MANGALORE UNIVERSITY

B.Sc. Food Technology

Program Outcomes (POs)

At the end of the program, Food technology graduates will be able to:

1. Scientific Knowledge: Apply knowledge of science, mathematics, engineering, and technology to solve complex food processing and quality assurance problems.
2. Design and Development of Solutions: Design food processing and plan quality assurance strategies as per the specified requirement of regulatory bodies, health, society and environment.
3. Problem Analysis: Identify, formulate, rationalise, and analyse food processing problems reaching substantiated conclusions using the principles of food sciences and technology.
4. Modern tool usage: Create, select, and apply modern food processing and quality assurance techniques, resources and tools of relevance in food processing industries.
5. Environment and Sustainability: Learn the food science and technology in the context of societal and environmental sustainability.
6. Individual and teamwork: Function objectively as an individual and as a member in diverse teams.
7. Communications: Effectively document and communicate complex food technology activities with society at large.
8. Lifelong learning: Independently engage in learning the changes in food processing technology and consumer requirement.

Program Specific Outcomes (PSOs):

At the end of the program, Food Technology graduates will be able to:

- Define and have an overview on composition of various food materials, particularly lipids and protein composition which are applicable in the commercial field.
- Classify carbohydrates, vitamins and flavours and understand their importance in food products.
- Apply the knowledge of minerals and various natural food pigments at the industrial level and application of browning reactions in food products.
- Apply food processing technology skills of planning and processing for assessing and analysing food in a sustainable manner.
- Apply knowledge of principles and techniques of food processing and quality assurance for higher studies.
- Build their own products in innovative ways and increase their production area.
- Have a clear idea about the various changes that occurs during food development and use of enzyme technology in food production.
- Apply skills of food science and technology for research, development, and entrepreneurship.

MANGALORE UNIVERSITY

Scheme and Syllabus for B.Sc. (Food Technology) 2024-25 onwards

Title of the Course	Instruction Hours / week	Duration of Exam (Hours)	Marks			Credits
			IA	Exam	Total	
SEMESTER I						
Food and Nutrition	4	3	20	80	100	3
Principles of Food Science	4	3	20	80	100	3
Food Microbiology	4	3	20	80	100	3
Food and Nutrition Practical - 1	3	3	10	40	50	2
Principles of Food Science Practical - 2	3	3	10	40	50	2
Food Microbiology Practical - 3	3	3	10	40	50	2
	21				450	15
SEMESTER II						
Food Chemistry	4	3	20	80	100	3
Food Preservation	4	3	20	80	100	3
Fundamentals of Food Processing	4	3	20	80	100	3
Food Chemistry Practical - 4	3	3	10	40	50	2
Food Preservation Practical - 5	3	3	10	40	50	2
Fundamentals of Food Processing Practical - 6	3	3	10	40	50	2
	21				450	15
SEMESTER III						
Technology of Plant Products	4	3	20	80	100	3
Technology of Animal Products	4	3	20	80	100	3
Dairy Technology	4	3	20	80	100	3
Technology of Plant Products Practical - 7	3	3	10	40	50	2
Technology of Animal Products Practical - 8	3	3	10	40	50	2
Dairy Technology Practical - 9	3	3	10	40	50	2
Domain Elective / Optional Sensory analysis in food industry / Food adulteration	2	2	10	40	50	2
	21				500	17
SEMESTER IV						
Bakery, Confectionary and Extruded foods	4	3	20	80	100	3
Technology of Fat and Oil Products	4	3	20	80	100	3
Food Additives and Preservatives	4	3	20	80	100	3
Bakery, Confectionary and Extruded foods Practical -10	3	3	10	40	50	2
Technology of Fat and Oil Products Practical - 11	3	3	10	40	50	2
Food Additives and Preservatives Practical - 12	3	3	10	40	50	2
Domain Elective / Optional / Sensory analysis in food industry / Food adulteration	2	2	10	40	50	2
Skill based paper- Pest management of stored food	2	2	10	40	50	2
	23				550	19

SYLLABUS for B.Sc.-FOOD TECHNOLOGY-2024-25
SEMESTER-I

FOOD AND NUTRITION

(48 hours)

Course Objectives:

1. To be familiar with nutritional and compositional aspects of various food groups.
2. To identify and understand the methods and their effects in processing of foods.

Course Outcomes:

At the end of the Course, students will be able to

CO 1. Apply the knowledge in maintenance of good health for individual and community.
CO 2. Understand the types and importance of various food nutrients and requirement of vitamins and minerals in foods.
CO 3. Assess the methods and its effects on foods used in cooking.
CO 4. Enumerate codex FSSAI guidelines for nutritional labeling of foods

UNIT I

1. **Introduction** **(4 hours)**
Basic terms used in study of food and nutrition, Body Mass Index (BMI) and Nutritional Status, Understanding Relationship between food, nutrition and health. Definition of calorie & Joule, Measurement of basic nutrients.
2. **Balanced Diet** **(4 hours)**
Functions of food-physiological, psychological and social, Concept of Balanced Diet, Malnutrition – over and under. Basic Food Groups, Food Pyramid. Classification of food – ICMR 2020
3. **Concepts of Meal Planning** **(2 hours)**
Factors affecting meal planning, understanding specific considerations for planning meal for different groups of people.

UNIT II

4. **Carbohydrates** **(4 hours)**
Classification, digestion, functions, dietary sources, requirement, Clinical manifestations of deficiency and excess and factors affecting absorption of carbohydrates.
5. **Proteins** **(4 hours)**
Classification, digestion, functions, dietary sources, requirement, evaluation of protein quality, Clinical manifestations of deficiency and excess and factors affecting absorption of proteins
6. **Lipids** **(4 hours)**
Classification, digestion, functions, dietary sources, requirement, essential fatty acids, PUFA, Cholesterol, Clinical manifestations of deficiency and excess and factors affecting absorption of Lipids.

UNIT III

7. **Vitamins** **(4 hours)**
Classification, digestion, functions, dietary sources, requirement, effects of deficiency (Vitamin A, D, K).
8. **Minerals** **(4 hours)**
Classification, digestion, functions, dietary sources, requirement, effects of deficiency (Iodine, Sodium and Potassium).

9. Pigments and colloids **(4 hours)**

Chlorophyll, Flavanoids, Anthocyanins, Anthoxanthins, Colloidal chemistry, Properties of solutions, Sols & Suspensions, Food colloids.

UNIT IV

10. Enzymes **(4 hours)**

Classification of enzymes, Source of enzymes in food, Use of enzymes in food, Enzymatic and non-enzymatic reactions during storage.

11. Methods of Cooking **(4 hours)**

Dry, moist, frying and microwave cooking, Advantages, disadvantages and the effect of various methods of cooking on foods, Changes in food during cooking using dry heat, moist heat, heated oil and microwave.

12. Nutritional Labeling **(2 hours)**

Importance, global trends, codex guidelines, nutritional labeling in India, FSSAI guidelines.

References

1. Bamji MS, Krishnaswamy K, Brahmam GNV. Textbook of Human Nutrition, 3rd Edition. Oxford and IBH Publishing Co. Pvt. Ltd. 2009
2. Srilakshmi. Food Science, 4th Edition. New Age International Ltd, 2007.
3. Srilakshmi. Dietetics, Revised 5th edition. New Age International Ltd. 2005.
4. Wardlaw MG, Paul M Insel Mosby. Perspectives in Nutrition, 3rd Edition, 1996.
5. Codex Guidelines on Nutrition Labeling (CAC/GL 2_1985) (Rev.1_1993). Rome, Food and Agriculture Organisation of the United Nations / World Health Organisation, 1993.
6. Food Safety and Standards Authority of India portal, Government of India
7. Gopalan, C. NIN, ICMR. Nutritive Value of Indian Foods. 1990
8. Seth V, Singh K. Diet planning through the Life Cycle: Part 1. Normal Nutrition. A Practical Manual, Fourth edition, Elite Publishing House Pvt Ltd. 2005
9. Gibney et al (ed.), Introduction to Human Nutrition, Blackwell Publishers, 2005
10. Khanna K, Gupta S, Seth R, Mahna R, Rekhi T. The Art and Science of Cooking: A Practical Manual, Revised Edition. Elite Publishing House Pvt Ltd., 2004
11. ICMR. Nutrient Requirements and Recommended Dietary Allowances for Indians, 2010.
12. Krishna Prasad Nooralabettu. Enzyme Technology, Pace Maker of Biotechnology, PHI Learning Private Limited, New Delhi, 2011

FOOD AND NUTRITION (PRACTICAL-1)

Course Outcomes:

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

CO 1. Understand balanced diet and its components.
CO 2. Know the different food groups and their nutritive value.
CO 3. Gain experience in planning and calculation of diet.
CO 4. Develop recipes by applying knowledge on cooking methods and properties of food.

1. Identification of food sources for various nutrients using food composition tables.
2. Record diet of self using 24 hours dietary recall.
3. Nutritional analysis of diet of self using 24 hours dietary recall.
4. Introduction to meal planning,
5. Concept of food exchange system.
6. Planning of meals for adults of different activity levels for various income groups.
7. Planning of nutritious snacks for different age and income groups.
8. Preparation of nutritious snacks using various methods of cooking.
9. Nutritional labeling of food products.

10. Estimation of BMI and other nutritional status parameters.
11. Collection of nutritional components of the various vegetables and fruits available.
12. Collection of nutritional components of fish, poultry and meat.

PRINCIPLES OF FOOD SCIENCE

(48 hours)

Course Objectives:

1. To understand the importance of food chemistry, sensory evaluation process of food and study various microorganisms and their importance in industrial food technology
2. To have an in-depth understanding of water disposal, shelf life of the food material, packaging materials and food storage.

Course Outcomes:

At the end of the Course, students will be able to

CO 1. Differentiate between the characteristics of various molecules, develop sensory evaluation skills and understand use of colloidal substance at the industrial level
CO 2. Understand and apply beneficial microorganisms in food technologies in the industry
CO 3. Comprehend utility of water source in the production area and approaches for waste water treatment.
CO 4. Develop various packaging methods to sustainably improvise its outcome in the food development process.

UNIT I

1. Introduction **(2 hours)**

Concepts of food science, importance, scope, history, properties of food (physical, chemical and sensory) .

2. Growth of microorganisms in foods **(4 hours)**

Food as a substrate for microorganism, factors affecting growth of microbes: pH, water activity, O-R potential, nutrient contents, inhibitory substance and biological structure**.**

3. **Sensory evaluation of food** **(5 hours)**

Subjective and Objective evaluation, type of food panels, selection of panel members, characteristics of panel member, layout of sensory evaluation laboratory, sensitivity tests, threshold value, paired comparison test, duo trio test, triangle test, hedonic scale.

UNIT II

4. Hurdle technology **(4 hours)**

Principles and applications, Hurdle effect in fermented foods, shelf stable products, intermediate moisture foods, application of hurdle technology.

5. Minimal processing **(4 hours)**

Minimal processing of foods with thermal methods and non thermal methods-safety criteria in minimally processed foods-Minimal processing in practice-fruits and vegetables-seafood-effect on quality-Future developments

6. Ohmic heating and High Pressure processing **(6 hours)**

Principles, equipment and processing, effect heat and pressure on food.

UNIT III

7. Water disposal **(4 hours)**

Waste water, hardness of water, break point chlorination, physical and chemical impurities, BOD, COD, waste water treatment,

8. **Sanitation and hygiene** **(3 hours)**
   Sanitization of food processing plants and equipments, CIP system, sanitizers used in food industry.
9. **Shelf life of food material** **(3 Hours)**
   Objectives of packaging, packaging requirements of all major food groups, food contact materials,

UNIT IV

10. **Packaging materials** **(6 Hours)**
    Properties of the following packaging materials, edible, biobased and biodegradable food packaging materials, flexible packaging, New and active packaging technologies, food packaging closures and sealing systems, as well as optical, mechanical, and barrier properties of thermoplastic polymers
11. **Packed storage** **(3 Hours)**
    Design and analysis of shelf life experiments and the shelf life estimation of foods, Factors effecting shelf life of the material during packed storage.
12. **New product development** **(4 hours)**
    Definition, Importance, Need of product development, Steps of product development-Product development tools Reasons for failure

References

1. Coles R, McDowell D and Kirwan MJ, Food Packaging Technology, CRC Press, 2003
2. De S, Outlines of Dairy Technology, Oxford Publishers, 1980
3. Deman JM, Principles of Food Chemistry, 2nd ed. Van Nostrand Reinhold, NY 1990
4. Frazier WC and Westhoff DC, Food Microbiology, TMH Publication, New Delhi, 2004
5. Jenkins WA and Harrington JP, Packaging Foods with Plastics, Technomic Publishing Company Inc., USA, 1991
6. Manay NS and Shadaksharaswamy M, Food-Facts and Principles, New Age International (P) Ltd. Publishers, New Delhi, 1987
7. Meyer LH, Food Chemistry, CBS Publication, New Delhi, 1987
8. Potter NH, Food Science, CBS Publication, New Delhi, 1998
9. Ramaswamy H and Marcott M, Food Processing Principles and Applications CRC Press, 2006
10. Ranganna S, Handbook of Analysis and Quality Control for Fruits and Vegetable Products, 2nd ed. TMH Education Pvt. Ltd, 1986

PRINCIPLES OF FOOD SCIENCE (PRACTICAL-2)

Course Outcomes:

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

CO 1. Use techniques, instruments and equipment to analyse biochemical constituents found in food products
CO 2. Evaluate food products based on sensory attributes
CO 3. Estimate the microbiological content of food samples
CO 4. Use Hand Refractometer and asses the nutritive qualities of food samples

1. Sensory evaluation of seafood on 10-point hedonic scale.
2. Sensory evaluation of vegetables.

3. Sensory evaluation of fruits.
4. Total bacterial count of the food sample.
5. Total mould count of the food sample
6. Determination of Free Fatty acids.
7. Determination of Peroxide value.
8. Determination of Total Volatile Base Nitrogen.
9. Determination of TBA.
10. Estimation of total salt content in butter.
11. Estimation of total ash content of the food
12. Preparation of brix solution and checking by hand refractometer

FOOD MICROBIOLOGY

(48 hours)

Course Objectives:

1. To provide the knowledge of microorganisms involved in spoilage, fermentation and diseases associated with foods, their origin and role.
2. To identify and understand methods and technologies used for controlling microorganisms in foods.

Course Outcomes:

At the end of the Course, students will be able to

CO 1. Express the characteristics of microorganisms using various types of laboratory microscopes.
CO 2. Know the factors involved in the growth of microorganisms and their in the spoilage of various food groups.
CO 3. Apply in-depth knowledge of microorganisms in fermentation and understand food-borne diseases.
CO 4. Use techniques, skills and modern trends in controlling microorganisms in foods.

UNIT I

1. **Introduction to food microbiology** **(4 hours)**
   History and Development of Food Microbiology, Definition and Scope of food microbiology, Inter-relationship of microbiology with other sciences.
2. **Microscopy** **(4 hours)**
   Light microscope - Resolving power, Limits of resolution, Refractive index, Magnification. Parts of microscope. Types of microscopy - Bright field, Dark field, Electron microscope - Transmission Electron microscope, Scanning electron microscope.
3. **Evolution of Microorganisms in foods** **(2 hours)**
   Theory of spontaneous generation, Germ theory of disease, Koch's postulates, Pure culture concept

UNIT II

4. **Microbial Growth in Food** **(4 hours)**
   Bacterial growth curve and microbial growth in food, Factors affecting the growth of microorganisms in food, Sources of Microorganisms in foods,
5. **Characteristics of Microorganisms in Food** **(4 hours)**
   Classification on microorganism (yeast, mould and bacteria), Prokaryotes, Eukaryotes, Importance of microorganisms in food, Significance of spores in food microbiology.
6. **Microbial Food Spoilage** **(6 Hours)**

Some important food spoilage microorganisms, Spoilage of specific food groups- Milk and dairy products, Meat, poultry and seafoods, Cereal and cereal products, Fruits and vegetables and Canned products.

UNIT III

7. **Food Fermentations** **(5 hours)**
   Fermentation –definition and types, Microorganisms used in food fermentations, Dairy Fermentations-starter cultures and their types, Fermented Foods-types, methods of manufacture for traditional fermented foods.
8. **Food borne Diseases** **(3 hours)**
   Types – food borne infections, food borne intoxications and toxic infections, Common and Recent Examples
9. **Cultivation of Microorganisms** **(4 hours)**
   Pure culture technique, Methods of isolation and cultivation, Enumeration of microorganisms- qualitative and quantitative.

UNIT IV

10. **Concepts of microbial control** **(5 hours)**
    Principles and methods of preservation, Introduction to Hurdle concept and Non Thermal methods, Probiotic concept.
11. **Control of Microorganisms in Foods** **(5 hours)**
    Physical Methods of Food Preservation- Dehydration, Freezing, Cool Storage, Heat Treatment, Irradiation, Biopreservation,
12. **Trends in Food Microbiology** **(2 hours)**
    Rapid Methods of Detection, Recent Advances

References

1) Frazier William C and Westhoff, Dennis C. Food Microbiology, TMH, New Delhi, 2004
2) Jay, James M. Modern Food Microbiology, CBS Publication, New Delhi, 2000
3) Garbutt, John. Essentials of Food Microbiology, Arnold, London, 1997
4) Pelczar MJ, Chan E.C.S and Krieg, Noel R. Microbiology, 5th Ed., TMH, New Delhi, 1993

FOOD MICROBIOLOGY (PRACTICAL-3)

Course Outcomes:

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

CO 1. Utilize laboratory techniques common to food microbiology.
CO 2. Evaluate the morphology of microorganisms.
CO 3. Evaluate the different method of cultivation of microorganisms.
CO 4. Determine the microorganisms by using different staining methods.

1. Introduction to the Basic Microbiology Laboratory Practices and Equipments
2. Functioning and use of compound microscope
3. Cleaning and sterilization of glassware
4. Preparation and sterilization of nutrient agar
5. Cultivation and sub-culturing of microbes
6. Preparation of slant, stab and plates using nutrient agar
7. Morphological study of bacteria using permanent slides
8. Study of bacterial growth curve
9. Simple staining
10. Gram's staining
11. Fungal staining
12. Negative staining

SEMESTER-II

FOOD CHEMISTRY

(48 hours)

Course Objectives:

1. Comprehensive study on definition, composition of food, water-food relation, macronutrients, vitamins and flavours.
2. Study of various natural food pigments, enzymatic reactions, changes taking place and new product development and browning reactions in food required at industrial level.

Course Outcomes:

At the end of the Course, students will be able to

CO 1. Define and have an overview on food chemistry including composition and the importance of water.

CO 2. Classify the carbohydrates, lipids, proteins, vitamins and flavour, minerals and natural food pigments used in food products.

CO 3. Apply the knowledge of browning reactions in food products

CO 4. Build own product in innovative way by understanding changes that occurs during food development and use of enzyme technology.

UNIT I

1. Introduction **(4 hours)**

Definition, Composition of food, Definition of water in food, Structure of water and ice, Types of water, Sorption phenomenon, Water activity and packaging, Water activity and shelf-life

2. Carbohydrates **(4 hours)**

Classification of carbohydrates, Structure of important polysaccharides, Chemical reactions of carbohydrates, Modified celluloses and starches.

3. Lipids **(4 hours)**

Classification of lipids, Physical properties of lipids. Chemical properties of lipids. Effect of frying on fats, Changes in fats and oils and its prevention, Technology of edible fats and oils-Refining, Hydrogenation and Interesterification, Fat Mimetics

UNIT II

4. Proteins **(4 hours)**

Protein classification and structure, Nature of food proteins (plant and animal proteins, Properties of proteins, Functional properties of proteins.

5. Vitamins **(4 hours)**

Importance and Stability, Water soluble vitamins, Fat soluble vitamins,

6. Flavour **(4 hours)**

Definition and basic tastes, Description of food flavours, Flavour enhancers

UNIT III

7. Minerals **(4 hours)**

Major and minor minerals, Metal uptake in canned foods, Toxic metals

8. Natural Food Pigments **(4 hours)**

Introduction and classification, Food pigments (chlorophyll, carotenoids, anthocyanins and flavonoids, beet pigments, caramel)

9. Browning Reactions in Food **(4 hours)**

Enzymatic browning, Non-Enzymatic browning, Maillard reaction, Caramelization reaction, Ascorbic acid oxidation,

UNIT IV

10. Enzymes (4 hours)

Introduction, General characteristics, Enzymes in food processing, Industrial Uses of Enzymes, Immobilized enzymes

11. Changes occurring during food processing treatments (4 hours)

Drying and dehydration, Irradiation, Freezing, Canning

12. Colloidal chemistry (4 hours)

Characteristics and stabilization of colloidal system, properties and formation of emulsions, formation, stability and destruction of foam, application of colloidal chemistry to food preparation.

References:

1. Fennema, Owen R, Food Chemistry, 3rd Ed., Marcell Dekker, New York, 1996
2. Whitehurst and Law, Enzymes in Food Technology, CRC Press, Canada, 2002
3. Wong, Dominic WS, Food Enzymes, Chapman and Hall, New York, 1995
4. Potter, N.N. and Hotchkiss, J.H, Food Science, 5th Ed., Chapman & Hall, 1995
5. DeMan, J.M., Principles of Food Chemistry, AVI, NewYork, 1980
6. DeMan, J.M., Principles of Food Chemistry, 3rd Ed., Springer 1999
7. Desrosier, Norman W. and Desrosier., James N., The technology of food preservation, 4th Ed., Westport, Conn.: AVI Pub. Co, 1977.
8. Fuller, Gordon W, New Product Development from Concept to Marketplace, CRC Press, 2004.
10. Whitehurst and Law, Enzymes in Food Technology, CRC Press, Canada, 2002
11. Krishna Prasad Nooralabettu. Enzyme Technology, Pace Maker of Biotechnology, PHI Learning Private Limited, New Delhi. 2011

FOOD CHEMISTRY (PRACTICAL 4)

Course Outcomes:

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

CO 1. Test the principles underlying analytical techniques of food products.
CO 2. Evaluate quantitatively total protein, total sugar and total lipid content in different food samples.
CO 3. Estimate food contents using different methods.
CO 4. Understand the non-enzymatic process by extraction process and estimate the non-protein nitrogenous substances in the various food samples

1. Qualitative analysis of carbohydrates.
2. Estimation of vitamin C.
3. Determination of acid value.
4. Estimation of saponification value.
5. Estimation of reducing and non reducing sugars.
6. Estimation of calcium using EDTA method.
7. Estimation of total ash.
8. Estimation of iodine value.
9. Estimation of peroxide value.
10. Determination of moisture content in food samples.
11. Estimation of non-enzymatic browning by extraction methods.
12. Estimation of non protein nitrogenous substances in the food.

FOOD PRESERVATION

(48 hours)

Course Objectives:

1. To familiarize students with different types of modern technology used in the field of food preservation
2. Learning and understanding the principles and technology and its application.

Course Outcomes:

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

CO 1. Understand principles of food preservation and types of foods
CO 2. Discern working principles, application and technology used in freezing, thermal processing and drying
CO 3. Define, describe and give the working principle behind evaporation, irradiation, fermentation
CO 4. Describe the evolution of modified atmosphere packaging and various chemical preservatives used to preserve the food and recent technology used

UNIT I

1. **Principles of Food Preservation** **(5 hours)**
   Principle, objectives and techniques of food preservation, Water activity of food and its significance in food preservation, microbial and autolytic degradation of food items, oxidative degradation.
2. **Food Microbiology** **(5 hours)**
   Microorganisms associated with foods- bacteria, yeast and mold, Importance of bacteria, yeast and molds in foods. Classification of microorganisms based on temperature, pH, water activity, nutrient and oxygen requirements, typical growth curve of micro-organisms.
3. **Types of foods** **(2 hours)**
   Classification of food based on pH, Food infection, food intoxication, definition of shelf life, perishable foods, semi perishable foods, shelf stable foods.

UNIT II

4. **Freezing and Refrigeration** **(4 hours)**
   Introduction to refrigeration, cool storage and freezing, definition, principle of freezing, freezing curve, changes occurring during freezing, types of freezing i.e. slow freezing, quick freezing, introduction to thawing, changes during thawing and its effect on food.
5. **Thermal Processing** **(4 hours)**
   Principle and application of heat preservation methods: Sterilization, commercial sterilization, Pasteurization, ultrahigh temperature sterilization, aseptic processing and blanching.
6. **Drying and Dehydration** **(4 hours)**
   Definition, drying as a means of preservation, differences between sun drying and dehydration (i.e. mechanical drying), factors affecting rate of drying, normal drying curve, names of types of driers used in the food industry.

UNIT III

7. **Evaporation** **(4 hours)**
   Definition and principle of evaporation, factors affecting evaporation, names of evaporators used in food industry.

8. **Food Preservation by Irradiation** **(4 hours)**
Introduction, units of radiation, kinds of ionizing radiations used in food irradiation, mechanism of action, uses of radiation processing in food industry.

9. **Fermentation** **(4 hours)**
Principles of fermentation, Types of fermentation, curing and pickling; Hurdle technology, Advantages

UNIT IV

10. **Modified atmosphere** **(4 hours)**
History of Controlled Atmosphere Storage, Modified Atmosphere Packaging techniques, Equilibrium Modified Atmosphere Packaging techniques, gas-flushing and compensated vacuum techniques

11. **Chemical Preservatives** **(4 hours)**
Natural Preservatives-Mode of action, Chemical preservatives- Sulphur dioxide, Benzoic acid, Sorbic acid, Antioxidants

12. **Recent Trends** **(4 hours)**
Bio-preservatives, Pulsed electric fields, High pressure technology, Ohmic heating, Microwave heating, Hurdle technology

References

1. Srilakshmi, B. Food science, New Age Publishers, 2002
2. Meyer, Food Chemistry, New Age, 2004
3. Bawa, A.S, Chauhan O.P. Food Science. New India Publishing agency, 2013
4. Frazier WC and Westhoff DC, Food Microbiology, TMH Publication, New Delhi, 2004
5. Krishna Prasad Nooralabettu, Downstream processing-A new horizon in biotechnology, PHI publication, New Delhi, 2010.
6. Robertson, G. L., Food Packaging: Principles and Practice, 3rd edition, 2013.

FOOD PRESERVATION (PRACTICAL-5)

Course Outcomes:

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

CO 1. Assess the various methods of food preservation for extended shelf life
CO 2. Estimate the moisture content using graphical representation
CO 3. Determine the qualitative characteristics of preserved foods
CO 4. Perform different preservation methods and study the shelf-life characteristics

1. Food preservation techniques.
2. Concept of shelf life of different foods
3. Determination of acidity of fruit juices
4. Effect of heat on vegetables and fruits.
5. Characteristics study of foods preserved by drying/dehydration/ freezing.
6. Effect of Ph in cooking of vegetable samples.
7. To perform blanching of different food sample.
8. Effect of enzymatic browning in food sample.
9. Dry salting and wet Salting of fish samples.
10. Artificial drying of vegetables.
11. Preparation of pickle and shelf life study.
12. Preparation of jams/jellies/marmalades by concentration method

FUNDAMENTALS OF FOOD PROCESSING

(48 hours)

Course Objectives:

1. To familiarize students with the compositional, nutritional and technological aspects of various food groups.
2. To identify and understand the methods and technology used in processing various food groups.

Course Outcomes:

At the end of the Course, students will be able to

CO 1. Define and describe the evolution of food processing from prehistoric times till date.
CO 2. Describe compositional, nutritional and the rationale for use of each raw material in processing.
CO 3. Apply knowledge of the various processing technologies used in industries.
CO 4. Analyse the methods used to assess and classify the specific use of technologies applied for processing.

UNIT I

1. **Introduction (2 hours)**
Historical development of food Science and technology, Evolution of Food Processing from prehistoric times till date.
2. **Compositional, Nutritional and Technological aspects of cereals & Millets (5 hours)**
Composition, Nutritive value and Structure of cereal grain. Toxins, Malting, Gelatinization of starch, Changes during cooking, Changes during germination.
3. **Compositional, Nutritional and Technological aspects of pulses & legumes (5 hours)**
Composition, Nutritive value, and Structure of pulses and legumes, Antinutritional factors, Factors effecting cooking time, Changes during cooking, Changes during germination.

UNIT II

4. **Compositional, Nutritional and Technological aspects of animal meat (4 hours)**
Definition of carcass, concept of red meat and white meat, composition of meat, marbling, post-mortem changes in meat- rigor mortis, tenderization of meat, ageing of meat.
5. **Compositional, Nutritional and Technological aspects of Fish (4 hours)**
Fish - Classification of fish (fresh water and marine), composition of fish, characteristics of fresh fish, spoilage of fish- microbiological, physiological, biochemical. 6.
6. **Compositional, Nutritional and Technological aspects of poultry meat (4 hours)**
Structure of hen's egg, composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality.

UNIT III

7. **Compositional, Nutritional and Technological aspects of fruits (4 hours)**
Classification, general composition and nutritional values, Post-harvest changes in fruits– Climacteric rise, physiological changes, physical changes, chemical changes, and pathological changes during the storage of fruits.
8. **Compositional, Nutritional and Technological aspects of vegetables (4 hours)**
Classification, general composition and nutritional values of vegetables, Post-harvest changes in vegetables–Climacteric rise, horticultural maturity, physiological maturity, physiological changes, physical changes.
9. **Compositional, Nutritional & Technological aspects of Milk & Milk Products(4 hours)**

Definition of milk, chemical composition of milk, its constituents, processing of milk, pasteurization, homogenization. An overview of types of market milk and milk products.

UNIT IV

10. **Compositional, Nutritional & Technological aspects of nuts & oilseeds (6 hours)**
Classification of lipids, types of fatty acids - saturated fatty acids, unsaturated fatty acids, essential fatty acids, trans fatty acids**.** Refining of oils, types- steam refining, alkali refining, bleaching, steam deodorization, hydrogenation. Rancidity –Types- hydrolytic and oxidative rancidity and its prevention.
11. **Compositional, Nutritional & Technological aspects of health foods (3 hours)**
Functional foods, Prebiotics, Probiotics, Nutraceuticals, organic foods, GM foods
12. **Compositional, Nutritional & Technological aspects of spices (3 hours)**
Definition, Classification, Chemical composition, use of spices

References

1. Bawa. A.S, O.P Chauhan et al. Food Science. New India Publishing agency, 2013
2. Roday, S. Food Science, Oxford publication, 2011.
3. Srilakshmi, B. Food science, New Age Publishers, 2002
4. Meyer, Food Chemistry, New Age, 2004
5. De Sukumar, Outlines of Dairy Technology, Oxford University Press, 2007
6. Manay Shakuntala N, M Shadakshara Swamy Foods: Facts and Principles -, New Age International Publishers, New Delhi 2001
7. Srilakshmi B, Food Science - New Age International Publishers, New Delhi 2005
8. Swaminathan M, Food science, Chemistry & Experimental Foods, The Bangalore Print and Publishing Company Ltd, 1995.
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10. Rui M. S. Cruz, Igor Khmelinskii, Margarida Vieira, Methods in Food Analysis, CRC Press, 2014
11. Picó Y, Chemical Analysis of Food: Techniques and Applications, Academic Press, 2012
12. *Maynard Joslyn,* Methods in Food Analysis, Elsevier Inc, 1950

FUNDAMENTALS OF FOOD PROCESSING (PRACTICAL-6)

Course Outcomes:

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

CO 1. Estimate the nutritional characteristics during food processing.
CO 2. Determine the moisture content changes during processing of food.
CO 3. Determine the organoleptic characteristics of food.
CO 4. Evaluate the action of microorganisms on food.

1. Estimation of total yield during the processing of vegetables.
2. Effect of cooking on pulses.
3. Determination of pH of the food products using pH meter.
4. Estimation of drip loss of meat during frozen storage.
5. Moisture change during artificial drying of vegetables.
6. Moisture change during sundrying of vegetables.
7. Moisture change during salting of fishes.
8. Determination of specific gravity of fats and oils.
9. Determination of acidity of milk sample.
10. Detection of adulterants in turmeric, pepper, chillies, coffee .
11. Preparation of value added products from millets.
12. Visit to a food processing industry .

SEMESTER-III

TECHNOLOGY OF PLANT PRODUCTS (THEORY)

(48 hours)

Course Objectives:

1. To learn about the processing of plant products undertaken at the industrial level
2. To gain knowledge about post-harvest technologies and novel technologies in the processing of plant products

Course Outcomes:

At the end of the Course, students will be able to

CO 1. Comprehend the need for preservation, canning and bottling process for vegetable and fruit products.

CO 2. Understand the rationale behind processing and drying techniques of fruits and vegetables leading to a final product with enhanced characteristics and shelf life.

CO 3. Evaluate the reactions and changes taking place in fruits and vegetables, beverages and spices during overall processing.

CO 4. Apply the technological ideas and methodologies to preserve the harvest and turn it into multiple uses.

UNIT I

1. **Introduction** **(2 hours)**
   Importance of fruits, vegetable, cereals and pulses, History and need of preservation, reasons of spoilage, method of preservation.
2. **Canning and bottling of Fruits and vegetable** **(5 hours)**
   Selection of fruits and vegetables, process of canning, factors affecting the process- time and temperature, containers of packing, lacquering, syrups and brines for canning, spoilage in canned foods**,** Process of bottling, factors affecting the sterilization, factors affecting the quality of the bottled foods**.**
3. **Fruits juices and tomato pulps** **(5 hours)**
   Selection of fruits, Processing of fruit juices, preservation of fruit juices. Selection of tomatoes, pulping& processing of tomato juice, tomato puree, paste, ketchup, sauce and soup**.**

UNIT II

4. **Fruit squashes, Jams, Jellies, Marmalades and candies** **(4 hours)**
   Selection of fruits, Processing, essential constituents, types, technology and defects in Fruit squashes, Jams, Jellies, Marmalades and candies
5. **Pickles, Chutneys and Sauces** **(4 hours)**
   Processing of pickles, chutneys and squashes, Types of pickles, chutneys and squashes, Causes of spoilage in pickling**.**
6. **Drying of Foods and Vegetables** **(4 hours)**
   Sun drying and mechanical drying of Food and Vegetables, process variation for fruits and vegetables, packing and storage**.**

UNIT III

7. **Spices** **(5 hours)**
   Processing and properties of major and minor spices, essential oils & oleoresins, adulteration**.**
8. **Tea, Coffee and Cocoa** **(5 hours)**
   Processing of Tea, Coffee and Cocoa, Variety Tea, Coffee and Cocoa and its products**.**
9. **Browning** **(2 hours)**
   Enzyme activity enzymic browning Non enzymic browning, its prevention.

UNIT IV

10. Technology of Cereals (4 hours)

Introduction, Properties, types, milling, treatment, product and byproducts of wheat, rice

11. Technology of Pulses (4 hours)

Milling of pulses, Dry milling, Wet milling, improved milling method

12. Technology of Oilseeds and alcoholic beverages (4 hours)

Introduction, Extraction of oil and refining, Sources of protein, properties and uses, protein texturization, fibre spinning, Processing of Beer, Wine, Distilled Spirits

References

1. Girdharilal, Siddappaa, G.S and Tandon, G.L.1998. Preservation of fruits & Vegetables, ICAR, New Delhi
2. Crusess W B.2004. Commercial Unit and Vegetable Products, W.V. Special Indian Edition, Pub: Agrobios India
3. Manay, S. & Shadaksharaswami, M.2004. Foods: Facts and Principles, New Age Publishers
4. Ranganna S.1986. Handbook of analysis and quality control for fruits and vegetable products, Tata Mc Graw-Hill publishing company limited, 2nd edition.
5. Srivastava, R.P. and Kumar, S. 2006. Fruits and Vegetables Preservation- Principles and Practices. 3rd Ed. International Book Distributing Co.
6. Kent, N.L. 2003. Technology of Cereal, 5th Ed. Pergamon Press.
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TECHNOLOGY OF PLANT PRODUCTS (PRACTICAL-7)

Course Outcomes:

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

CO 1. Estimate the composition and nutritional content of fruits and vegetables.
CO 2. Evaluate the characteristics on cooking of food.
CO 3. Assess different preservation techniques.
CO 4. Analyze changes the occur during preservation processes

1. Estimation of total soluble solids (TSS).
2. Preparation of marmalades
3. Determination of gluten content in wheat
4. Effect of heat treatment on vegetables and fruits.
5. Preparation of tomato ketchup/sauce.
6. Cooking characteristics of rice.
7. Adulteration of spices.
8. Dehydration of fruits and vegetables.
9. Rehydration of fruits and vegetables.
10. Salting of vegetables / Brining of vegetables
11. Identification and description of common pulses
12. Physical characteristics of wheat
13. Do It Yourself (DIY) – Innovative plant product development

TECHNOLOGY OF ANIMAL PRODUCTS (THEORY)

(48 hours)

Course Objectives:

1. To understand the various processes and technologies relevant to animal products at the industrial level.
2. To identify and evaluate the various preservation technologies used

Course Outcomes:

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

CO 1. Understand processing of meat and various preservation techniques used
CO 2. Evaluate egg production practices and the various quality identification analysis parameters
CO 3. Differentiate between different types of fishery byproducts and fermented fish products
CO 4. Assess the different techniques used in production of market milk products

UNIT I

1. **Introduction to Meat and Meat products** **(2 hours)**
Status and development of fishery, meat, poultry industries in India and its need in nation's economy. Introduction & Importance of meat products in India, Chemical Composition, Nutritional value & microscopic structure of meat, Pre□slaughter inspection of animal, Transportation, feeding of animal before slaughtering. Post-mortem muscle chemistry
2. **Processing of meat** **(4 hours)**
The meat processing industry, its techniques of working, general management, structure, composition. Slaughter, inspection and grading.
3. **Preservation of meat** **(6 hours)**
Effects of feed, breed and environment on production of meat animals and their quality, quality of the meat, Refrigeration and freezing, thermal processing- canning of meat, retort pouch, dehydration, irradiation, meat curing. Sausages-processing, types and defects, byproducts.

UNIT II

4. **Egg Industry and Egg Production Practices** **(6 hours)**
The egg industry, its techniques of working, General management, structure, composition and Nutritive value of egg and its products.
5. **Preservation of eggs** **(4 hours)**
Refrigeration and freezing, thermal processing, dehydration, coating.
6. **Quality identification of shell eggs** **(2 hours)**
Factors affecting egg quality and measures of egg quality.

UNIT III

7. **Processing of sea foods** **(6 hours)**
Post-harvest change in fish, changes during chilled storage, various techniques of fish processing and preservation: chilling, freezing, canning, irradiation, curing, smoking, fermentation, salting, brining, and drying. Quality changes due to improper handling and processing. Processing of Crustaceans and Molluscs.
8. **Fishery by-products** **(4 hours)**
Surimi- Introduction, fish muscle proteins, the surimi process, traditional and modern surimi production lines, quality of surimi products, comparison of surimi and fish mince products**.**

Fish protein concentrates (FPC), fish protein extracts (FPE), fish protein hydrolysis, fish oil, glue, gelatin.

9. Fermented fish (2 hours)

Principles of fermentation of fishery products, Flowchart of Indigenous products- Fish sauce and Paste

UNIT IV

10. Animal meat handling and by-products: (4 hours)

Modern abattoirs, Typical layout and features, Ante-mortem handling and design of handling facilities, Hoisting rail and traveling pulley system, Stunning methods, Steps in slaughtering and dressing, Offal handling and inspection, Inedible by-products, Operational factors affecting meat quality, Effects of processing on meat tenderization, Abattoir equipment and utilities.

11. Meat alternatives (4 hours)

History of meat alternatives, Plant based meat, Market for plant-based alternatives, Meat alternatives - health benefits

12. Spoilage and test methods in meat (2 hours)

Color, microbiology and spoilage factors of meat and meat products, Factors affecting post-mortem changes, properties and shelf-life of meat. The spoilage of meat by infecting organisms — Test methods: Physical, Chemical and microbiological testing of meat, Sensory evaluation

References

1) Lawrie R A, Lawrie's Meat Science, 5th Ed, Woodhead Publisher, England, 1998
2) Parkhurst & Mountney, Poultry Meat and Egg Production, CBS Publication, New Delhi, 1997
3) Pearson & Gillet Processed Meats, 3rd Ed, CBS Publication, New Delhi, 1997
4) Shai Barbut, Poultry Products Processing, CRC Press 2005
5) Stadelman WJ, Owen, J Cotterill, Egg Science& Technology, CBSP, New Delhi, 2002
6) Sukumar D E, Outlines of Dairy Technology, Oxford University Press, Oxford.2007.
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8) Sen DP, Advances in Fish Processing Technology, Allied Publishers Pvt. Limited, 2005
9) Shahidi F and Botta JR, Seafoods: Chemistry, Processing, Technology and Quality, Blackie Academic & Professional, London, 1994.
10) Webb and Johnson, Fundamentals of Dairy Chemistry, 3rd Ed., CBS Publishers, New Delhi 1988

TECHNOLOGY OF ANIMAL PRODUCTS (PRACTICAL 8)

Course Outcomes:

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

CO 1. Describe the various acidity methods in milk sample.
CO 2. Identify the presence of milk fat by Gerber method.
CO 3. Perform various methods of evaluation of fish samples.
CO 4. Evaluate moisture and protein content in meat; lipid content in fish and use various quality parameters to compare various brands of eggs.

1. Estimation of tenderization of meat.
2. Pickling of meat/ fish.
3. Estimation of lipid content of egg yolk.
4. Determination of water holding capacity of meat and extract release volume.
5. Determination of pH of meat fish and poultry samples.
6. Determination of moisture content of meat and fish samples.

7. Quality evaluation of fish/prawn.
8. Subjective evaluation of Fresh Fish.
9. Estimation of moisture content of meat.
10. Estimation of protein content of meat.
11. Estimation of lipid content of fish sample.
12. Evaluation of eggs for quality parameters (market eggs, branded eggs)
13. Do It Yourself (DIY) – Innovative animal product development

DAIRY TECHNOLOGY (THEORY)

(48 hours)

Course Objectives:

1. To learn about the varied processing of dairy products undertaken in an industrial level
2. To gain the knowledge about the post-harvest technology and the novel technologies in the processing of the products

Course Outcomes:

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

CO 1. Acquire the basic knowledge of developments in dairy industries.
CO 2. Comprehend the recent advances in processing of dairy products.
CO 3. Acquire the knowledge in manufacturing of different dairy products.
CO 4. Understand about types of dairy plants and working principles of dairy instruments.
CO 5. Gain knowledge regarding hygiene and sanitation practices in the milk and milk products industry

UNIT I

(15 hours)

Dairy industry: Review of dairy development in India. Dairy industry in India and abroad. Co-operative dairying, Market survey; milk production & consumption pattern, national and global markets. Clean milk production & hygienic handling of raw milk. Milk collection/ procurement and pricing.

Recent developments in dairy sector: Dehydration, LHT, HTST, UHT processing, types of UHT plants, aseptic fillers, heat stability and deposit formation aspects, retort processing, use of bio-protective factors for preservation of raw milk and their effects on physicochemical, microbial, and nutritional properties of milk and milk products. Packaging of dairy products.

UNIT II

(15 hours)

Dairy products: Fluid milk: Full cream, standardized, toned & double toned milk, reconstituted, rehydrated, and recombined milk, flavoured milk, condensed milk, lactose-free milk, fortified milk, skimmed milk, valorised milk.

Traditional dairy products, Fat-rich dairy products, Heat and acid coagulated milk products, Cheese (types and manufacture process), fermented milk products; value added dairy products, ice-cream and frozen desserts, imitation dairy products, By-products Technology (Processing and utilization of whey, ghee residue, casein – classification and applications). Probiotic milk products – yoghurt; milk powders.

UNIT III

(15 hours)

Milk Testing: Qualitative and quantitative analysis of milk. **Dairy Plant Management:** Principles of dairy plant design, classification of dairy plants, Instrumentation and process control, microbial quality and safety in dairy industry, HACCP, FSSAI regulations, cGMP/GHP practices in dairy processing. Waste Disposal and Pollution Abatement, Current trends in cleaning and sanitization of dairy equipment.

DAIRY TECHNOLOGY (PRACTICAL 9)

Course Outcomes:

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

CO 1. Acquire the skills to assess milk quality
CO 2. Perform chemical analysis of milk
CO 3. Prepare quality milk products
CO 4. Innovate on new milk products

1. Rapid tests for evaluation of milk quality- Clot on boiling test, alcohol test, alizarin alcohol test, phosphatase, acidity, turbidity
2. Chemical analysis of milk and determination of its components like fat, SNF, protein and TSS.
3. Preparation and quality evaluation of milk products: Heat desiccated/ Heat – acid
4. Coagulated milk products, Cultured milk products, Fat rich products, Puddings / desserts
5. By product utilization experiments (Whey and ghee residue)
6. Adulteration of milk and milk products
7. Estimation of free fatty acids in ghee
8. Preparation of pudding/desserts
9. Visit to dairy plant.
10. Do It Yourself (DIY) – Innovative milk product development /milk testing

References

1) Products. Dairy India Yearbook Publications, New Delhi. 2002.
2) Gupta P. R., Dairy India, 5th Ed., New Delhi. 1997.
3) Robinson R. K., Modern dairy Technology, 2nd Ed., Chapman and Hall, New York. 1994.
4) Subbulaksmi G and Shobha A. Udipi, Food processing and preservation, New age international, 2008.
5) D.B. Puranik, Dairy plant management, New India Publishing Agency. 2014
6) De Sukumar, Outlines of dairy: Technology, 1st edition, Oxford, 2001.

SEMESTER-IV

BAKERY, CONFECTIONERY AND EXTRUDED FOODS (THEORY)

(48 hours)

Course Objectives:

1. To enable students to understand the bakery, confectionary and extruded industry.
2. To enable students to examine the technologies used in different industries.

Course Outcomes:

At the end of the Course, students will be able to

CO 1. Understand and identify methods and products used in bakery industry.
CO 2. Apply the knowledge of the various technologies in bakery industries.
CO 3. Define and describe the manufacturing methods and general technical aspects of confectionary industry.
CO 4. Identify and explain about the extruded food product industry

UNIT I

1. Baking Industry **(4 hours)**

Historical development and status of bakery industry in India; Introduction and definition of bakery products as per FSSAI — bread, biscuit, cake, pastries, rusk, crackers, bun and their specifications. Present status and future prospectus

2. Bakery Ingredients **(4 hours)**

Classification of bakery products. Bakery ingredients and their functions-Essential ingredients. Flour, yeast and sour dough, water, salt- Other ingredients Sugar, color, flavor, fat, milk, milk powder and bread improvers. Leaveners and yeast foods. Shortenings, emulsifiers and antioxidants.

3. Baking methods **(4 hours)**

Various methods of production and effect of ingredients, formulations and process parameters on quality, machinery used in baking industry.

UNIT II

4. Bakery Product Quality **(3 hours)**

Rheological testing of dough- Farinograph, mixograph, extensograph, amylograph/ rapid visco analyser, Falling number; Microbiological aspects of different bakery products – prevention of bacterial rope and mold infection

5. Cakes, Biscuits and Breads **(6 hours)**

Flour specifications, ingredients, manufacturing process and quality evaluation of cakes, biscuits and breads. Basic methods of cake preparations, variety cakes, biscuits, breads, rusk, cracker and bun. Cake recipe balancing, faults and remedies; Preparation of basic custards, pudding; Mousse.

6. Bakery plants sanitation **(3 hours)**

Bakery hygiene and sanitation including control of rodents and pests. Bread faults – causes and remedies; Bread staling – theory, manifestation, retardation measures

UNIT III

7. Confectionery industry **(4 hours)**

Definition, importance of sugar confectionery. Types of confectioneries-classification. Raw materials-types of sugar-role of sugar-alternative, bulk sweeteners –syrup production, quality parameters, faults and corrective measures. Spoilage of confectionery products.

8. Confectionary manufacture (4 hours)

Raw materials and processing of cocoa, and its products, chocolate processing-processing steps, types of chocolates, tempering, enrobing technology.

9. Sugar confectionery (4 hours)

General technical aspects, manufacture of boiled sweets, lollipops, lozenges, gums and jellies, chewing gums, caramel, toffee, fudge. Indian Confectionery – Types, role of sugar in preparation, other ingredients and their role in preparation

UNIT IV

10. Extruded food product industry (4 hours)

Objectives and importance of extrusion in food product development; Advantages and disadvantages. Components, functions and classification of extruder.

11. Extruded food products (4 hours)

Change of functional properties of food components during extrusion; Pre and post extrusion treatments; Manufacturing process of extruded products; Application of extrusion technologies in food industries.

12. Cost consideration (4 hours)

Costing economics & Marketing of processes and products, including energy required and auditing; Project Preparation for Baking Unit and Layout; Bakery management and marketing

References

1. Matz, Samuel A, Bakery Technology and Engineering, 3rd Ed, CBS Publishers, 2008.
2. Stanley Cauvain and Linda Young, Baked Products- Science, Technology and practice, Blackwell Publishing, 2006.
3. Amendola, Joseph and Nicole Rees, The Baker's Manual, 5th Ed, Wiley, 2003.
4. Hamed Faridi and Jon M. Faubion, Dough Rheology and Baked Product Texture, CBS Publishers, 1997.
5. Duncan, Manley. Biscuit, Cookie and Cracker Manufacturing Manuals. Vol.1-6. Woodhead Publishing Harper JM. Extrusion of Food, Vol 2, CRC Press1981.
6. Matz SA. Bakery Technology & Engineering. AVI Pub. 1960.
7. Fance WJ and Wrogg BH. Up to-date Bread Making; Maclasen & Sons Ltd. 1968,
8. Kent-Jones DW and Amos AJ, Modern Cereal Chemistry, Food Trade Press Ltd. 1967
9. NIIR Board of Consultants & Engineers, The Complete Technology Book on Bakery Products (Baking Science with Formulation & Production) 3rd Ed., 2014
10. Ashokkumar Y, Textbook of Bakery and Confectionery, PHI India Pvt. Ltd., 2012
11. Stanley Cauvain and Linda Young, Baked Products- Science, Technology and practice, Blackwell Publishing, 2006.
12. Amendola, Joseph and Nicole Rees, The Baker's Manual, 5th Edition, Wiley, 2003.
13. Hamed Faridi and Jon M. Faubion, Dough Rheology and Baked Product Texture, CBS Publishers, 1997.

BAKERY, CONFECTIONERY, AND EXTRUDED FOODS (PRACTICAL 10)

Course Outcomes:

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

CO 1. Prepare recipes and create formulations used in baking and confectionery.
CO 2. Create a variety of baked goods and confectionery
CO 3. Assess and select ingredients for baking and pre preparation of the products.
CO 4. Evaluate factors that affect quality of baked products and confectionery.

1. Introduction to bakery equipments
2. Determination of ash content of the given sample of white wheat flour
3. Estimation of water absorption power and gluten content of the given flour.
4. Determination of alcoholic acidity of the given sample of wheat flour.
5. Determination of sedimentation value of white wheat flour
6. Determination of yeast quality by its dough rising capacity
7. Preparation of plain biscuit in laboratory
8. Preparation of egg less cake.
9. Preparation of bread by straight dough method.
10. Microbial flora of aging bakery items.
11. Sensory characteristics of the baked products.
12. Objective characteristics of biscuits.
13. Do It Yourself (DIY) – Innovative bakery/confectionary product development

TECHNOLOGY OF FAT AND OIL PRODUCTS (THEORY)

(48 hours)

Course Objectives

1. To enable students to understand the production and processing technologies of fats and oils.
2. To evaluate the diverse technologies and the consequent chemical and physico-chemical modifications on oils and fats.

Course Outcomes

At the end of the Course, students will be able to

CO 1. Identify sources, composition, importance and properties of fats and oils.
CO 2. Apply various methods of extraction and processing of fats and oils.
CO 3. Assess the processing of fat in various food industries.
CO 4. Analyse the methods used for production, packaging, storage and distribution of fats and oils.

UNIT I

1. **Edible fats and oil processing industry** **(4 hours)**
Global status of edible fat and oil industry, Introduction to edible fat and oil production, , traditional edible fat and oil products; Modern fat and oil products.
2. **Properties of fat and oil products** **(4 hours)**
Chemical, physical and functional properties of fats and oils, Importance of fats and oils in human nutrition Commercial oil resources
3. **Edible fats and oil products** **(4 hours)**
Importance of fats and oils in foods; Sources, composition and properties of fats and oils of plant and animal origin; Reversion and rancidity of fats and oils.

UNIT II

4. **Extraction of fats and oils** **(4 hours)**
Rendering, pressing, solvent extraction, supercritical fluid extraction, enzyme-derived oil extraction.
5. **Processing of fats and oils** **(4 hours)**
Basic processing of fats and oils - oil extraction, degumming, refining, bleaching, hydrogenation, fractional crystallization, interesterification, glycerolysis, molecular distillation, plasticizing and tempering

6. **Modification of fats and oils** **(4 hours)**
Breeding, Hydrogenation, Fractionation, Emulsification, Interesterification, Crystallization, Blending and Calculation

UNIT III

7. **Plastic fats** **(4 hours)**
Application of plastic fat in bakery, confectionary and cocoa butter replacers, shortenings,
8. **By-products of fat and oil processing industry** **(4 hours)**
Oil seed protein isolates; Quality standards of fats and fatty foods; Antioxidants and its mechanism of application.
9. **Chemical adjuncts** **(4 hours)**
Chemical adjuncts-lecithins, monoglycerides and derivatives, propylene glycol esters, polyglycoesters.

UNIT IV

10. **Shortening** **(4 hours)**
Introduction into shortening, manufacturing and uses of shortening, types of shortening.
11. **Value added products** **(4 hours)**
Margarine-manufacturing process and its uses. Mayonnaise and salad dressings. Confectionery coatings. Imitation dairy products - peanut butter and vegetable ghee.
12. **Packaging and testing of fat and oil products** **(4 hours)**
Packing, storage and transportation of fats and oils, cocoa butter, fat substitutes. Quality Control: Peroxide value, FFA, sensory evaluation, shelf-life, testing.

References

1. Swern D, Bailey's Industrial Oil and Fat Products, Vol 1 & 2; 4th ed, John Wiley & Sons, 1982.
2. Devine J & Williams PN, The Chemistry & Technology of Edible Oils and Fats, Pergamon Press, 1961.
3. Weiss TJ. Food Oils and their Uses. AVI,1983,
4. Torrey S, Edible Oils & Fats: Developments since 1978 (Food Technology Review # 57); NDC, 1983.
5. Hamilton RJ and Bharti A, Fats and Oils: Chemistry and Technology, Applied Science, London, 1980.
6. Salunkhe OK, Chavan JK, Adsule RN and Kadam SS, World Oilseeds: chemistry, Technology and Utilization, VNR, New York, 1992.
7. Wolf IA, Handbook of Processing and Utilization in Agriculture, (2 vol. set), CRC Press, Florida, 1983.

TECHNOLOGY OF FAT AND OIL PRODUCTS (PRACTICAL 11)

Course Outcomes:

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

CO 1. Analyse physical and chemical parameters of fats and oils by using different techniques
CO 2. Understand various refining processes carried out at industrial level
CO 3. Prepare peanut butter.
CO 4. Evaluate using subjective parameters

1. Determination of physical characteristics of fats, and oils.
2. Chemical analysis of fats and fatty acids.
3. Determination of acid value in oil sample.
4. Preparation of peanut butter.

5. Estimation of specific gravity of oil samples.
6. Processing methods of oil
7. Determination of peroxide value of oil.
8. Determination of free fatty acid of oil.
9. Adulteration of fats and oils.
10. Preparation of mayonnaise.
11. Objective parameters of fat and oils
12. Subjective characteristics of fats and oil.
13. Do It Yourself (DIY) – Innovative oil/fat product development

FOOD ADDITIVES AND PRESERVATIVES (THEORY)

(48 hours)

Course Outcomes:

At the end of the Course, students will be able to

CO 1. Students will understand the chemical and technological properties of relevant food additives used as food improvement.

CO 2. Students learnt the knowledge of the food additives, the reasons of their use in foods and toxicological evaluation.

CO 3. Students will acquire competence in the proper use of additives in safe food production.

UNIT I

(16 hours)

Food additives: Definitions, classification, and function. Role of Food Additives in food preparation and uses in processed food products. Chemical, technological, and toxicological aspects of food additives, pH controllers, salts and chelating/sequestering agents, leavening agents, antioxidants, emulsifying and stabilizing agents, anti-caking agents, thickeners, firming agents, Proteins, starches and lipids as functional ingredient; isolation, modification, specifications, functional properties and applications in foods

UNIT II

(16 hours)

Health and safety aspects of food additives: Present status of various food additives. Controversial food additives Saccharin, history, function, aspartame, nitrite and nitrate compounds, nitrosamines. Additives to improve acceptability, permitted food colors, natural and artificial sweeteners composition, uses, emulsifiers, enzymes, fat replacers, gelling agents, leavening agents, stabilizers, surfactants, tenderizers, texturizers, thickeners, vitamins, nutraceuticals, essential oils and oleoresins viscosity modifiers, whipping agents.

UNIT III

(16 hours)

Food Flavors and Food adulteration: Types of flavours, flavoring constituents, stability of flavours during food processing, analysis of flavours, extraction techniques of flavours, flavours emulsions; flavours Spices and flavors in food industries. Food adulteration, definition, reasons for food adulteration, methods of adulteration, and methods of detection. Normal food adulterants in coffee, tea leaves, edible oil, milk, cereals, spice powders. Adverse effects of food adulterants. Testing, regulations and QC for food additives and preservatives.

FOOD ADDITIVES AND PRESERVATIVES Practical

Course Outcomes:

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

CO 1. Students will understand the chemical and technological properties of relevant food additives used as food improvement.

CO 2. Students learnt the knowledge of the food additives, the reasons of their use in foods and toxicological evaluation.

CO 3. Students will acquire competence in the proper use of additives in safe food production.

1. E-Numbers for different food additives.
2. Qualitative tests for presence of Benzoic acid in food.
3. Role of leavening agents in baked food products.
4. Study of effect of stabilizers/thickeners on quality of foods.
5. Detection of chemical preservatives in foods.
6. Detection of common adulterants present in the food sample.
7. Study of emulsion stability.
8. Study of effect of clarifying agents on fruit juices.
9. Isolation of pectin from food sample.
10. Effect of tenderizing agents on the various food samples.
11. Quantitative estimation of glucose.

References

1) Branen, A.L., Davidson PM & Salminen S. 2001. Food Additives. 2nd Ed. Marcel Dekker.
2) Gerorge, A.B. 1996. Encyclopedia of Food and Color Additives. Vol. III. CRC Press
3) Gerorge, A.B. 2004. Fenaroli's Handbook of Flavor Ingredients. 5th Ed. CRC Press.
4) Madhavi, D.L., Deshpande, S.S & Salunkhe, D.K. 1996. Food Antioxidants: Technological, toxicological and Health Perspective. Marcel Dekker
5) Mahindru, S N (2000) Food Additives- Characteristics Detection and Estimation. Tata Mc Graw Hill Publishing Co. Ltd.

DOMAIN ELECTIVE / OPTIONAL COURSE
SENSORY EVALUATION OF FOOD PRODUCTS

30 hrs

Course Outcomes (COs):

After the successful completion of the course, the student will be able to:

CO1. explain the importance of sensory evaluation in the food industry and its role in product development and quality control.

CO2. demonstrate an understanding of human sensory perception, including the functioning of sensory organs, the concept of thresholds, and sensory adaptation.

CO3. apply different sensory evaluation techniques, such as discrimination tests, descriptive analysis, hedonic evaluation, and consumer tests, to assess and analyse food products.

CO4. gain practical skills in designing and conducting sensory evaluation experiments, including sample preparation, panel selection and training, experimental design, and statistical analysis of sensory data.

CO5. interpret and communicate the results effectively.

Unit 1

Introduction to Sensory Evaluation of Food Products: Definition and Importance of Sensory Evaluation – Understanding the role of sensory evaluation in food product development and quality control. Exploring the significance of sensory attributes in consumer acceptance. Sensory Evaluation Methods – Discrimination tests: paired comparison, triangle test, duo-trio test. Descriptive analysis: profiling sensory attributes using trained panels. Hedonic evaluation: determining consumer preference and liking. Consumer tests: focus groups, surveys, and preference mapping. Sensory Evaluation Experimental Design: Sample preparation and presentation. Randomization and balancing. Control of extraneous variables. Sample size determination.

Unit 3

Sensory Evaluation in Food Industry: Quality Control and Product Development – Sensory evaluation in quality assurance programs. Monitoring product consistency and identifying sensory defects. Using sensory data for product reformulation and improvement. Shelf-Life Studies – Sensory evaluation techniques for determining product stability over time. Sensory attributes affected by storage conditions. Sensory testing protocols for shelf-life determination. Consumer Acceptance and Preference – Understanding consumer preferences and drivers of product acceptance. Application of consumer tests and preference mapping. Consumer research techniques and data analysis. Sensory Evaluation in Marketing – Sensory branding and product positioning. Sensory claims substantiation.

References:

1) Sensory Properties of Foods by Brich G; Brennan J., & Parker K.J., Applied Science Publisher 1977.
2) Food Science by Charley H., Macmillan Publishing Company.
3) Evaluation of food principle & Practice by Lawlers H.T., & Heymann, Chapman & Hall.
4) Sensory Evaluation of food: Statistical methods & procedures by Mahony M.
5) Food Science by Srilakshmi B., New Age International (p) Ltd. Publishers, 2000.
6) Food Science, Chemistry & Experimental Foods by Swaminathan M., Bappco, Ganesh & Company, Madras.

OR

DOMAIN ELECTIVE / OPTIONAL COURSE
FOOD ADULTERATION

30 hrs

Course Outcomes (COs):

After the successful completion of the course, the student will be able to:

CO1. Understand the adulteration of common foods and their adverse impact on health
CO2. Understand the concept of toxicants in foods
CO3. Comprehend certain skills of detecting adulteration of common foods.
CO4. Able to extend their knowledge to other kinds of adulteration, detection and remedies.
CO5. Know the basic laws and procedures regarding food adulteration and consumer protection.

Unit I

15 hrs

Introduction to Food Adulteration: Definition. New adulterants in foods. Common Foods subjected to Adulteration - Adulteration – Definition – Types, Poisonous substances, Natural toxins in food: natural toxins of importance in food- toxins of plant and animal origin; microbial toxins (e.g., bacterial toxins, fungal toxins and Algal toxins); Heavy metals and

radioactive materials; Foreign matter, Cheap substitutes, Spoiled parts. Adulteration through Food Additives – Intentional and incidental. General Impact on Human Health. Methods of Detection of Adulterants in the following Foods: Milk, Oil, Grain, Sugar, Spices and condiments, Processed food, Fruits and vegetables. Additives and Sweetening agents (at least three methods of detection for each food item).

Unit II

15 hrs

Laws and Procedures on Adulteration: Highlights of Food Safety and Standards Act 2006 (FSSAI) – Food Safety and Standards Authority of India–Rules and Procedures of Local Authorities. Role of voluntary agencies such as AGMARK, ISI. Quality control laboratories of companies, Private testing laboratories, Quality control laboratories of consumer co-operatives. Consumer education, Consumer's problems rights and responsibilities, COPRA 2019 – Offenses and Penalties – Procedures to Complain –
Compensation to Victims

References:

1) A first course in Food Analysis by A.Y. Sathe, New Age International (P) Ltd.,1999
2) Food Safety, case studies by Rames V. Bhat, NIN,1992
3) DART- Detect adulteration with rapid test. FASSAI, Imprinting Trust, assuring safe and nutritious food, Ministry of Health and Family Welfare, Government of India.
4) Rapid detection of food adulterants and contaminants Theory and Practice by S. N. Jh, Kindle Edition, 2016
5) Food Safety and Standards Act, 2006. Bare ACT, Commercial law publishers, 2020.
6) Food Toxicology by Helferich, W., and Winter, C.K, CRC Press, LLC. Boca Raton, FL. 2007.
7) Introduction to Food Toxicology by Shibamoto, T., and Bjeldanes, L., 2nd Edition. Elsevier Inc., Burlington, MA. 2009
8) Natural Toxicants in Food by Watson, D.H., CRC Press, LLC. Boca Raton, FL1998.

COMPULSORY SKILL-BASED COURSE
PEST MANAGEMENT OF STORED FOOD

UNIT I

(15 hours)

Principles of construction of scientific metallic & non-metallic storage structures & their specifications. Mode of Action of insecticides, rodenticides & fungicides. Tolerance limit of pesticide residues, antidotes and precautions and safe handling of pesticides. Insect pest of stored grain and milled products, Integrated Insect Pest Management, Sources and detection of infestation in stored food grains. Identification of rats and Management. Termite and their control, Control of household pests. Toxic contaminants in food grains, their ill effect and prevention.

UNIT II

(15 hours)

General Principles of fumigation, different type of fumigations with MBr, Alp and Precautions in their use. Insecticide Act, Consumer protection Act & Stress Management. Role and function of Warehousing Development and Regulatory Authority and negotiability of Warehouse Receipt. Role of regulation agencies & responsibilities of fumigation operators. Stack/Container/Ship fumigation. Maintenance of Fumigation records.

References

1) Chattopadhyay SB. 1985. Principles and Procedures of Plant Protection. Oxford & IBH, New Delhi.
2) Dhaliwal GS & Arora R. 2001. Integrated Pest Management: Concepts and Approaches. Kalyani Publ., New Delhi.
3) Duntson PA. 2004. The Insects: Structure, Function and Biodiversity. Kalyani Publ., New Delhi.
4) Evans JW. 2004. Outlines of Agricultural Entomology. Asiatic Publ., New Delhi.
5) Jerry Heeps (2006) Insect Management for Food Storage and Processing, Second Edition, Elsevier, eBook ISBN: 9780128104293.
6) Patnaik BD. 2002. Physiology of Insects. Dominant, New Delhi.
7) Saxena AB. 2003. Biological Control of Insect Pests. Anmol Publ., New Delhi.

Model Question Paper (Theory)

I Semester B.Sc. (Food Technology) Degree
Examination Month & Year
COURSE CODE AND TITLE

Time: 3 Hours Max. Marks: 80

PART – A

1. Answer in brief on any **ten** of the following: (10x2=20)

a)
b)
c)
d)
e)
f)
g)
h)
i)
j)
k)
l)

PART – B

Answer any four of the following choosing one full question from each unit: (4x15=60)

UNIT – 1

2.
a)
b)
c)

(3+5+7=15)

OR

3.
a)
b)
c)

(3+5+7=15)

UNIT – 2

4.
a)
b)
c)

(4+4+7=15)

OR

5.

a)
b)
c)

(4+4+7=15)

UNIT – 3

6.
a)
b)
c)

(4+4+7=15)

OR

7.
a)
b)
c)

(4+4+7=15)

UNIT – 4

8.
a)
b)
c)

(3+5+7=15)

OR

9.
a)
b)
c)

(4+4+7=15)

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Model Question Paper (Theory)

I Semester B.Sc. (Food Technology) Degree
Examination Month & Year
COURSE CODE AND TITLE

Time: 1½ Hours Max. Marks: 40

PART – A

1. Answer in brief on any five of the following: (5x2=10)

a)
b)
c)
d)
e)
f)

PART – B

Answer any two of the following choosing one full question from each unit: (2x15=30)

UNIT – 1

2.
a)
b)
c)

(3+5+7=15)

OR

3.
a)
b)
c)

(3+5+7=15)

UNIT – 2

4.
a)
b)
c)

(4+4+7=15)

OR

5.
a)
b)
c)

(4+4+7=15)

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MODEL QUESTION PAPER
I Semester B.Sc. (Food Technology) Degree Practical Examination Month & Year
COURSE CODE AND TITLE

Time: Max. Marks: 40

I. Major: 10 marks
1.
2.
3.

II. Minor: 5 marks
1.
2.

III. Procedure writing: 5 marks
1.
2.
3.
4.

IV. Spotters: 5×2=10 marks
a.
b.
c.
d.
e.

V. Viva. 5 marks

VI. Record. 5 marks

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