



ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

Programme: B.Sc. Honours in Food Science & Technology (Major)

w.e.f. AY 2023-24

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
I	I	1	Introduction to Food Science and Nutrition	3+2	4
		2	Health, Hygiene & Wellness	3+2	4
	II	3	Food Biochemistry	3	3
			Food Biochemistry Practical Course	2	1
		4	Human Nutrition	3	3
			Human Nutrition Practical Course	2	1
II	III	5	Food Microbiology	3	3
			Food Microbiology Practical Course	2	1
		6	Chemistry of Fats and oils	3	3
			Chemistry of Fats and oils Practical Course	2	1
		7	Diary Technology	3	3
			Diary Technology Practical Course	2	1
	8	Confectionery Technology	3	3	
		Confectionery Technology Practical Course	2	1	
	IV	9	Food Additives and toxicology	3	3
			Food Additives and toxicology Practical Course	2	1
		10	Food Packaging	3	3
			Food Packaging Practical Course	2	1
		11	Technology of Cereals Pulses and Oil Seeds	3	3
			Technology of Cereals Pulses and Oil Seeds Practical Course	2	1
	III	V	12	Food Safety and Quality Control	3
Food Safety and Quality Control Practical Course				2	1
13			Baking Science & Technology	3	3
			Baking Science & Technology Practical	2	1

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
			Course		
		14A	Technology of Meat, Fish Poultry and their Products	3	3
			Technology of Meat, Fish Poultry and their Products Practical Course	2	1
		OR			
		14 B	Food Process engineering	3	3
			Food Process engineering Practical Course	2	1
		15 A	Technology Fruits, Vegetable and Plantation Crops	3	3
			Technology Fruits, Vegetable and Plantation Crops Practical Course	2	1
		OR			
		15 B	Fermentation Technology	3	3
			Fermentation Technology Practical Course	2	1
	VI	Internship			
	VII		Courses will be available in due course of time		
	VIII		Courses will be available in due course of time		

SEMESTER-I

COURSE 1: INTRODUCTION TO FOOD SCIENCE AND NUTRITION

Theory

Credits: 4

5 hrs/week

Objectives

- Understanding the role of foods in our daily life
- To gain knowledge of different plant and animal derived foods and their nutritive values and properties
- Understand the vital link between nutrition and health.

Course Outcome: On completion of the course, the students shall display ability to/ knowledge about

- Design food products that meet the various food regulations and laws.
- Comprehend the idea of food safety of the product and preserving it in good condition
- Plan adequate meals for different stages of life cycle to maintain health.
- Principles of diet therapy and different therapeutic diets.

UNIT – I

- Introduction to nutrition – Definition of nutrition, nutrients, and Food.
- Functions Of Food – Physiological, Social, Psychological and Emotional.
- Food Groups— Sources and functions of Basic five food groups.

UNIT- II

- Classification of Nutrients- Macronutrients and Micronutrients- Sources and functions.
- My Plate, Food Pyramid and portion size- Definition and Illustration
- Inter relationship between Food , nutrition and health.

UNIT-III

- Nutrition during Life cycle- Nutritional requirement for all age groups.
- Nutritional requirement during – Pregnancy, Lactation.
- Nutritional requirement during Childhood – Infancy (weaning) and school going.
- Nutritional requirements of youngsters- Adolescents and Adults.
- Geriatric Nutrition- Physiological changes and nutritional requirement.

UNIT- IV

- Nutrition During Disease- Classification of Diseases- Communicable and Non-Communicable, mode of transmission.
- Communicable diseases- Types, Diet and lifestyle modifications.
- Non-Communicable diseases- Types, Diet and lifestyle modifications.
- Relation Between Immunity, Health and Nutrition.

Unit -V

Research and standards organization of Food Science and Food Technology-

- Role and Function of the organizations.
- Nutritional research organization- ICMR-NIN, NNMB.
- Food Technology research organization- AFSTI, CFTRI, DFRL, NIFTEM.
- Food Standards- FSSAI, AMARK, FPO, MMPO.

References:

1. Food Facts & Principles by Shakunthala manay & Shadakhraswamy.
2. Food Science by Srilakshmi , second edition,2002
3. Food science, Chemistry and Experimental foods by M. Swaminathan.
4. Food Science by Norman.N.Potter.
5. Experimental study of Foods by Griswold R.M.
6. Food Science by Helen Charley.
7. Vijaya Khader, Text book of food science and technology, Indian council of Agricultural research New Delhi, 2001.
8. Stainley Sacharous. Roger C Griffin. Principles of food packaging 2nd Ed. Avi pub Co. Westport.
9. F.A. & Paine. H.Y. Leonard hill. A hand book of food packaging. Blackie Sons Ltd London.

Recommended Activities

- Visits to food industries
- Market survey of preserved fruits and vegetable products.
- Visit to food testing lab or any agency of food standards.

SEMESTER-I

COURSE 2: HEALTH, HYGIENE & WELLNESS

Theory

Credits: 4

5 hrs/week

Learning Outcome: On completion of the course a student shall

- Possess an understanding of the concept of good health and means to achieve it.
- Display the ability to identify the morphology, growth and reproductive features of various microorganisms
- Acquire the skills in various sterilization techniques

Theory

Unit I Health & wellness – Definition & meaning

- Dimension/ Elements of health and wellness – Physical, Social, Emotional, Intellectual, and Spiritual.
- Factors affecting Health and Wellness
- Indicators of health- concept of Mortality, Morbidity, Disability

Unit II Classification & Study of Microorganisms- in terms of morphology, growth, Nutrition and Reproduction

- Bacteria, Virus, Yeasts, Algae and Mould
- Beneficial Applications of Microorganisms in Food Industry, Agriculture and other areas.

Unit III Mode of infection

- Infection- sources, mode of transmission.
- Diseases caused by microorganisms-Symptoms, aetiology, mode of transmission of
 - a. Bacterial diseases- Typhoid, Tuberculosis, Jaundice, Dysentery;
 - b. Viral Diseases: Influenza, Measles, Poliomyelitis, AIDS
 - c. Parasite transmitted diseases- Malaria, Dengue, Filariasis.

Unit IV Prevention & Control

- Control of Micro-organisms – Sanitation, Sterilization & Disinfection- Physical and chemical method.
- Immunity- definition & types, Immunization schedule
- Hygiene - Meaning and importance of personal hygiene
- Standard precautions to prevent infections

Unit V Management of Health & Wellness

- Modern lifestyle and hypo-kinetic diseases; prevention and management through Physical exercise
- Stress, anxiety, and depression- Definition and concept
- Role of Yoga, asanas and meditation in maintaining health and wellness.
- Role of sleep-in maintenance of physical and mental health.

Suggested Activities

1. Demonstration of the use and care of Microscope
2. Demonstration of the Microscopic observation of different Microorganism
3. Visit to Diagnostic Laboratory
4. Demonstration of Slide Preparation & staining of molds.
5. Study of permanent slides of parasites.
6. Visit to Water treatment plant/Milk factories to assess sanitation
7. Hanging drop preparation to observe true motility of bacteria
8. First aid during cut, fractures, burns, accidents, shocks, unconscious, convulsions, Poisoning, foreign bodies in the eyes

References:

1. Frazier, W. Candwestnoff, D.C (1997) Food Microbiology, Tata McGraw Hill
2. A.S. Rao 2001 Introduction to microbiology, Prentice Hall of India
3. Anna k. Joshua, Microbiology, popular book depot, Madras
4. R. Ananthanarayanan, C.K.J. Paniker, 2001, Orient Longman Private Limited.
5. General Microbiology , 1982, power &Daginawala, Himalaya Publishing House
6. Stanier R. Y., Adelberg, E.A. and Ingraham, J.L. (1989) General Microbiology.
7. Atlas R. M. (1988) Microbiology, fundamentals and application. Micmillon N. Y.

SEMESTER-II

COURSE 3: FOOD BIOCHEMISTRY

Theory

Credits: 3

3 hrs/week

Learning Objectives

1. Understand the basic concepts of biomolecules.
2. Explore the concepts of Enzymes and techniques.

Learning Outcomes

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

LO1: To Study about Classification structure and functions of Carbohydrates.

LO2: To Study about classification structure and function of Proteins

LO3: To Study about classification, structure and functions of lipids

LO4: To Study about Classification and specificity of Enzymes.

LO5: To know about the Fundamental properties of water classification of vitamins and minerals

UNIT –I

Carbohydrates: -Definition structure and isomerism: Classification, properties and uses of monosaccharides, disaccharides, oligosaccharides and polysaccharides and their uses – Reactions of carbohydrates: Hydrolysis, acyclic reactions, dehydration/ thermal degradation, gelatinization caramelization. Hydrophilicity, flavor ligands, Browning, Sweetness. Functions of Polysaccharides: Starch, Cellulose, hemi-cellulose, pentosans, pectin, gums (Alginates, carrageenan, locust bean gum, xanthum gum). Digestion & absorption of carbohydrates.

Unit – II

Proteins: - Amino Acids: classification, chemical properties. Peptides and Proteins: Primary Structure- Spatial relation- Denaturation. Functional Properties: Hydration, Solubility, Viscosity, Gelatin, Texturization, Emulsification, Foaming. Nutritional Properties. Protein Modification /

Processing and storage. Millard reactions. Oxidation of amino acids, De-amination. Oxidative and non-oxidative deamination, transamination, deamination, removal of carboxylic group, Carbon skeleton metabolism. Digestion & Absorption of proteins.

Unit – III

Lipids:-Lipids-definition, classification with examples source and functions of fatty acids, Glycerides- Phospholipids and sterols Physical Aspects: Triacylglycerol Distribution, Positional Distribution, Consistency, Emulsions and emulsifiers-Chemical Aspects: Lipolysis, Auto oxidation, Thermal decomposition, Chemistry of frying. Digestion & Absorption of fats.

Unit- IV

Enzymes:-Definition, holo enzyme, apoenzyme, zymogene forms classification, specificity, catalysis and regulations- Factors influencing activity: Temperature, p^H , water activity and ionic strength/ electrolytes-Mechanisms of enzyme inhibition & enzyme activation - endogenous enzymes: pectic enzymes, amylases, cathepsins and enzymatic browning. cofactors & co enzyme with examples

Unit – V

Basic Principles and techniques- Fundamental Properties/ Structure: Ice, Water- Availability in foods: Water composition, Isotherms – Effect of Water Activity on Food stability (Shelf life).

Principle & uses of all analytical methods. (Chromatography, Electrophoresis, and Spectrophotometer).

REFERENCES

1. Pomeranz Y and Meloan C E., “Food Analysis: Theory and Practice”, 3rd Edition, CBS Publishers, New Delhi, 1996.
2. Nielsen S S., “Introduction to the chemical analysis of foods”, Jones and Bartlett Publishers, London., 1994.
3. Nielsen S S., “Food Analysis Laboratory Manual”, Chips Ltd, USA. 2003.
4. Principles of Biochemistry: Lehninger AL. CBS Publication, New Delhi.
5. Biochemistry: Voet O ,Voet G, John Wiley and Sons Publications. 1994
6. Biochemistry: Stryer L . 4th Edition, 1994
7. Biochemistry :Zubay G . William C Brown , New York. 1997

SEMESTER-II

COURSE 3: FOOD BIOCHEMISTRY

Practical

Credits: 1

2 hrs/week

1. Estimation of Titrable acidity in foods
2. Estimation of Moisture and total solids analysis
 - a. Karl Fischer titration
3. Estimation of Sugars – Reducing, non reducing, total sugars
4. Estimation of Protein by Kjeldhal Method.
5. Estimation of Fat
 - a. Soxhlet method
 - b. Rosegotlib method
6. Estimation of Ash and Acid insoluble ash
7. Determination of Water activity of different food samples
8. Qualitative tests for amino acids.
9. Qualitative tests for proteins.
10. Estimation of minerals a) calcium) phosphorous (Fiske&subbarow),c)iron(wongs)
11. Estimation of vitamins a) ascorbic acid)
12. Fatty acid model for unsaturation
13. Paper chromatography-amino acid detection.
14. Estimation for maltose-DNase method.

SEMESTER-II
COURSE 4: HUMAN NUTRITION

Theory

Credits: 3

3 hrs/week

Learning Objectives

To familiarize with the concepts of nutrition

Learning Outcomes

Upon successful completion of the course, the students will be able to

LO1: To Understand about Nutrition, and importance of food for Health

LO2: To Analyze about different vitamins and minerals and their importance

LO3: To know about Balanced diet and Recommended Dietary Allowances

LO4: To study about diet surveys and Vitamin Deficiency Control Programmes

LO5: To gain knowledge about International agencies like WHO, FAO, UNICEF and CARE

Unit – I

Introduction to human nutrition- basic definition of nutrition, health, nutrients. Principles compounds in foods- classification of foods, sources, functions and deficiency symptoms of carbohydrates, proteins, fat, vitamins and minerals.

Unit – II

Nutritional requirements for different age groups – infant, pre-school children, school going children, adolescents, adults, old age, pregnancy, lactation and industrial workers; recommended dietary allowances (RDA) for different age groups.

Unit – III

Classification of foods, their Nutritive value, effect of processing on nutritive value of foods- obesity, food faddism and faulty food habits- toxicants naturally occurring in foods- food adulteration.

Unit – IV

Food production and consumption pattern in different parts of India – food requirements and availability- applied nutrition programme, diet and nutrition in India.

Unit – V

Prevention of malnutrition in developing countries- nutritive value of common Indian recipes- therapeutic diets – food allergy- processed supplementary foods and novel foods.

References:

1. Dietetics (2007) by B. Srilakshmi.
2. ICMR (2010). Nutrient Requirements and Recommended Dietary Allowances for Indians
3. Text Book of Human Nutrition (2010) by Bamji
4. Essentials of Human Nutrition (2007) by A.S.Truswell.
5. Nutrition & Dietetics 3rd edition Subhangini Joshi
6. Oxford Handbook of Nutrition and Dietetics (2012) Joan Webster
7. Srilakshmi (2007). Food Science, 4th Edition. New Age International Ltd
8. IFCT (2017) Indian Food Composition Tables

SEMESTER-II

COURSE 4: HUMAN NUTRITION

Practical

Credits: 1

2 hrs/week

1. Identification of food sources for various nutrients using food composition tables.
2. Record diet of self-using 24 hour dietary recall and its nutritional analysis.
3. Introduction to meal planning, concept of food exchange system.
4. Estimation of BMI and other nutritional status parameters.
5. Planning meals for adults of different activity levels for various income groups.
6. Survey of locally available foods and identifying the key nutrients
7. Estimation of BMI and other nutritional status parameters.
8. Formulation of weaning foods
9. Planning and preparation of diets for aged people

SEMESTER-III
COURSE 5: FOOD MICROBIOLOGY

Theory

Credits: 3

3 hrs/week

Learning Objectives

To introduce the fundamental concepts of microbiology.

Learning Outcomes

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

LO1: To understand about scope of microbiology & classification of micro organisms & sterilization methods.

LO2: To study about the prokaryotic cells like bacteria, yeast, molds & viruses which are associated with food.

LO3: To learn about physical & chemical factors affecting growth of micro organisms.

LO4: To understand about metabolism & growth of micro organisms.

LO5: To study bacterial genetics & mutation.

UNIT – I

Historical aspects, Scope of microbiology, General classification of microorganisms, morphology, Structure and function of prokaryotic cells and their organelles – Structure and function of eukaryotic cells and their organelles morphological and biochemical characteristics of important groups. Brief survey of microbes as friends and foes. Characteristics, growth and reproduction, Sterilization and disinfections.

UNIT – II

Characteristics of growth and reproduction. Physical and chemical factors affecting growth of microorganisms like temperature, pH, oxygen, Osmotic pressure, nutrients etc, bacteriostatic and

bactericidal. Physiology, Nutritional requirement of bacteria, yeast and fungi, bacterial growth curve. Structure of DNA, Types of RNA and difference between DNA & RNA.

UNIT – III

Microorganisms associated with foods, Sources of microorganisms – Soil, water, plants and of animal origin. Useful microorganisms – Endospore formers, Irregular non-sporing gram positive rods. Yeasts & molds their role in food spoilage, Estimating number of microorganisms, sampling, sample size. Aseptic collection of samples, total cell counts and viable cell counts, plate counters. Indicator organisms. Alternative and Rapid methods for detection of specific microbes and toxins : Dye-reduction tests, Electrical methods, ATP determination – Pure cultures-preparation, maintenance and preservation – Microbiological quality control and HACCP

UNIT – IV

Microbiology of Food commodities, Contamination, preservation and spoilage & beneficial role of microorganisms in Cereals, Pulses, Nuts and Oilseeds, Fruits and Fruit products, Vegetables and Vegetable products Meat, dairy and their products.

Microbiology of water- Contamination and microbial standards.

Food Borne Illnesses Food poisoning, Food borne infections, Food borne Intoxications (*Aeromonashydrophila*, *Bacillus cereus*, *Brucella*, *Camphylobacter*, *Clostridium botulinum*, *Clostridium perfringenes*, *Escherichia coli*, *Salmonella*, *Staphylococcus aureus*, *vibrio*, *yersinia*, *Listeria*) Hepatitis A and B Gastroenteritis viruses.

Spongiform encephalopathy - occurrence, symptoms, Preventive and control measures

UNIT – V

Food preservation Heat processing: Pasteurization and appertization, Determination of D and z values. Heat sensitivity of micro-organisms & Spoilage of canned foods. Aseptic packaging, Irradiation Brief account of microwave, UV and ionizing radiation. Brief account of High pressure

processing Low temperature storage –Chilling and freezing. Effect of chemical and natural preservatives on microbes in food.

REFERENCES:

1. General microbiology – Pelzar
2. Food Microbiology – Frazier
3. Molecular biology of the Cell – Bruce Alberts
4. Cell and molecular biology – De Robertis&De Robertis
5. W.C.Frazier: *Food Microbiology (IV edition)*Mcgraw Hill Book Company, New York (1995)
6. James M jay: *Modern food microbiology IV edition*, CBS publishers, New Delhi (1996)
7. M.R. Adams and M.O. Moss, *Food Microbiology*, Second Edition, Panima Publishing corporation, New Delhi. Third reprint 2004.
8. Gustavo F Gutierrez-Lopez, Gustavo V Barbosa-Canovas *Food Science and Food Biotechnology: CRCPress 2003*
9. Bibek Ray: *Fundamental Food Microbiology*, (Third Edition) CRC Press December 2003

SEMESTER-III
COURSE 5: FOOD MICROBIOLOGY

Practical

Credits: 1

2 hrs/week

1. Identification of microbes by Simple staining
2. Identification of microbes by Gram staining
3. Microbial mobility test (hanging drop method)
4. Determination of size of microbes (micrometry)
5. Direct microscopic count (DMC) of microorganisms
6. Identification of common microorganisms.
7. Identification of fungi in bread, pickles, jam, groundnut etc.
8. Microbiological examination of fresh fruits, vegetables and spices.
9. Microbiological examination of canned foods (acidic and non-acidic foods)
10. Microbiological examination of bottled and aseptically packed beverages
 - a. water (MPN method for determination of coliform count)
11. Microbiological examination of flour, bread, cakes, sugar and cocoa confectionery products
12. Microbiological examination of meat, milk and their products
13. Visit to food microbiology lab.

SEMESTER-III
COURSE 6: CHEMISTRY OF FATS AND OILS

Theory

Credits: 3

3 hrs/week

Learning Objectives

To study the composition, chemistry and processing aspects of oils and fats

Learning Outcomes

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

LO1: To study about the composition & classification of fats.

LO2: To study about the nutritional aspects & characteristics of fats.

LO3: To know about the processing aspects of fats.

LO4: To gain knowledge about the various value added products from facts of technologies to improve.

LO5: To understand the utilization of byproducts from oil & fat industry.

Unit – I

Composition & Classification of Fats

Fat - Definition, Importance, Chemical composition of fats, Triglycerides – their structure and composition, Mono glycerides and diglycerides, Free fatty acids – phosphatides, Sterols – fatty alcohols, Tocopherols

Unit – II

Characteristics of fat

Nutritional aspects of fats and oils, Metabolism – fat level in the diet and effect on health , Non-allergenicity of edible oils, Fat reduction in foods, Factors affecting physical characteristics of fats and oils, Chemical reactions of fats and fatty acids, Important characteristics of oils from coconut, cotton seeds, Palm, Sunflower, sesame, safflower, rice bran, rape seed, Mustard, Linseed, soybean, castor and lard

Unit – III

Processing of fats

Processing methods of oils – Degumming, refining, bleaching, Deodorizing, fractionation, Hydrogenation, inter esterification & esterification, Common products preparation – Salad and cooking oils, shortenings (baking and frying fats), Hard butters, margarine and spreads, Dressings for food -(Mayonnaise and Salad dressings), Pourable – type dressings, reduced calorie dressing, Toppings, coffee whiteners, confectionaries coatings, Low Fat spreads for traditional breakfast foods

Unit – IV

Value Added Products from fats

Growing demands on oils & lipids from traditional and convenience food markets in terms of quality,

Functional, sensory and nutritional strengths, Technologies to improve the edible oil pool in India,

Stability of oils and fats, Value added products from vegetable oil refining industry: lecithin, wax, Value added products from vegetable oil refining industry: Vitamin-E, oryzanol, Alternative methods for extraction & processing of oils

UNIT-V

By Product Utilization

Value added products from non-traditional oils and fats, By-products from bran oil and oil refining industry, Utilization of lingo cellulosic waste from oil industry, Bakery fats with zero trans fatty acids, Refining procedures for edible oils with a note on analytical techniques in lipids

REFERENCES

- 1) D.Swern, “Bailey’s industrial oils and fat products” Wiley Inter Science Publications, New york
- 2) B.B. Min & C.C Akoh, “Food lipids” Marcel & Decker Publishers,1998.
- 3) D.B. Min, R.E. McDonald, “Food Lipids and Health”, Marcel & Decker Publishers, 1996.

SEMESTER-III

COURSE 6: CHEMISTRY OF FATS AND OILS

Practical

Credits: 1

2 hrs/week

- Common Test methods for Fats
 - 1) Cold Test
 - 2) Colour, (Lovibond)
 - 3) Dropping point
 - 4) Flavour
 - 5) FFA
 - 6) Melting Point
 - 7) Oil stability index
 - 8) Peroxide Value
 - 9) solid fat index
 - 10) Solid fat content
 - 11) Total lipids and thiobarbituric acid reactive substances (TBARS)
 - 12) Karl-Fischer titration- application
- B) Oil Seeds
 1. Experimental expeller processing
 2. Experimental solvent extraction
 3. Production of protein concentrates and isolates.
 4. Lab model hydrogenator (for hydrogenation of vegetable oils).
 5. Visit to oil mills

SEMESTER-III
COURSE 7: DAIRY TECHNOLOGY

Theory

Credits: 3

3 hrs/week

Learning Objectives

To study the composition and manufacture of dairy products

Learning Outcomes

Upon successful completion of the course, the students will be able to

LO1: To study about the different methods of processing.

LO2: To study about the knowledge

LO3: The understanding about freezing food industry.

LO4: To understand about micro organisms.

LO5: To understand about sterilization method.

UNIT-I

Processing of Milk

- Milk Industries in India – Role of operation flood program
- Definition of milk – Source as food composition and nutritive value
- Physical and Chemical Properties of milk
- Processing of milk: Receiving of milk, Platform tests, Filtration and
- Clarification, Standardization
- Pasteurization methods– Sterilization methods,

- Homogenization, Packaging and distribution of milk
- Definition – Standardized milk, Single toned, Double toned milk

- Manufacture and shelf life of Sterilized bottle milk and flavored milk

UNIT-II

Cream & Butter

- Cream – cream separation, cream separator,
- Methods of cream separation-
- Factors governing richness of cream, factors governing fat percentage.
- Butter- introduction, composition process involved, cream neutralization, addition of starter cultures, cream ripening, churning, packing of butter
- Packing- factors influencing churning, over-run in butter,
- Butter defects- their causes and prevention.

UNIT- III

Cheese

- Cheese- introduction, history, definition,
- Classification, composition, nutritive value, legal standards.
- Manufacturing of cheddar cheese, their defects and control
- Manufacture of processed cheese their defects and control
- Manufacture of Swiss cheese and their defects and control
- Manufacture of cottage cheese, their defects and control.

UNIT – IV

Concentrated & Dehydrated Milk Products

- Condensed milk- history, composition, and types
- Methods of manufacture, vacuum pan condensing, and defects in condensed milk.
- Dried milk (Milk Powder)- history, types, composition of dried milk-
- Methods of manufacture- drum drying, spray drying, freeze-drying,

- Packaging of milk powder- Properties of dry milk- bulk density, solubility, solubility index, wettability, dispersability-
- Defects in dried milk, Reconstitution- instant milk powder-
- Malted milk beverages like horlicks, viva, etc.

UNIT- V

Ice Cream

- Ice cream – history, definition, classification, composition
- Ingredients sweeteners, stabilizers, flavours, etc-
- Preparation of ice cream, calculation of ice cream mix,
- Pasteurization of milk, homogenization, ageing, freezing, packaging of ice cream-defects and over run in ice cream.
- Indigenous milk products:
Rabri, kheer, channa, paneer, rasogolla, ghee, khoa, Kalakhand, srikhand & lassi
- Methods of preparation of Indigenous milk products & composition.
- Cultured milk products: Dahi / Yoghurt – their composition,
- Changes in constituents during fermentation and flavor development.

REFERENCES

1. Sukumar De, “Outlines of Dairy Technology, Oxford Univ. Press, 1980.
2. Aneja RP, Mathur BN, Chandan RC & Banerjee AK. “ Technology of Indian Milk Products”, Dairy India Publications, 2002.
3. Rathore NS et.al. “ Fundamentals of Dairy Technology – Theory & Practises”, Himanshu Pub., 2008.
4. Henderson JL, “Fluid Milk Industry”, AVI Pub.1971.
5. Web BH, Johnson AH & Lford JA, “ Fundamentals of Dairy Chemistry”, 3rd Edition. AVI Pub.1987.

SEMESTER-III
COURSE 7: DAIRY TECHNOLOGY

Practical

Credits: 1

2 hrs/week

- Determination of pH, Specific gravity in milk
- Estimation of Fat and Total Solids (TS)
- Estimation of Solids-Not-Fat (SNF) in milk.
- Estimation of Protein and Casein in milk.
- Detection of Adulterants in milk.
- Detection of Preservatives in milk.
- Preparation of Milk Products.
- Quality Evaluation of Milk Products.
- Cream Separation using Separator
- Visit to Milk Chilling and Processing Center

SEMESTER-III

COURSE 8: CONFECTIONERY TECHNOLOGY

Theory

Credits: 3

3 hrs/week

Learning Objectives

To understand composition and manufacture of various confections

Learning Outcomes:

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

LO1: To gain knowledge about the status of confectionery industries & information about sugar.

LO2: To learn about the various ingredients used in confectionery product.

LO3: To learn the manufacturing methods of chocolates.

LO4: To study the technology & ingredients involved in production of jams & jellies.

LO5: To understand the causes of cereal bars.

UNIT –I

Status of confectionery industries in India – Types of sugar: granulated, Caster, Icing, Liquid sugars, Brown Sugars, Molasses, and microcrystalline sugars. Composition of sugars- Properties of sugar and sugar solutions – Glucose syrups and refined glucose syrups in sugar confectionery manufacture.

UNIT –II

Oils and Fats – uses in confectionery items, Milk and related products, Composition of milk and functional properties of its major components, Application of milk and milk based ingredients. Colors – Factors influencing choice – natural and Synthetics colors. Flavoring - Natural and Artificial – Flavor Strength, factors effecting stability of flavoring compounds. General technical aspects of industrial sugar confectionery manufacture, Compositional effects, change of state, evaporation, sweetness and taste.

UNIT – III

Manufacture of hard-boiled sweets: ingredients, Prevention of recrystallization and stickiness, Manufacturing methods of toffee and fudge, Product types: Caramel, toffee and fudge: -
Ingredients, Structure of toffee, formulation, processing, toffee stability. Cocoa beans, cocoa fruit, pulp. Cocoa chocolate and related products: Sequence of processes, Chocolate recipes, Cocoa powder, mixing, refining and conching, tempering of chocolates.

UNIT-IV

Gums and Jellies: Technology and Chemistry of hydrocolloids, Hydrocolloid pretreatment process, Liquor preparation, shaping, drying, finishing treatment, re-work, common faults, causes and cures. Liquorices paste, cream paste and aerated confectionery, Ingredients of liquorices paste and manufacture, ingredients of cream paste, Manufacture and extrusion of cream paste. Liquorices all shorts, aerated confectionery, Methods of aeration – Marshmallow – Nougat.

UNIT – V

Tablets, Lozenges and Sugar panning: Tablets granulation, ingredients compression, lozenges, Sugar panning, hard panning soft panning, polishing. Additional panning techniques. Chewing gums technology: Gum base, sugar, flavors, humectants, Fruit acids, sugar-free chewing gum ingredients, formulation Chewing gum mixing, count line components, Manufacturing of count-lines, Cereal bars.

REFERENCES

1. Sugar Confectionery Manufacture E.B. Jackson, 2nd edition, 1995 Blackie Academic and Professional, Glasgow.
2. Sugar Confectionery and Chocolate Manufacture: R.Lees 197 Leonard Hill Books, International Text Book Company Limited.
3. Meade-Chen Cae Sugar Handbook :Chen, J C PO,11th edition,1985 John Wiley and Sons, New York
4. Sugar Technology for Students Lionnet, G R E, 1999 Lang Fred, Durban, S.Africa

SEMESTER-III
COURSE 8: CONFECTIONERY TECHNOLOGY

Practical

Credits: 1

2 hrs/week

1. Analysis of sucrose (Liquid and sugar Crystals)
2. Analysis of confectionery products
3. Handling of processing equipment in sugar confectionery
4. Preparation of Hard boiled sweets
5. Preparation of Chocolate syrup and moulded chocolates
6. Preparation of Fudge
7. Preparation of fondant
8. Preparation of marshmallow
9. Study of working principles of Evaporator,
10. Study of working principles of Crystallizer and Centrifugal machines
11. Visit to the Sugar Confectionary Industry.
12. Cost benefit analysis of Confectionery industry

SEMESTER-IV

COURSE 9: FOOD ADDITIVES AND TOXICOLOGY

Theory

Credits: 3

3 hrs/week

Learning Objectives:

To familiarize with concepts of food additives and toxicology

Learning Outcomes: On successful completion of the course, students will be able to

LO1: To learn about the effective processing on vitamins.

LO2: To study about the flavoring agents & nutritional, preservatives.

LO3: To know about the food colors & sources.

LO4: To learn about the fruits & vegetables composition.

LO5: To understand milk and egg composition and processing effects

Unit – I

Vitamins - Classification, Structure, Sources, Functions, Deficiencies; Minerals- Types, Sources, Functions, Deficiencies, Effect of Processing on vitamins

Unit – II

Introduction to food additives- classifications, nutritional, preservatives/ antimicrobial agents, antioxidants, flavoring agents, sweeteners, enzymes, p^H controls agents and acidulants. Food additives and hypersensitivity. Risks and benefits of different food additives. Food dispersions, solutions, gels, emulsions and foams.

Unit – III

Food colours- sources of food colours, types with reference to natural and synthetic, properties/ reactions reference to processing, food applications. Food flavours- natural, natural identical and synthetic – Flavour enhancers and potentiators and applications

Unit – IV

Fruits & Vegetables Composition, Physico-Chemical Properties, Textural Components; Post Harvest Changes In Fruits And Vegetables- Respiration, Ripening, Colour and Textural Changes, Changes In Fats And Organic Acids.

Unit – V

Chemistry of milk and its constituents- compositions, effect of processing on constituents (heating, fermentation, freezing, homogenization); Egg- composition, proteins of egg, effects of processing on egg and their constituents.

References:

1. Food Chemistry : Mayer , CBS Publications
2. Food Chemistry : Fennema
3. Food Science : Sri Lakshmi
4. Food Science : Potter
5. Dairy Chemistry : Mathur
6. Food & Nutrition : M.S. Swaminathan Vol- I & II
7. Fruit & Vegetable Preservation
8. Principles & Practic : Srivastava R.P, III edition, IBDC Publishers

SEMESTER-IV

COURSE 9: FOOD ADDITIVES AND TOXICOLOGY

Practical

Credits: 1

2 hrs/week

1. Estimation of crude fiber
2. Estimation of Chlorophyll content
3. Estimation of carotenoids
4. Extraction of colors from native source
5. Estimation of calcium in foods
6. Estimation of iron in foods
7. Estimation of total soluble solids using refractometer
8. Estimation of NaCl in butter, pickles and processed foods
9. Estimation of energy content in Foods
10. Visit to food industry / Quality Control lab
11. Fruit & Vegetable Preservation

SEMESTER-IV
COURSE 10: FOOD PACKAGING

Theory

Credits: 3

3 hrs/week

Learning Objective:

To familiarize with the concepts of food packaging

Learning Outcomes:

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

LO1: To understand about packing methods of food & preservation.

LO2: To study about food packing materials.

LO3: To understand flexible packing materials.

LO4: To know the evaluation of packing material & packing performance.

LO5: To understand about recent trends in packing

Unit – I

Introduction to packaging: Packaging operation, package-functions and design, Principle in the development of protective packaging, Deteriorative changes in food stuff , packaging methods for prevention, shelf life of packaged foodstuff, methods to extend shelf life

UNIT- II

Food containers: wooden boxes, crates, plywood and wire bound boxes, corrugated and fiber board boxes, textile and paper sacks , Metal containers, tin plate, corrosion of containers, Food packages-bags, pouches, wrappers, cartons, other traditional package

UNIT- III

Flexible packaging materials and their properties; Paper, metal foils, polymers, and laminates, Packaging additives, Considerations in the packaging of perishables and processed foods, Aluminum as packaging material

UNIT-IV

Evaluation of packaging material and package performance, packaging equipment, Metering and filling of different foods, Aseptic filling of foods, Labeling requirements, Bar coding- Printing, package standards and regulation

UNIT-V

Trends in latest packaging, Modified Atmospheric Packing (MAP), Controlled Atmospheric Packaging (CAP), Oxygen scavengers, Shrink packaging, aseptic and retortable pouches , Flexible and laminated pouches, Biodegradable packaging, Active packaging, Packaging of different food materials- Fruit and vegetables, meat, milk and egg, products, oils, RTE foods1

References

1. Painy, F.A. and Painy, H.Y. "A Handbook of Food Packaging" Leonard Hill, Glasgow, UK.1983.
2. Food Packaging. : Westport. Scicharow, S. and Griffin, R.C. 1970.
3. Principles of Food packaging: Stanley Sacharow
4. Food packaging and preservation: Mathlouthi
5. Food packaging (Principles & Practices): Gordan L Robertson
6. Principles of food packaging: Heiss . R
7. Packaging of food Beverages: Day F T

SEMESTER-IV

COURSE 10: FOOD PACKAGING

Practical

Credits: 1

2 hrs/week

- Identification of different types of packaging materials
- Determination of following properties on different packaging materials
 - a) Tensile strength
 - b) Tearing resistance
 - c) Impact test
 - d) Compression resistance
 - e) Sealing strength
 - f) Chemical stability
 - g) Dimensional stability
 - h) Gas transmission rate
 - i) Water vapour transmission rate
 - j) Grease resistance
 - k) Grammage (GSM)
 - l) Bursting strength
- Physical properties of paper
- Determination of tin coating, weight and porosity
- Vacuum/ gas/shrink packaging of food products
- Performance evaluation of transport packages
- Shelf life studies of packaged foods
- Design of labels for food packages

SEMESTER-IV

COURSE 11: TECHNOLOGY OF CEREALS PULSES AND OIL SEEDS

Theory

Credits: 3

3 hrs/week

Learning Objectives

To understand the concepts of processing, value addition of pulses, cereals and oil seeds.

Learning Outcomes

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

- LO 1** Student will have basic knowledge of Cereals Pulses and oil seeds
- LO 2** Student will learn how to Mill cereals pulses and oil seeds at home scale, and large scale
- LO 3** Student will learn about changes occurring during processing of Cereals Pulses and oil seeds
- LO 4** Student will learn about various processing Technologies
- LO 5** Student will learn how to prepare value added products from Cereals Pulses and oil waste

Unit 1

Present status and future prospects of legumes and oilseeds; Morphology of legumes and oilseeds; Classification and types of legumes and oilseeds Chemical composition, nutritional value and anti-nutritional compounds in legumes and oilseeds; Methods of removal of anti-nutritional compounds

Unit 2

Pulse milling: Home scale, cottage scale and modern milling methods, machines, milling quality, milling efficiency Factors affecting milling quality and quantity; Problems in dhal milling industry.

Oil seed milling: Ghanis, hydraulic presses, expellers, solvent extraction methods, machines, Milling quality, milling efficiency, factors affecting milling quality and quantity; Problems in oil milling industry;

Unit 3

Nutritional changes during soaking and sprouting of pulses; Cooking quality of dhal, methods, factors affecting cooking of dhal; Quick cooking dhal, instant dhal; Soybean milk processing and value addition; Fermented products of legumes.

Unit 4

Desolventization Refining of oils: Degumming, neutralization, bleaching, filtration, deodorization, winterization and their principles and process controls; Hydrogenation of oils; New technologies in oilseed processing.

Unit 5

Utilization of oil seed meals for different food uses: High protein products like protein concentrates and isolates; By-products of pulse and oil milling and their value addition.

Reference

Guriqbal Singh, Harbhajan Singh Sekhon, Jaspinder Singh Kolar and Masood Ali. 2005. Pulses. Agrotech Publishing Academy, Udaipur.

A. Chakraverty. 2008. Post Harvest Technology of Cereals, Pulses and Oilseeds, 3rd Ed. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Frank D. Gunstone. 2008. Oils and Fats in the Food Industry. John Wiley and Sons, Ltd., West Sussex, UK.

Fereidoon Shahidi. 2005. Bailey's Industrial Oil & Fat Products, 6th Ed., Vols. 1 to 6. John Wiley and Sons, Inc. Hoboken, New Jersey, USA.

Amalendu Chakraverty, Arun S. Mujumdar, G.S. Vijaya Raghavan and Hosahalli S. Ramaswamy. 2003. Handbook of Post Harvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices. Marcel Dekker, Inc., NY, USA.

K.M. Sahay and K.K. Singh. 2001. Unit Operations of Agricultural Processing, 2nd Ed. Vikas Publishing House Pvt. Ltd., Noida.

SEMESTER-IV

COURSE 11: TECHNOLOGY OF CEREALS PULSES AND OIL SEEDS

Practical

Credits: 1

2 hrs/week

1. Chemical analysis of select spices: Moisture, valuable oil,
- 2 Physical analysis of select spices: specific gravity, refractive index, acid value
- 3 Identification and characterization of flavouring compounds of spices
- 4 Valuable oil determination
- 5 Extraction of oil from clove/ pepper
- 6 Extraction of oil from cardamom/ chilli
- 7 Extraction of oleoresins: Turmeric/ ginger, pepper, clove
- 8 Extraction of oleoresins: pepper/ clove
- 9 Peperine estimation in pepper oleoresin
- 10 Steam distillation of spices
- 11 Determination of curcumin content in turmeric
- 12 Study of standard specification of spices
- 13 Packaging study of spices
- 14 Preparation of curry powder
- 15 Extraction of active ingredients by TLC, HPLC and GC

SEMESTER-V

COURSE 12: FOOD SAFETY AND QUALITY CONTROL

Theory

Credits: 3

3 hrs/week

Learning Objectives:

To study the various aspects of quality control and sensory evaluation in food industries.

Learning Outcomes: On successful completion of the course, students will be able to

LO1: To gain the knowledge about the food safety of various hazards involved in it.

LO2: To understand the quality assurance & various voluntary & obligatory food standards.

LO3: To learn the sampling methods & testing of raw materials & finished food products.

LO4: To learn about sensory parameters & its associated subjective & objective tests.

LO5: To study about the sanitation, hygiene & quality assurance in food industries.

Unit – I

- Food safety: characterization and risk analysis
- Food hazards: Physical, chemical and biological Systems for food safety.
- Hazard Analysis Critical Control Point (HACCP) and its implementation.

Unit-II

- Quality assurance: Theoretical and practical considerations
- Description of different systems: GAP, GMP, TQM, ISO.
- Indian food standards- voluntary and obligatory standards
- (PFA, FPO, MMPO, Meat and Meat Products order, AGMARK etc.)
- Food safety and standards act (FSSA)

- Codexalimantarius
- Worldwide food safety issues.

Unit-III

- Sampling methods- random and statistical methods
- Quality assurance
- Quality control and testing of raw material and finished products in
- cereals, fruits and vegetables,
- dairy, confectionery, beverages,
- meat and egg processing plants

Unit-IV

- Sensory evaluation- Requirements and methods.
- Sensory parameters: colour, flavour, texture, taste, aroma, general acceptability
- Subjective and objective test of sensory parameters.
- (Differential tests, Descriptive test, Rating tests, Sensitivity threshold test)

Unit-V

- Cleaning In Place (CIP)
- Different Sanitizers and detergents
- Sanitation and hygiene in quality assurance in different food industries
- (Fruits and vegetables, Meat, Milk, and Cereal based).
- Cost of quality
- Supplier development.

References:

1. Pomeranz Y and Meloan C E, “ Food analysis: Theory And Practice”. 3rd ed. CBS Publishers, New Delhi.1996.
2. Nielsen S S, “ Introduction to the chemical analysis of foods”Jones and Bartlett Publishers, London.1994.
3. Nielson S S. “Food analysis laboratory manual”. Chips Ltd, USA.2003.
4. Lawless H T and Heymann H. “ Sensory Evaluation of Foods Principles And Practices”, Chapman and Hall, New York1998.
5. AOAC, “Official methods of analysis. Association of OfficialAnalytical Chemists”, Arlington 1995.

SEMESTER-V

COURSE 12: FOOD SAFETY AND QUALITY CONTROL

Practical

Credits: 1

2 hrs/week

1. Layout of quality control laboratory for food processing unit the requirements of glassware and equipments.
2. Microbiological quality control of utensils and glassware SWAB, RINSE methods
3. Evaluation of personnel hygiene
4. Evaluation of detergents AOAC method.
5. Evaluation (Sensory and chemical) of canned foods
6. Evaluation (Sensory and chemical) of dairy products
7. Evaluation (Sensory and chemical) of confectionery products
8. Detection of common adulterants
9. Good Laboratory Practices
10. Visit to food industry quality control lab

SEMESTER-V

COURSE 13: BAKING SCIENCE & TECHNOLOGY

Theory

Credits: 4

5 hrs/week

Learning Objectives: To understand the principles of baking science & technology of production.

Learning Outcomes: On successful completion of the course, students will be able to

LO1: To gain knowledge about the bread, formulation & ingredients.

LO2: To learn the bread making & its baking process.

LO3: To understand the methods & ingredients used in biscuit production.

LO4: To learn the principles & procession preparation of cakes.

LO5: To learn the preparation of frozen dough products & application of starches in bakery industry.

UNIT-1

- Bread types, quality assessment and formulations
- Ingredients: wheat flour, components and functions; proteins carbohydrates, lipids and enzymes
- Miscellaneous flours (rye, tricale)
- shortenings; functions, sources, types and mechanisms
- sweeteners; functions; types
- yeast; functions, types and factors influencing the fermentation
- Minor ingredients; yeast foods enzymatic supplements, oxidizing agents, salt, dairy and egg products, mold inhibitors, dough strengtheners/ softeners and enrichment

Unit – II

- Bread making process; straight dough - rapid processing
- mechanical dough development
- Mixing and dough processing; functions of mixing, mixer types
- fermentation, dough transfer system, dough make up
- dividing rounding and pre-moulding
- first proving moulding panning and proving Process; developments
- Baking process, stages, baking reactions and bread cooling
- thermal reactions keeping properties of bread and related products
- Bread spoilage and staling, factors and control measures

Unit – III

- Biscuits; biscuits, cookies and crackers
- ingredient and their functions, wheat flour, granulation, Shortening, sweeteners, chemical leaveners
- Baking powder, function, composition, and reactive rates, neutralizing value
- Preparation of biscuits dough's mixing objectives, mixer types
- fermentation of shaped dough pieces
- Biscuit baking, heat transfer mechanism, changes during baking
- Cooling, packaging and storage

Unit – IV

- Cakes: cake varieties, ingredients and their functions
- wheat flour, components; shortening, egg, baking powder icing, confectionery coating, minor ingredients
- formulations, formula balance

- cake mixing objectives and methods
- Batter specific gravity, temperature and P^H, baking reactions

Unit – V

- Wafers: fermentation, ingredients and their function
- flour, water, shortening, aerating agent and minor ingredients
- mixing, storage and depositing of wafer butter, baking, cooling and conditioning of wafer sheets
- Frozen dough products
- Fat bread technology
- Starches-sources, composition, properties, modifications methods and applications in bakery industry

Reference Books

1. Cauvain & Linda S.Y, “ Technology of Bread making”, Blackie Academy & Professional, London 1998.
2. Matz, S.A. “Bakery Technology & Engineering” 3rd edition, CBS publications Delhi. 1996.
3. Plyer, E.J “Baking Science & Technology” Vol.-I & II, 3rd edition, Sopsland Pub. Kansas, U.S.A 1988.
4. Pomeroy, Y, “Wheat chemistry & Technology” Vol.I & II, 3rd edition A.A.C.C.
5. Wade, P, “Biscuits Cookies & Crackers” Vol.I, Elsevier. 1998.
6. Almond, “Biscuits Cookies & Crackers “Vol.II, Elsevier 1998.

SEMESTER-V
COURSE 14 A: TECHNOLOGY OF MEAT, FISH, POULTRY & THEIR PRODUCTS

Theory

Credits: 3

3 hrs/week

Objective: To study the various aspects of meat, fish and poultry processing technology.

Learning Outcomes

Students after Success full completion of the course will be able to

LO1: To gain knowledge about various sources, feed, breed & structure of meat.

LO2: To study about the various steps involved in slaughtering of meat animals.

LO3: To know about the preservative & processing methods of meat.

LO4: To understand the steps involved in the processing of poultry meat.

LO5: To gain knowledge about the types of fish, its composition & processing & preservation methods.

Unit – I

- Sources of meat and meat products in India
- Its importance in national economy
- microscopic structure of meat
- Physico-chemical properties of meat
- Nutritive value of meat
- Effect of feed, breed and management on meat production and quality
- Conversion of muscle to meat

Unit – II

- Premortem inspection and care of animals
- stunning types, slaughtering types
- Slaughter house operations
- dressing, anti- and postmortem changes in carcass composition
- grading of meat and meat cuts

Unit – III

- Processing and preservation of meat:
 - canning, freezing
 - salting, Dehydration
 - Aging, pickling and smoking of meat
- Spoilage and its control
- Comminuted and non-comminuted meat products
- Meat by- products

Unit – IV

- Poultry: Classes of poultry meat
- Commercial methods of slaughtering, dressing
- Post-slaughter handling, storage and preservation of poultry meat
- Spoilage and its control
- Freezing of poultry (whole and cuts)
- Eggs: Composition, handling, candling washing, coating, packaging and storage
- Egg processing (Egg powder manufacturing)
- Spoilage and its control

Unit – V

- Types of fish, composition
- structure, post-mortem changes in fish
- Fish processing & Preservation:
 - Canning, smoking
 - freezing and dehydration of fish
- Fish by-products
- shrimp and its processing

References:

1. Lawrie, R.A. “Meat Science”, 2nd Edn. Pergamon Press, Oxford UK. 1975.
2. Lavie A. “Meat Handbook”. 4th Edn. AVI, Westport 1980.
3. Portsmouth, J.I. “Commercial Rabbit Meat Production”. 2nd Edn. Saiga Survey, England. 1979.
4. Stadelmen, W.J. and Cotterill, O.J., “Egg. Science and Technology”. 2nd Edn. AVI, Westport. 1977.

SEMESTER-V

COURSE 14 A: TECHNOLOGY OF MEAT, FISH, POULTRY & THEIR PRODUCTS

Practical

Credits: 1

2 hrs/week

1. Pre-slaughter operations of meat animals and poultry birds
2. Slaughtering and dressing of meat animals
- 3 Study the anatomy of poultry
- 4 Study of different primal meat cuts/ dressing of fish
- 5 Cutting and handling of meat/fish
- 6 Preservation of meat/fish by freezing
- 7 Preservation of meat/ fish by curing and pickling
- 8 Preservation of meat/ fish by dehydration
- 9 Evaluation of quality and grading of raw and boiled eggs
- 10 Preservation of egg by thermo stabilization
- 11 Preparation of value added poultry/meat/ egg
- 12 Evaluation of meat quality by determination of ERV and WHC
- 13 Evaluation of meat quality by determination of pH and dye reduction test
14. Estimation of TVB and TMA
- 15 Protein estimation by Folin-Lowrey's method
- 16 Determination of iodine value
- 17 Canning of meat/ egg/poultry/ fish products
- 18 Visit to abattoir

SEMESTER-V
COURSE 14 B: FOOD PROCESS ENGINEERING

Theory

Credits: 3

3 hrs/week

Learning Objectives:

To enable students to develop understanding on food process engineering concepts.

Learning Outcomes

Students after Success full completion of the course will be able to

LO1: Study about units & dimensions.

LO2: Solve problems involved in dilution, concentration & dehydration.

LO3: Study about fluid dynamics

LO 4: Understand about heat transfer

LO5: To understand about filtration sedimentation & reverse osmosis.

UNIT – I

Units & Dimensions: Definition of terms – System of measurements – The S.I System – Conversion of Units – Dimensional Consistency – Conversion of Dimensional equations – Examples. Material Balances: basic Principles – Problems involved in dilution, Concentration and dehydration – Blending of Food Ingredients – Examples.

Energy Balances: Basic Principles – Energy terms – Heat properties of saturated and super heated steam – heat balances – Examples. Gases and vapors: definition-equation of state for an ideal and real gases- ideal gas equation - P.V.T relationship for ideal gases-gas mixture.

UNIT – II

Thermodynamics: thermodynamic variables- define enthalpy- the relationship between C_p and C_v for gases- P.V.T relationship for ideal gases in thermodynamic process- changes in thermodynamic properties, Work and Heat associated with thermodynamic processes. Refrigeration- mechanical refrigeration system- refrigeration cycle- use of refrigerant charts- condenser-evaporator-compressor-refrigeration load- Freezing: types

UNIT-III

Fluid Mechanics Flow of Fluids – Concept of viscosity – Rheology, Newtonian and Non-Newtonian fluids –Viscometry- types-determination of rheological Properties of fluids using rotational viscometry- Continuous viscosity monitoring and control-Transportation of Fluids- Continuity principle and Bernoulli equation- Reynolds number-flow measuring instruments: Orifice meter- Venturimeter-Rotometer-Problems.**Mass Transfer** Masstransfer:- Psychometry – heat and Mass transfer in dehydration – Stage of drying- Prediction of drying from drying rate data- Types of driers – Problems-Extraction- types- principles- systems- Problems.

UNIT-IV

Heat Transfer Theory- types- Estimation of thermal conductivity of food products- Fourier's law of heat transfer-Temperature profile of unidirectional heat transfer through conduction-Heat transfer by convection- Forced convection and Free convection.Heat transfer by radiation- Kirchhoff's law- Stephan- boltzman - plank's distribution law-Wein's displacements law Microwave and direct electric heating ,Temperature measuring devices- various thermometers- Examples.Steady state heat transfer- calculation- heat exchanger equipment- types- local heat transfer coefficients- equation-heat transfer to non-Newtonian fluids in laminar flow- examples-unsteady state heat transfer – Fourier number – Biot number – heisler and gurney- Lurie charts-calculations- evaporation – single effect evaporators- improving the economy of evaporators- Dehydration- water activity.

UNIT-V

Physical separation process- Types, Filtration – Filtrate flow through filter cake-Types of filtrations – Constant pressure filtration and constant rate filtration, Reverse osmosis Sieving and Gravity separation- problems-Sedimentation,Material handling equipment.

References

1. Methods of Physico-Chemical analysis of fruits: B.C.Muzumdar&K.Muzumdar, 2003
Dayapublishers , New Delhi.
2. Fundamentals of food process engineering, Romeo T. Toledo 2nd edition
CBS Pub. Delhi.
3. Pandey H. *et al.*, “Experiments in Food Process Engineering” 1st edition, CBS Pub. Delhi.
4. R. Paul Singh, “Introduction to Food Process Engineering” 3rd Edition. Academic Press, London, 2004.
5. R. E. Earley, “Unit Operations in Food Process Engg”.
6. Refrigeration & Air conditioning P Kurmy&Guptha
7. Warren L Macabe, Julian C Smith, Peter Hariot, “Unit Operations of Chemical Engineer
8. Experiments in Food Process Engineering : Pandey H. *et al.*, I edition.
CBS Pub. Delhi.
9. Introduction to Food Process Engineering: R. Paul Singh.
10. Unit Operations in Food Process Engg. : R. E. Earley
11. Lal G, Siddapa GS & Tandon GL. “Preservation of Fruits and vegetables”. ICAR, 1986.

SEMESTER-V
COURSE 14 B: FOOD PROCESS ENGINEERING

Practical

Credits: 1

2 hrs/week

1. Preparation of syrups and brine solution
2. Preparation and Preservation of Squashes, Cordial, Crush etc.
3. Preparations and Preservation of Jams, Jellies, Marmalades, and Pickles
4. Drying of fruits and vegetables(Banana, Resins, Potatoes, Tomatoes, etc.)
5. Preparations of Canned Foods

Visits to ICMRI, Rice Mill, Dhal Mill and Flour Mill

SEMESTER-V
**COURSE 15 A: TECHNOLOGY FRUITS, VEGETABLE AND
PLANTATION**

Theory

Credits: 3

3 hrs/week

Learning Objectives:

To understand the concepts of processing and preservation of fruits, vegetables and plantations crop

Learning Objectives

LO 1 Student will learn overview of fruit and vegetable production and its handling

LO 2 Student will learn how to preserve the harvested fruits and vegetables

LO 3 Student will learn how to prepare various products from fruits as per FASSAI standards

LO 4 Student will learn how to prepare various products Vegetables fruits as per FASSAI Standards

LO 5 Student will learn how to prepare value added products from fruit and vegetable waste

Unit I

Production and processing scenario of fruits and vegetables in India and world; Scope of fruit and vegetable processing industry in India. Overview of principles and preservation methods of fruits and vegetables; Supply chain of fresh fruits and vegetables. Primary processing and pack house handling of fruits and vegetables; Peeling, slicing, cubing, cutting and other size reduction operations for fruits and vegetables.

Unit 2

Minimal processing of fruits and vegetables; Blanching- operations and equipment. Canning: Definition, processing steps, and equipment; Cans and containers, quality assurance and defects in canned products.

Unit -3

FSSAI specifications and preparation and preservation of juices, squashes, syrups, sherbets, nectars, cordials, etc.; Processing and equipment for above products. FSSAI specifications of crystallized fruits and preserves, jam, jelly and marmalades, candies Preparation, preservation and machines for manufacture of above products.

Unit- 4

Preparation, preservation and machines for manufacture of chutney, pickles, sauce, puree, paste, ketchup; toffee, cheese, leather, dehydrated, wafers and papads, soup powders;

Unit -5

Production of pectin and vinegar Commercial processing technology of selected fruits and vegetables for production of various value added processed products. By-products of fruit and vegetable processing industry.

Reference

U.D. Chavan and J.V. Patil. 2013. Industrial Processing of Fruits and Vegetables. Astral International Pvt. Ltd., New Delhi.

S. Rajarathnam and R.S. Ramteke. 2011. Advances in Preservation and Processing Technologies of Fruits and Vegetables. New India Publishing Agency, New Delhi.

Y.H. Hui. 2006. Handbook of Fruits and Fruit Processing. Blackwell Publishing Ltd., Oxford, UK.

W.V. Cruess. 2004. Commercial Fruit and Vegetable Products. Agrobios India, Jodhpur. 49

Y. H. Hui, Sue Chazala, Dee M. Graham, K.D. Murrell and Wai-Kit Nip. 2004. Handbook of Vegetable Preservation and Processing. Marcel Dekker, Inc., NY, USA.

A.K. Thompson. 2003. Fruit and Vegetables: Harvest, Handling and Storage, 2nd Ed. Blackwell Publishing Ltd., Oxford, UK.

AmalenduChakraverty, Arun S. Mujumdar, G.S. Vijaya Raghavan and Hosahalli S. Ramaswamy. 2003. Handbook of Post Harvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices. Marcel Dekker, Inc., NY, USA.

R.P. Srivastava and Sanjeev Kumar. 2002. Fruit & Vegetable Preservation: Principles and Practices, 3 rd Ed. International Book Distribution Co., Delhi.

P.H. Pandey. 1997. Post Harvest Technology of Fruits and Vegetables. Saroj Prakashan, Allahabad.

Mircea EnachescuDauthy. 1995. Fruit and Vegetable Processing. FAO Agricultural Services Bulletin No.119. FAO of UN, Rome.

Girdhari Lal, G.S. Siddappa and G.L. Tandon. 1959.Preservation of Fruits and Vegetables. ICAR, New Delhi.

EIRI Board of Consultants and Engineers. Manufacture of Snacks, Namkeen, Papads and Potato Products. EIRI, New Delhi.

SEMESTER-V
**COURSE 15 A: TECHNOLOGY FRUITS, VEGETABLE AND
PLANTATION**

Practical

Credits: 1

2 hrs/week

1. Primary processing of selected fruits and vegetables
2. Canning of Mango/Guava/ Papaya 2 Qualitative analysis of pectin
- 3 Determination of salt concentration in processed/ preserved product
- 4 Determination of sulphurdioxide content in processed/preserved product
- 5 Preparation of jam from selected fruits
- 6 Preparation of jelly from selected fruits
- 7 Preparation of fruit marmalade
- 8 Preparation of RTS/ nectar
- 9 Preparation of squash/ crush
- 10 Preparation of cordial
- 11 Preparation of anardana
- 12 Preparation of pickles
- 13 Dehydration of ginger, onion and garlic
- 14 Preparation of banana and potato wafers;
- 15 Preparation of vegetable sauces

SEMESTER-V

COURSE 15 B: FERMENTATION TECHNOLOGY

Theory

Credits: 3

3 hrs/week

Learning Objective : To study the various aspects Fermentation Technology

Learning Outcomes

LO1: Learn the Basics of Fermentor and types of fermentation

LO2: Learn about traditional fermented food.

LO3: Learn about various types about beverages.

LO4: Learn about fruit based Juices and beverages, tea, coffee, cocoa processing

LO5: Learn about fermentation of various alcoholic To know types of beverages & quality control in beverage industry.

Unit- I

- Types of Fermentation Processes-Solid state fermentation, Liquid state fermentation (Surface, Submerged),
- Design and functioning of a Fermenter
- Types of Fermenters batch, Fed Batch, Continuous, Airlift Solid state fermenter, Packed bed reactors, Photo bio reactor
- Importance of Primary and secondary Metabolites
- Screening and isolation of Industrially Important Microorganisms

Unit – II

- Fermented Foods: Introduction to fermentation
- Lactic acid fermentation of cabbage, cucumber, olives, Production of sauerkraut

- Preparation of pickles ,Fermentation of dill pickles
- Oriental fermented foods,Soy sauce, Masco, Tempe, Ontjons, Hamanatto,Tofu, Natto
- Traditional fermented foods – Idli, Dosa
- Fermented meat and milk Products

Unit – III

- Beverages: Introduction, classification
- beverage industry in India
- Ingredients for beverages: Water - sources and purification
- types of water Purification systems
- Fruit pulps, juices, concentrates, and other additives
- Sweeteners - sugars, artificial sweeteners
- Colours, flavours, preservatives

Unit-IV

- Fruit based beverages:
 - Nectar, cordial, squash
 - syrup, juice concentrates, fruit flavored powders
- Barley water
- Carbonated beverages, synthetic, low calorie beverages, dry mix formulation
- Tea, coffee, cocoa processing

Unit – V

- Alcoholic Beverages: Alcoholic fermentation of grape juice
- Brief study of yeast in fermenting ‘Must’
- Wine Types, Technology of wine making - Aroma of wines
- Types and Production of beer

- Elements of brewing process
- Distilled Beverages
- Types and production Technology of whisky, brandy
- Quality control in beverage industry

References:

1. A. H. Patel, Industrial Microbiology, 2/e, MacMillan Publishers, 2012.
2. N. Okafor, Modern Industrial Microbiology and Biotechnology, Science Publishers, 2007.
3. Casida, L E JR., Industrial Microbiology, New Age International Publishers, 1968.
4. E. M. T. El Mansi, C. F. A. Bryce, A. L. Demain, A. R. Allaman, Fermentation Microbiology and Biotechnology, 3/e, Taylor and Francis, 2011.
5. W. C. Frazier, D. C. Westhoff and N. M. Vanitha, Food Microbiology, 4/ e, McGraw Hill, 2014.
6. A. N. Glazer and H. Nikaido, Microbial Biotechnology: Fundamentals of Applied Microbiology, 2/e, Cambridge University Press, 2007.
7. G. Reed, Prescott and Dunn's Industrial Microbiology, 4/e, CBS Publishers and Distributors, 2004.
8. W. Cruger and A. Cruger, Biotechnology: A Textbook of Industrial Microbiology, Panima Publishing Corporation, 2003
9. Nduka Okafor. 2007. Modern Industrial Microbiology and Biotechnology. Science Publishers, Enfield, New Hampshire, USA.
10. Dennis E. Briggs, Chris A. Boulton, Peter A, Brookes and Roger Stevens. 2004. Brewing Science and Practice. Woodhead Publishing Ltd. Cambridge, England.
11. G. Reed. 2004. Prescott & Dunn's Industrial Microbiology, 4th Ed. AVI Publishers, Connecticut, USA.
12. Peter F. Stanbury, Allan Whitakar and Stephen J. Hall. 1995. Principles of Fermentation Technology, 2nd Ed. Elsevier Science Ltd., Burlington, MA, USA

SEMESTER-V

COURSE 15 B: FERMENTATION TECHNOLOGY

Practical

Credits: 1

2 hrs/week

1. Screening and isolation of few industrially important Microorganism.
2. Preparation of Yoghurt
3. Preparation of buttermilk
4. Preparation of whey based fermented beverage
5. Preparation of pickles
6. Preparation and maintenance of starter cultures
7. Preparation of distilled ethanol by yeast