D.J., 2012. Encapsulation Technologies and Delivery Systems for Food Ingredients and Nutraceuticals. Elsevier Science.
2. Handbook of Food Preservation, Second Edition. India: Taylor & Francis, 2007

FT23002OE

Functional Foods for Human Health (2+0+0)

Course Description:

This course explores the fascinating world of functional foods and their impact on human health. In Unit I, students will gain an understanding of phytochemicals and antioxidants, including their introduction and their role in combating free radicals and oxidative stress. The course will also cover the biosynthesis pathways of common phytochemicals and delve into the chemistry, sources, and health benefits of compounds such as flavonoids, carotenoids, ascorbic acid, lycopene, and capsaicinoids. In Unit II, students will explore the therapeutic effects of specific functional foods, including garlic, tea, soybean, and olives, as well as their composition and associated health benefits.

Unit – I

- Phytochemicals and Antioxidants – Introduction
- Free radicals and oxidative stress
- Biosynthesis of common phytochemicals-Shikmic acid and mavalonic acid pathway
- Chemistry, sources and health benefits - Flavonoids, Carotenoids, Ascorbic acid, Lycopene, Capsaicinoids

Learning outcomes:

Upon completing Unit I, students will be able to:

- Define and explain the concept of phytochemicals and antioxidants.
- Understand the role of free radicals and oxidative stress in human health.
- Examine the biosynthesis pathways of common phytochemicals, including the Shikmic acid and mevalonic acid pathways.
- Identify, describe, and discuss the chemistry, sources, and health benefits of important phytochemicals, such as flavonoids, carotenoids, ascorbic acid, lycopene, and capsaicinoids.

Unit – II

- Garlic-composition and its therapeutic effects.
- Tea and its health benefits.
- Soybean as a functional food.

- Health benefits of olives

Learning outcomes:

Upon completing Unit II, students will be able to:

- Analyze the composition of garlic and evaluate its therapeutic effects on human health.
- Assess the health benefits of tea and its components in promoting well-being.
- Examine the nutritional profile of soybean and its role as a functional food.
- Evaluate the health benefits associated with olives and olive-derived products.

References

1. Goldberg, I.. Functional Foods: Designer Foods, Pharmafoods, Nutraceuticals. United States: Springer US, 2012.
2. Handbook of Nutraceuticals and Functional Foods. United Kingdom: CRC Press, 2019.
3. Functional Foods: Biochemical and Processing Aspects byJohn Shi, G. Mazza, Marc Le Maguer, CRC Press,2006.
4. Lockwood, Brian. Nutraceuticals: A Guide for Healthcare Professionals. United Kingdom: Pharmaceutical Press, 2007.
5. Postharvest Physiology and Biochemistry of Fruits and Vegetables. United Kingdom: Elsevier Science, 2018.

Assessment and Grading:

Assessment in this course will be multifaceted and may include the following components:

Examinations: Regular quizzes, mid-term exams, and a comprehensive final exam will assess your understanding of course materials.

Assignments: Homework assignments, research papers, or case studies will be assigned to reinforce theoretical knowledge and analytical skills.

Class Participation: Active engagement in class discussions, presentations, and group activities will be considered in the evaluation.

Grading Criteria (Note: These percentages are subject to adjustment based on the course structure):

Examinations: 80%

Class Participation: 5%

Assignments: 10%

Attendance: 5%

Feedback and Assessment Criteria:

- Constructive feedback will be provided on assignments and exams to help you understand your performance and areas for improvement.
- Clear assessment criteria, rubrics, and expectations will be provided at the beginning of the course to guide your work.
- Please feel free to seek clarification on grading and assessment-related questions throughout the course.
- Students with special needs may contact the concerned teacher before hand.

FT23116CR

Semester III

Cereal, Pulses and Oil seed Technology (4+0+0)

Course Description:

This course provides an in-depth understanding of the structure, chemical composition, processing qualities, and technological significance of cereals, pulses, and oilseeds. Students will explore various aspects of grain and oilseed processing, including milling, oil extraction, refining, and the production of value-added products. Additionally, the course covers the importance of these food sources in the Indian diet and their nutritional significance.

Unit I

- Structure, chemical composition and types of wheat grain and its relation to processing qualities, Enzymes of wheat and their technological significance.
- Wheat milling – principle, conditioning, and milling systems. Flour streams, extraction rates and their composition.
- Dough rheology and dough testing apparatus such as recording dough mixers, load extension meter.
- Bread making processes. Soft and hard wheat products: types, chemistry, and functionality of ingredients.

Learning outcomes:

- Understand the structure and chemical composition of wheat grain and its relation to processing qualities.
- Explain the role of enzymes in wheat and their technological significance.
- Describe the principles of wheat milling, including conditioning and milling systems.
- Analyze flour streams, extraction rates, and their composition.
- Evaluate dough rheology and use dough testing apparatus such as recording dough mixers and load extension meters.
- Demonstrate an understanding of bread making processes.
- Differentiate between soft and hard wheat products, including types, chemistry, and ingredient functionality.

Unit II

- Rice grain structure and chemistry

- Milling of rice – types of rice mill. Factors affecting rice yieldduring milling. By-products of rice milling and their utilization. Cooking quality of rice.
- Parboiling rice – traditional method and their drawbacks. CFTRI process of parboiling. Properties of parboiled rice. Changes during parboiling. Advantages and disadvantages of parboiling.
- Rice convenience foods – precooked rice, canned rice, expanded rice, rice based infant food formulas, rice puddings and breads, rice cakes, rice noodles and fermented foods.

Learning outcomes:

- Examine the structure and chemistry of rice grain.
- Discuss the types of rice mills and factors affecting rice yield during milling.
- Identify by-products of rice milling and their utilization.
- Evaluate the cooking quality of rice.
- Compare traditional and CFTRI methods of parboiling rice, understanding properties and changes during parboiling.
- Assess the advantages and disadvantages of parboiling.
- Explore the production of rice convenience foods such as precooked rice, canned rice, expanded rice, and rice-based infant food formulas.

Unit III

- Corn: Composition and structure, wet and dry milling of corn, Corn products.
- Oats: Composition, structure, milling and nutritional significance of oats. Oat products
- Barley: Composition, structure and milling of barley. Malting of barley.
- Millets: Nutritional significance and processing potential of some common millets such as Foxtail, Proso, Kodo, & pearl millet.

Learning outcomes:

- Analyse the composition and structure of corn and its wet and dry milling processes.
- Describe corn products.
- Investigate the composition, structure, milling, and nutritional significance of oats and oat products.
- Examine the composition, structure, milling, and malting of barley.
- Evaluate the nutritional significance and processing potential of common millets like Foxtail, Proso, Kodo, and pearl millet.

Unit IV

- Types of oil seeds and their chemical composition.
- Oil extraction – Mechanical and solvent extraction and refining.
- Processing of oil seeds for protein concentrates and isolates.
- Margarine manufacturing processing and its uses.
- Structure and composition of pulses, their importance in Indian diet. Dhal milling and processing of pulses.

Learning outcomes:

- Identify various types of oilseeds and their chemical composition.
- Explain the principles of oil extraction, including mechanical and solvent extraction, and refining.
- Explore the processing of oilseeds for protein concentrates and isolates.
- Understand margarine manufacturing processes and its uses.
- Describe the structure and composition of pulses, emphasizing their importance in the Indian diet.
- Discuss the milling and processing of pulses for various food applications.

References:

1. Pomeranz, Y. (1998). *Wheat: Chemistry and Technology*, Vol. I 3rd Ed., American Association of Cereal Chemists, St. Paul, MN, USA.
2. Juliano, B. O. (1985). *Rice Chemistry and Technology*, American Association of Cereal Chemists, St. Paul, MN, USA.
3. Samuel, A.M. (1996). *The Chemistry and Technology of Cereal as Food and Feed*. CBS Publishers & Distribution, New Delhi.
4. Dandy, D. A. V &Dobraszczyk, B. J. (2001) Cereal and Cereal Products: Chemistry abd Technology, Aspen Publishers.
5. Kent, N. L. & Evers, A. D. (1994) Kent's Technology of cereals 4th Ed. Elsevier science Ltd. Oxford, U. K.

FT23117CR

Nutraceuticals and Toxicology (4+0+0)

Course Description:

This course delves into the fascinating intersection of nutraceuticals and toxicology. Students will explore the world of nutraceutical factors, their classification, sources, and mechanisms of action, along with their specific roles in various foods. Additionally, the course covers essential concepts in toxicology, including dose-response relationships, phases of toxicological effects, toxicity testing methods, and the manifestation of organ toxicity. Students will also gain insights into various toxins, antinutrients in plant foods, contaminants introduced during processing, and the impact of heavy metals and pesticides on food safety.

Unit – I

- Introduction - Definition, Classification of nutraceutical factors- Food and non food sources, mechanism of action, nutraceutical factors in specific foodsand chemical nature.
- Dietary fibre – Types, Physical and physiological properties of dietary fiber Hypocholesterolemic, hypolilpidemic and hypoglycemic effects. Role in prevention of CHD and cancer.
- Probiotics&Prebiotics –Specific and non specific physiological effects of probiotics. Different types of prebiotics and their chemical nature**.** Concept of synbiotics.
- Oxidative stress- Free radicals and Reactive Oxygen Species and types.
- Antioxidants – role and types.

Learning outcomes:

Define nutraceuticals and classify them based on food and non-food sources.

- Explain the mechanisms of action of nutraceutical factors and their chemical nature.
- Analyze the presence of nutraceutical factors in specific foods.
- Describe dietary fiber, its types, and its physical and physiological properties.
- Evaluate the hypocholesterolemic, hypolipidemic, and hypoglycemic effects of dietary fiber.
- Discuss the role of dietary fiber in the prevention of Coronary Heart Disease (CHD) and cancer.
- Explore the physiological effects of probiotics and prebiotics, including synbiotics.
- Define oxidative stress, free radicals, Reactive Oxygen Species (ROS), and their types.
- Discuss the role and types of antioxidants in combating oxidative stress.

Unit – II

- Fatty acid as functional food- Nomenclature of Mono and poly-unsaturated fatty acids.
- Eicosanoid metabolism of fatty acids and its implications in human health
- Omega 3 fatty acids- insulin resistance and Lipoprotein Metabolism
- Biosynthesis of common phytochemicals- Shikmic acid and mavalonic acid pathway.
- Bio synthesis of phenylpropanoids.

Learning outcomes:

- Name mono and polyunsaturated fatty acids and their nomenclature.
- Explain eicosanoid metabolism of fatty acids and its implications for human health.
- Explore the role of Omega-3 fatty acids in insulin resistance and lipoprotein metabolism.
- Describe the biosynthesis of common phytochemicals through the Shikmic acid and mevalonic acid pathways.
- Explain the biosynthesis of phenylpropanoids.

Unit – III

- Basic concepts of toxicology- dose response relationship - frequency response.
- Phases of Toxicological Effects- Exposure Phase, Toxicokinetic Phase, Toxicodynamic Phase
- Toxicity testing- Toxicological testing methods
- Manifestation of organ toxicity.
- Biotransformation reactions- Phase I and Phase II reactions

Learning outcomes:

- Define basic toxicological concepts, including dose-response relationships and frequency response.
- Identify and describe the phases of toxicological effects: Exposure Phase, Toxicokinetic Phase, and Toxicodynamic Phase.
- Analyze the methods used in toxicity testing.
- Discuss the manifestation of organ toxicity.
- Explain biotransformation reactions, including Phase I and Phase II reactions.

Unit -IV

- Animal Toxins: mode of action & clinical symptoms- Scombroid Poisoning, Saxitoxin, Pyropheophorbide-A, Tetrodotoxin, Ciguatoxin
- Toxicants and antinutrients in Plants foods.
- Toxins produced during processing.
- Pesticides and drug residues
- Heavy Metals – Mercury, Lead, Cadmium, Arsenic, selenium.

Learning outcomes:

- Explain the mode of action and clinical symptoms associated with animal toxins, including Scombroid Poisoning, Saxitoxin, Pyropheophorbide-A, Tetrodotoxin, and Ciguatoxin.
- Identify toxins and antinutrients present in plant foods.
- Discuss the production of toxins during food processing.
- Evaluate the presence of pesticides and drug residues in food.
- Analyze the impact of heavy metals, including Mercury, Lead, Cadmium, Arsenic, and Selenium, on food safety.

References

1. Goldberg, I.. Functional Foods: Designer Foods, Pharmafoods, Nutraceuticals. United States: Springer US, 2012.
2. Handbook of Nutraceuticals and Functional Foods. United Statesby Wildman: Taylor & Francis, 2016.
3. Functional Foods: Biochemical and Processing Aspects byJohn Shi, G. Mazza, Marc Le Maguer, CRC Press 2006.
4. Lockwood, Brian. Nutraceuticals: A Guide for Healthcare Professionals. United Kingdom: Pharmaceutical Press, 2007.
5. Postharvest Physiology and Biochemistry of Fruits and Vegetables.Postharvest Physiology and Biochemistry of Fruits and Vegetablesby Elhadi M. Yahia. United Kingdom: Elsevier Science, 2018.
6. Deshpande, S.S.. Handbook of Food Toxicology. United States: Taylor & Francis, 2002.
7. Maga.Food Additive Toxicology. Hong Kong: Taylor & Francis, 1995.
8. Food Toxicologyby Carl K.Winter. United States: CRC Press, 2000.

9. Omaye, Stanley T.. Food and Nutritional Toxicology. United States: CRC Press, 2004.

FT23118CR

Dairy Technology (4+0+0)

Course Description:

This course provides a comprehensive overview of dairy technology, covering all aspects of milk production, processing, and the manufacture of various dairy products. Students will explore the scope of the dairy industry in India, milk composition, processing techniques, and the production of items such as cheese, ice cream, and traditional Indian dairy products. Additionally, the course examines the impact of processing on milk components and nutritional value, as well as quality standards for dairy products.

Unit – I

- Scope of dairy industry in India. Importance & sources of milk.
- Composition of milk, Factors affecting composition of milk.
- Structure and Chemistry of Milk-Milk fat, proteins, enzymes, lactose

Learning outcomes:

- Understand the scope and importance of the dairy industry in India.
- Identify sources of milk and its significance in the human diet.
- Analyze the composition of milk and the factors that affect its composition.
- Describe the structure and chemistry of milk components, including milk fat, proteins, enzymes, and lactose.

Unit – II

- Storage, transportation and distribution of milk.
- Processing of market milk- standardization, toning of milk, homogenization. Pasteurization and sterilization.
- Milk products - Processing of cream, butter, butter oil, condensed milk, evaporated milk, whole and skimmed milk.
- Acidified milk products: Yogurt, Kefir, butter milk, sour milk.
- Effect of processing on milk components and nutritive value.

Learning outcomes:

- Explain the principles of milk storage, transportation, and distribution.
- Describe the processing of market milk, including standardization, toning, homogenization, pasteurization, and sterilization.

- Explore the production processes for milk products such as cream, butter, butter oil, condensed milk, evaporated milk, whole milk, and skimmed milk.
- Discuss the production and processing of acidified milk products like yogurt, kefir, buttermilk, and sour milk.
- Evaluate the effects of processing on milk components and the nutritive value of dairy products.

Unit – III

- Cheese: Classification and technology of cheese manufacturing. Packaging of cheese.
- Production of Ice creams & its quality control.
- Instantization of milk. Milk powder

Learning outcomes

- Classify cheese and understand the technology involved in cheese manufacturing.
- Discuss the packaging of cheese products.
- Explore the production of ice cream and methods for quality control.
- Explain the instantization process of milk and the production of milk powder.

Unit – IV

- Traditional dairy products of India: Paneer, Srikhand, Rabri, Kulfi, chhana, Lassi.
- Bioactive peptides derived from milk proteins.
- In plant cleaning system.
- Quality standards of milk and milk products.

Learning outcomes:

- Identify and describe traditional dairy products of India, including paneer, srikhand, rabri, kulfi, chhana, and lassi.
- Examine bioactive peptides derived from milk proteins.
- Understand the in-plant cleaning system in dairy processing.
- Familiarize with quality standards and regulations for milk and milk products.

References:

1. Technology of Dairy Products. Germanyby Early. R. : Springer, 1998.

2. De, Sukumar. Outlines of Dairy Technology. India: Oxford University Press, 1991.
3. Chemistry and Testing of Dairy Products by Athestem.

FT23119CR

Course Description:

This practical course focuses on skill development in the processing and evaluation of cereal grains and cereal-based products. Through hands-on experiences and laboratory work, students will learn various physico-chemical testing methods, milling techniques, quality assessment of flours, parboiling processes, rheological properties of dough, starch pasting properties, baking procedures, extrusion cooking, solvent extraction of oilseeds, and oil quality evaluation. Additionally, students will have the opportunity to visit wheat and rice processing plants and engage in activities related to yeast activity and protein isolates from legumes.

Skill Development in Cereal and Cereal Products (Practical)(0+0+2)

- Physico-chemical testing of wheat and rice.
- Experimental milling of wheat and rice. Assessment of per cent of head rice, broken, immature kernels and degree of polish in rice.
- Determination of quality characteristics of flours.
- Experimental parboiling and evaluation of quality of parboiled rice.
- Evaluation of cooking quality of rice.
- Rheological properties of dough using Farinograph/ Extensograph/Mixograph.
- Pasting properties of starches using Visco-amylograph/RVA.
- Experimental baking of bread, cake and biscuit and their evaluation,
- Experimental extrusion cooking and quality evaluation of extrudates.
- Solvent extraction of oil seeds.
- Quality evaluation of oils.
- Visit to wheat and rice processing plants.
- Determination of yeast activity
- Preparation of protein isolates from legumes and evaluation of cooking quality of legumes.

Learning outcomes

- Perform physico-chemical testing of wheat and rice grains, assessing key attributes.
- Execute experimental milling of wheat and rice grains and assess milled rice quality.

- Determine the quality characteristics of flours derived from cereal grains.
- Perform experimental parboiling of rice and evaluate parboiled rice quality.
- Evaluate the cooking quality of rice, considering factors such as texture and taste.
- Analyze rheological properties of dough using instruments like Farinograph, Extensograph, or Mixograph.
- Assess pasting properties of starches using instruments like Visco-amylograph or RVA.
- Participate in experimental baking of bread, cake, and biscuits, and evaluate product quality.
- Engage in experimental extrusion cooking and assess the quality of extrudates.
- Conduct solvent extraction of oilseeds and evaluate the quality of extracted oils.
- Visit wheat and rice processing plants to gain practical industry insights.
- Determine yeast activity in food processing.
- Prepare protein isolates from legumes and evaluate the cooking quality of legumes.

References:

1. Cauvain, Stanley P.., Young, Linda S.. Baked Products: Science, Technology and Practice. Germany: Wiley, 2008.
2. Bakery Technology & Engineering by Samueal A. Matz.
3. Manual of American Assocation of Cereal Chemists

FT23120DCE

Course Description:

This practical course focuses on developing hands-on skills and expertise in various aspects of dairy technology. Students will gain practical experience in the quantitative estimation of milk constituents, testing for milk quality, detecting adulterants and preservatives, and visiting local milk processing plants. Additionally, students will learn the art of preparing common milk products, including flavored milks, yogurt, butter, and ice cream.

Skill Development in Dairy Technology (Practical) (0+0+2)

- Quantitative estimation of milk constituents such as moisture, total solids, fat.
- Determination of acidity of milk.
- Determination of specific gravity of milk.
- Platform tests on given samples of milk.
- Determination of adulterants in milk, ghee, butter, ice cream etc.
- Detection of preservatives in milk.
- COB test.
- Visit to local milk processing plant.
- Preparation of common milk products
    - Flavoured milks.
    - Yoghurt.
    - Butter.
    - Ice-cream.

Learning outcomes

- Quantitatively estimate milk constituents such as moisture, total solids, and fat.
- Determine the acidity of milk.
- Determine the specific gravity of milk.
- Conduct platform tests on given samples of milk.
- Determine adulterants in milk, ghee, butter, ice cream, etc.
- Detect preservatives in milk.
- Perform the Chloroform-Butanol (COB) test.
- Visit a local milk processing plant.

- Prepare common milk products, including flavored milks, yogurt, butter, and ice cream.

References:

1. De, Sukumar. Outlines of Dairy Technology. India: Oxford University Press, 1991
2. Chemistry and Testing of Dairy products by H.V. Atherton & J.A. Newlander
3. Spreer, Edgar. Milk and Dairy Product Technology. United Kingdom: CRC Press, 2017.
4. Dairy Chemistry by H.H. Sommer.

FT23121DCE

Human Nutrition (2+0+0)

Course Description:

The course "Human Nutrition" offers a comprehensive exploration of the fundamental principles of nutrition and their practical applications in promoting and maintaining human health. Through a two-semester format, students will delve into the intricate relationship between food, nutrition, and overall well-being. The course is divided into two units, each covering distinct aspects of nutrition.

Unit I

- Introduction to Human Nutrition: Food, Nutrition & Health.
- Nutrient requirements & recommendation
- Digestion & Absorption of Nutrients
- Methods of cooking.
- Enhancing nutritional quality of the Diet.
- Lifecycle nutrition
- Principles of meal planning
- Food-based dietary guidelines
- Nutrition for Adults, pregnancy, lactation, infancy, preschools, adolescents & elderly.

Learning outcomes:

- Gain an understanding of the key concepts of human nutrition, including the relationship between food, nutrition, and health.
- Explain the nutrient requirements and recommendations for various age groups and life stages.
- Understand the processes of digestion and absorption of nutrients within the human body.
- Explore different methods of cooking and their impact on nutrient retention.
- Identify strategies for enhancing the nutritional quality of diets.
- Analyze the principles of meal planning and their application in different life stages.

- Recognize the importance of food-based dietary guidelines in promoting health.
- Describe specific nutritional needs for adults, pregnancy, lactation, infancy, preschoolers, adolescents, and the elderly.

Unit II

- Clinical & therapeutic diets
- Diet in lifestyle disorders:- diabetes, CVD, Cancer.
- Diet in fever, burns & surgery
- Nutritional care in weighs manager.
- Special Nutrition.
- Food borne diseases (Introduction).
- Exercise & Sports Nutrition.
- Nutrition & infection

Learning outcomes

- Understand the principles and applications of clinical and therapeutic diets.
- Evaluate the role of diet in managing lifestyle disorders such as diabetes, cardiovascular diseases, and cancer.
- Describe dietary considerations in fever, burns, and post-surgery recovery.
- Demonstrate knowledge of nutritional care for weight management.
- Explain the concept of special nutrition for individuals with specific dietary requirements.
- Introduce the concept of foodborne diseases and their prevention.
- Analyze the principles of exercise and sports nutrition.
- Understand the relationship between nutrition and infection.

References:

1. Davidson, Sirstanley, Passmore, R. J. F. Brock, A. S. Trustwell, (1975). Human Nutrition and Dietitics 6th Edition, The English language book society and Churchill Living stone.
2. Swaminathan, (1985). Advanced Text Book on Foods & Nutrition 2nd Edition, Banglore Printing & Publishing Co. Ltd.
3. Mudambi Sumati R. & Rajagopal, M. V. (1995). Fundamentals of Food & Nutrition, 3rd Edition, New Age International (P) Limited, Publishers.

4. J. Mann, A. S. Trustwell, (2017). Essentials of Human Nutrition 5th Edition Oxford University Press.

FT23122DCE

Entrepreneurship and Project Development (2+0+0)

Course description

This course focuses on equipping students with the essential knowledge and skills required to become successful entrepreneurs and project developers. It encompasses two units that explore the concepts of entrepreneurship, project identification, feasibility analysis, and financial aspects of project development. Students will gain insights into the characteristics of successful entrepreneurs, the motivation behind entrepreneurship, and the challenges they face. Additionally, the course covers the practical aspects of starting and managing a small business, including project generation, market analysis, cost estimation, and financial analysis.

Unit I:

- Entrepreneurship–Concept and development. Characteristics and personal attributes of successful entrepreneurship.
- Entrepreneurial motivation. Functions and role of entrepreneurs. Problems faced by entrepreneurs and their remedies.
- Identification of project, generation and screening of project ideas. Classification of projects.
- Forms of ownership–Sole proprietorship, partnership, company and cooperative society.

Learning outcomes:

- Understand the concept of entrepreneurship and its development.
- Identify the characteristics and personal attributes of successful entrepreneurs.
- Explore entrepreneurial motivation and its role in business ventures.
- Recognize the functions and roles played by entrepreneurs in the business ecosystem.
- Analyze the common problems faced by entrepreneurs and propose remedies.
- Learn to identify viable project opportunities and screen project ideas.
- Classify projects based on various criteria.
- Differentiate between forms of ownership, including sole proprietorship, partnership, company, and cooperative society.

UNIT II:

- Steps for starting a small business, procedure and formalities for registration. Incentives and subsidies. Market and demand analysis–Demand forecasting
- Technical, management and economical analysis of projects
- Estimation of project cost–Objectives, components and basic of estimates. Working capital requirement and its estimates
- Sources of Finance–Short term and long terms sources. Techniques of financial analysis–Cash flow Estimates, Break-even analysis, payback period, average rate of return, Net Present Value and Internal rate of Return.

Learning outcomes:

- Describe the steps involved in starting a small business.
- Understand the procedures and formalities required for business registration.
- Explore incentives and subsidies available for small businesses.
- Learn techniques for market and demand analysis, including demand forecasting.
- Perform technical, management, and economic analyses of projects.
- Estimate project costs, including objectives, components, and basic estimation methods.
- Determine working capital requirements and estimate them effectively.
- Identify sources of finance for projects, including short-term and long-term sources.
- Apply financial analysis techniques such as cash flow estimates, break-even analysis, payback period, average rate of return, Net Present Value (NPV), and Internal Rate of Return (IRR) to evaluate project viability.

FT23005GE

FOOD SAFETY (1+1+0)

Course Description:

This course is designed to provide students with a comprehensive understanding of food safety principles and practices. It explores the importance of safe food, identifies various hazards in food, and examines the management and mitigation of these hazards. The course also covers topics related to food laws and regulations, including the Food Safety and Standards Act 2006, and provides insights into food labeling, nutrition claims, and emerging issues in food safety, such as zoonotic diseases and genetically modified foods.

Unit – I

- Definition of food safety and importance of safe food
- Hazards and types of hazards
- Physical and Chemical hazards- Sources harmful effects and management
- Naturally occurring toxicants in foods, Process induced food toxicants, Safety aspects of food additives
- Biological hazards, food borne illnesses
- Toxicants of fungal and bacterial origin
- Food adulteration, common food adulterants; Methods to detect food adulteration
- Food safety and Quality management system; HACCP

Learning outcomes:

- Define food safety and emphasize the significance of ensuring the safety of food.
- Identify different types of hazards that can compromise food safety.
- Explore physical and chemical hazards in food, including their sources, harmful effects, and management strategies.
- Discuss naturally occurring toxicants in foods, process-induced food toxicants, and the safety aspects of food additives.
- Examine biological hazards, including foodborne illnesses, and discuss toxicants of fungal and bacterial origin.
- Investigate food adulteration, common food adulterants, and methods for detecting food adulteration.

- Introduce the concept of food safety and quality management systems, including Hazard Analysis and Critical Control Points (HACCP).

Unit – II (Tutorial)

- Food Safety and Standards Act 2006 and regulation 2011.
- Registration and Licensing
- Packaging and labeling
- Nutrition and Health Claims
- Zoonotic diseases. Eg Bird flu, Swine flu
- Genetically modified food- safety aspects

Learning outcomes:

- Familiarize students with the Food Safety and Standards Act 2006 and its associated regulations in 2011.
- Explain the processes of registration and licensing for food businesses.
- Discuss packaging and labeling requirements for food products.
- Explore nutrition and health claims made on food packaging.
- Introduce the concept of zoonotic diseases and provide examples such as Bird flu and Swine flu.
- Examine the safety aspects related to genetically modified foods.

References:

1. Food Safety & standards Act 2006, Commercial law Publishers (India) Pvt. Ltd
2. Potter, Norman N.., Hotchkiss, Joseph H.. Food Science: Fifth Edition. United States: Springer US, 2012.
3. Schmidt, Ronald H.., Rodrick, Gary E.. Food Safety Handbook. Germany: Wiley, 2005.

FT23006OE

Starch Chemistry &Technology (2+0+0)

Course Description:

This course delves into the fascinating world of starch, a versatile carbohydrate found abundantly in nature, and its applications in various industries. It covers the fundamentals of starch chemistry, including its sources, classification, granular and molecular structure, and physio-chemical properties such as swelling, solubility, gelatinization, and retrogradation. The course also explores the production of starch from plant sources using wet and dry milling processes, the concept of resistant starch, and various methods for the modification of starch, including physical, chemical, and biological approaches.

Unit I

- Starch: Introduction, sources, classification.
- Structure of starch: Granular structure and molecular structure.
- Physio-chemical properties of starch: Swelling, solubility index, gelatinization and retrogradation of starch.
- Use of starch in food, pharmaceutical and textile industries.

Learning outcomes:

- Introduce the concept of starch, including its sources and classification.
- Describe the granular and molecular structure of starch.
- Explore the physio-chemical properties of starch, including swelling, solubility index, gelatinization, and retrogradation.
- Examine the diverse applications of starch in the food, pharmaceutical, and textile industries.

Unit II

- Production of starch: Production of starch from plant sources using
- Wet and Dry milling of starch.
- Resistant starch.
- Modification of starch: Physical, Chemical and Biological modification of starch.

Learning outcomes:

- Discuss the production of starch from plant sources, emphasizing wet and dry milling processes.

- Introduce the concept of resistant starch and its significance.
- Explore various methods for the modification of starch, including physical, chemical, and biological approaches.

References:

1. Pomeranz, Y. (1998). *Wheat: Chemistry and Technology*, Vol. I 3rd Ed., American Association of Cereal Chemists, St. Paul, MN, USA.
2. Juliano, B. O. (1985). *Rice Chemistry and Technology*, American Association of Cereal Chemists, St. Paul, MN, USA.
3. Samuel, A.M. (1996). *The Chemistry and Technology of Cereal as Food and Feed*. CBS Publishers & Distribution, New Delhi.
4. Dandy, D. A. V &Dobraszczyk, B. J. (2001) Cereal and Cereal Products: Chemistry abd Technology, Aspen Publishers.
5. Kent, N. L. & Evers, A. D. (1994) Kent's Technology of cereals 4th Ed. Elsevier science Ltd. Oxford, U. K.

Semester IV

FT23123CR

Project Work (0+0+14)

Project work is a fundamental component of the masters program, allowing students to apply their knowledge and skills to real-world challenges in the food industry. Through research projects, students have the opportunity to explore specific areas of interest within food science and technology. These projects encourage critical thinking, problem-solving, and innovation, and often lead to valuable contributions to the field.

FT23124DCE

Credit Seminar (2+0+0)

Credit seminars provide a platform for students to enhance their communication and presentation skills. They are required to present their research findings, insights, and ideas to their peers and faculty members. These seminars foster collaboration, discussion, and constructive feedback, contributing to the overall professional development of the students.

FT23125DCE

Industrial visit (0+0+6)

Industrial visits are an integral part of the program, offering students a firsthand look at the food industry's operations and practices. These visits provide a unique opportunity to connect theory with industry realities. Students gain insights into food processing facilities, quality control measures, and emerging technologies. They also have the chance to interact with industry professionals, expanding their network and understanding of career opportunities in the field.

Significance of Project Work, Credit Seminars, and Industrial Visits:

Application of Knowledge: Project work allows students to apply the theoretical knowledge gained during coursework to real-world problems, bridging the gap between academia and industry.

Communication Skills: Credit seminars hone students' presentation and communication skills, essential for sharing research findings and ideas effectively.

Industry Exposure: Industrial visits offer invaluable exposure to industry practices, helping students understand the complexities and challenges of the food industry.

Networking: Interactions with industry professionals during industrial visits and project collaborations create networking opportunities and enhance students' career prospects.

Professional Development: These components collectively contribute to the holistic professional development of students, preparing them to become competent and innovative food scientists and technologists.

FT23007GE

Bakery Science (1+1+0)

Course description

The course "Bakery Science" is designed as an elective for students with non-food science backgrounds who are interested in gaining knowledge and skills related to bakery and confectionery products. This course provides a comprehensive overview of the science and technology behind baking, including the structure of grains, milling processes, raw materials used in bakery products, and the basics of bread, cookie, biscuit, and cake manufacturing. Through lectures and tutorials, students will learn about the history of baking, the chemistry of wheat proteins, the use of enzymes in the baking industry, common bread faults, and the development of health-promoting bread varieties enriched with specific nutrients.

Unit I:

- Structure and morphology of grain; Classification of wheat
- Milling, aims and principle of milling, steps of milling, milling machinery
- Raw materials used in bakery and their role in the product: Flour, yeast, fat, sugar, baking powder, egg, salt etc.
- Dough rheology and its measurement
- Basics of bread making: Basic bread recipe, flour characteristics and improvement, steps in bread making process, Charley-wood bread making process.
- Manufacturing cookies, biscuits and cakes, icings and toppings

Learning outcomes:

- Understand the structure and morphology of grains, with a focus on wheat.
- Classify different types of wheat and recognize their characteristics.
- Explain the aims and principles of milling and describe the steps involved in the milling process.
- Identify and understand the role of various raw materials used in baking, including flour, yeast, fat, sugar, baking powder, egg, and salt.
- Explore the rheology of dough and learn methods for its measurement.

- Gain insights into the basics of bread making, including the bread-making process, flour characteristics, and improvement techniques.
- Examine the Charley-wood bread-making process.
- Learn the manufacturing processes for cookies, biscuits, cakes, as well as icings and toppings.

Unit II: (Tutorials)

- History of bakery and confectionary
- Wheat proteins- chemistry, properties and their role in baked products
- Enzymes used in baking industry
- Bread faults and their remedies
- Breads enriched with health promoting components- high fiber breads, omega-3-fatty acid enriched breads, composite breads.

Learning outcomes:

- Explore the history of bakery and confectionery, tracing the evolution of these industries.
- Study the chemistry and properties of wheat proteins and their significance in baked products.
- Understand the role of enzymes used in the baking industry, including their functions and applications.
- Identify common bread faults and learn remedies to address them.
- Examine the development of specialty bread varieties enriched with health-promoting components, such as high-fiber breads, omega-3 fatty acid-enriched breads, and composite breads.

References:

1. Wheat chemistry and technology, Volume-I by Y. Pomeranz.
2. Cereals and cereal products by D. A. V. Dendy and B. J. Dobraszczyk.
3. Cereal processing technology by G. Owens.

4. Baking science and technology: fundamentals and ingredients by E. J. Pyler and L. A. Gorton.
5. Bread Science: The Chemistry and Craft of Making Bread by Emily Buehler.

FT23008OE

Post Harvest Physiology of Fruits & Vegetables (2+0+0)

Course Description:

The course "Post Harvest Physiology of Fruits & Vegetables" is tailored for students with non-food science backgrounds who wish to gain a comprehensive understanding of the physiological processes and factors affecting the post-harvest quality and storage of fruits and vegetables. This course covers fundamental concepts related to plant cell structure, post-harvest physiology, fruit classification, maturity indices, and the role of ethylene in ripening. Students will also delve into the enzymes and compounds associated with textural changes, post-harvest disorders, the influence of minerals, storage atmospheres, and management strategies to reduce post-harvest losses.

Unit I

- Cell and its structure with special reference to plant cell.
- Introduction to post harvest physiology of fruits and vegetables.
- Classification of fruits based on post harvest considerations.
- Fruit maturity and ripening; Maturity indices.
- Ethylene biosynthesis, regulation and mode of action. Factors affecting ethylene production.
- Water loss during fruit storage, factors affecting water loss, control of water loss.

Learning outcomes:

- Understand the structure of plant cells and their relevance to post-harvest physiology.
- Explore the introductory concepts of post-harvest physiology concerning fruits and vegetables.
- Classify fruits based on post-harvest considerations and maturity indices.

- Examine the biosynthesis, regulation, and mode of action of ethylene, as well as factors influencing ethylene production.
- Analyze water loss during fruit storage, identify influencing factors, and explore methods to control water loss.

Unit II

- Cell wall associated enzymes: polygalactouranase, Rhamnogalactouranase, pectin methyl esterase, Beta- galactosidase etc. Their role in textural change
- Polyphenol oxidases, lipoxygenase.
- Post harvest disorders in fruits and vegetables; mealiness, chilling injury etc.
- Role of minerals in post harvest storage life of fruits and vegetables with special reference to Ca, Mg, Zn, Mo & Co.
- Storage atmospheres - CA Storage, MA Storage, Hypobaric Storage.
- Management of post harvest processes and its importance to reduce post harvest losses: temperature management, atmospheric control and genetic control.

Learning outcomes:

- Analyze the roles of cell wall-associated enzymes and enzymes like polyphenol oxidases and lipoxygenase in textural changes.
- Recognize and address post-harvest disorders in fruits and vegetables.
- Explain the importance of minerals in extending the storage life of fruits and vegetables, with a focus on specific elements.
- Evaluate different storage atmospheres and their suitability for various fruits and vegetables.
- Apply management strategies for post-harvest processes, including temperature and atmospheric control, to minimize post-harvest losses.

References:

1. Michael knee. *Fruit Quality and its Biological Basis*; (CRC press).
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