Food Technology & Management

I semester

FOOD AND HUMAN NUTRITION

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. Essential of food and nutrition: M.S. Swaminathan, Ganesh and Co, Madras, Vol I&II
2. Nutritive value of Indian food: C. Gopalan, BV.Ramashastry and S Balasubrmanian

FOOD CHEMISTRY – I

UNIT –I

CARBOHYDRATES: - structure and isomerism: monosaccharides, disaccharides, oligosaccharides and polysaccharides – Reactions of carbohydrates: Hydrolysis, acyclic reactions, dehydration/ thermal degradation, gelatinization caramelization. - Functions of monosaccharides and oligosaccharides: Hydrophilicity, flavour ligends, Browning, Sweetness. Functions of Polysaccharides: Starch, Cellulose, hemi-cellulose, pentosans, pectin, gums (Alginates, carrageenan, locust bean gum, xanthum gum).

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.

Unit – III

Lipids:- Fatty acids, Glycerides- Physical Aspects: Triacylglycerol Distribution, Positional Distribution, Consistency, Emulsions and emulsifiers-Chemical Aspects: Lipolysis, Auto oxidation, Thermal decomposition, Chemistry of frying.

Unit- IV

Enzymes: - classification, specificity, catalysis and regulations- Factors influencing activity: Temperature, p^H, water activity and ionic strength/ electrolytes- endogenous enzymes: pectic enzymes, amylases, cathapsins and enzymatic browning

Unit – V

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

REFERENCES

1. Food Chemistry : Fennema, O.R III edition,
2. Food Chemistry : Mayer L.H, CBS Publishers
3. Food Science : Norman and Potter

4. Food Science : Srilakshmi

FOOD BIOCHEMISTRY
UNIT-I

Introduction to Biochemistry :

*Introduction to Biochemistry ,analytical methods used in Biochemistry .

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

*Enzymes –Definition ,holo enzyme ,apoenzyme ,zymogene forms .

*Classification of Enzymes

*Factors affecting the rate of Enzyme activity .

*Mechanisms of enzyme inhibition &enzyme activation .

*cofactors &co enzyme with examples .

UNIT-II

Carbohydrate Metabolism :

*Definition of carbohydrates,

*Functions & uses of carbohydrates,

*classification with examples.

*Properties of carbohydrates (physical & chemical).

*Digestion & absorption of carbohydrates.

*Metabolism of carbohydrates(citricacid cycle. H.M.Pshunt pathway., Glycogenolysis, Glycogensis, Gluconeogenesis.)

UNIT –III

Lipid Metabolism

*Lipids-definition, classification with examples, functions.

*Phospholipids, sterols definition sources ,classification with examples.

*Digestion & Absorption of fats.

*. Fatty acids-classification with examples.

* Glycerol- monoglycerides , , diglycerides,,Tryglycerides with examples

*Syntheseis of fatty acids even &add numbers with examples . .

UNIT-IV
Protein Metabolism :

*Protein- definition, classification of proteins with examples.
*Classification of amino acids with examples.
*Digestion & Absorption of proteins.
* Oxidation of amino acids
* De-amination. Oxidative and non-oxidative deamination
*transamination followed by deamination.
*Removal of carboxylic group.
* Carbon skeleton metabolism.
.

UNIT-V
Protein Biosynthesis :

*Steps in Protein Biosynthersis

*Activation of amino acids.

*Inhibition of peptide chain.

*Elongation of peptide chain .

*Termination of Peptide chain &release .

*Folding &Processing.

*Structure of proteins primary ,secondary ,tertiary ,quaternary .

*Different types of bonding &forces acting in protein structure .

II Semester

APPLIED MATHEMATICS – II

Unit- I

Trigonometry: measurement of angle, trigonometric rations of compound angles.

Unit –II

Applications of the derivatives – increasing and decreasing function, maxima & minima of functions of one variable. Applications of maxima & minima in economics.

Unit -III

Quadratic equations: The quadratic formula, sum, product of roots, nature of roots of $ax^2+bx+c=0$

Unit – IV

Integral calculus –introduction to integration, standard integrals method of substitution, application of integration, area of curves, consumer surplus.

Unit – V

Mathematical models, definition use of models, types of growth models, linear, quadratic exponential and logistic models.

Textbook:

Intermediate mathematics. S.Chand & Co. New Delhi volume –I & II

References:

1. Calculus: Narayanan and Manicavachaga Pillai 1985
2. Mathematics for Economists: Dowling ET 1986, Schaum's outline series in economics, McGraw Hill book company, New York.
3. Mathematics for plant sciences: Suyamulingam C and Kailasam C 1988.

Applied Mathematics – II

Practicals:

1. Problems on measurement of angles
2. Problems on trigonometric rations of compound angles.
3. Problem on maxima and minima of functions of one variable
4. Problem on application of maxima and minima in economics
5. Problems on quadratic equations.
6. Problem on evaluation of standard integrals
7. Problem on method of substitution
8. Problem on areas of curves and consumer surplus
9. Problems on linear and quadratic growth models
10. Problems on exponential and logistic growth models

Textbook:

1. Intermediate mathematics. S.Chand & Co. New Delhi volume –I & II

References:

1. Calculus: Narayanan and Manicavachaga Pillai 1985

2. Mathematics for Economists: Dowling ET 1986, Schaum's outline series in economics, McGraw Hill book company, New York.
3. Mathematics for plant sciences: Suyamulingam C and Kailasam C 1988.

FOOD ADDITIVES

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 potentiaters 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.

FOOD ADDITIVES

1. Estimation of crude fiber
2. Estimation of Chlorophyll content
3. Estimation of carotenoids
4. Extraction of colours 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

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
   Principles & Practice : : Srivastava R.P, III edition, IBDC Publishers

FOOD PROCESS ENGINEERING – I

UNIT – I

Units & Dimensions: Definition of terms – System of measurements – The S.I System – Conversion of Units – Dimensional Consistency – Conversion of Dimensional equations – Examples.

UNIT –II

Material Balances: basic Principles – Problems involved in dilution, Concentration and dehydration – Blending of Food Ingredients – Examples.

UNIT – III

Energy Balances: Basic Principles – Energy terms – Heat properties of saturated and super heated steam – heat balances – Examples.

UNIT – IV

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. Thermodynamics: thermodynamic variables-define enthalpy- the relationship between Cp and Cv for gases- P.V.T relationship for ideal gases in thermodynamic process- changes in thermodynamic properties, Work and Heat associated with thermodynamic processes

UNIT – V

Refrigeration- mechanical refrigeration system- refrigeration cycle- use of refrigerant charts-condenser-evaporator-compressor-refrigeration load- Freezing: types, freezing curve, freezing applications in food industry.

Textbooks:

1. Fundamentals of food process engineering. : Romeo T. Toledo 2nd edition. CBS Pub. Delhi.

References:

1. Experiments in Food Process Engineering : Pandey H. *et al.,* I edition. CBS Pub. Delhi.

2. Introduction to Food Process Engineering : R. Paul Singh.

3. Unit Operations in Food Process Engg. : R. E. Earley

GENERAL MICROBIOLOGY

UNIT – I

Historical aspects, Scope of microbiology, General classification of microorganisms, morphology, Characteristics, growth and reproduction, Sterilization and disinfections – Brief survey of microbes as friends and foes.

UNIT – II

Structure and function of prokaryotic cells and their organelles – Structure and function of eukaryotic cells and their organelles – microorganisms associated with food and food products like bacteria, yeast , molds and viruses – morphological and biochemical characteristics of important groups.

UNIT – III

Classification of micro organisms based on growth, temperature (Psychotropic, mesophiles, thermodurics and thermopiles) – physical and chemical factors affecting growth of microorganisms like temperature, pH, Osmotic pressure, nutrients, bacteriostatic and bactericidal.

UNIT- IV

Physiology, Growth and multiplication of microorganisms: - definition of bacterial physiology and metabolism of bacteria, yeast and fungi. Nutritional requirement of bacteria, yeast and fungi – bacterial growth curve, chemo stat and diauxy growth.

UNIT – V

Bacterial genetics:- Structure of DNA, Types of RNA and difference between DNA & RNA. Genetic recombination methods, Conjugation, Transduction, Transformation, Bacterial mutation – Types and Properties

REFERENCES:

1. General microbiology – Pelzar
2. Food Microbiology – Frazier
3. Molecular biology of the Cell – Bruce Alberts
4. Cell and molecular biology – De Roberties &De Roberties

General Microbiology

1. Study of microscopy
2. Preparation and sterilization of glassware and equipment for microbiological use.
3. Identification of microbes by Simple staining
4. Identification of microbes by Gram staining
5. Study of different special staining techniques
6. Microbial mobility test (hanging drop method)
7. Determination of size of microbes (micrometry)
8. Direct microscopic count (DMC) of microorganisms
9. Identification of common microorganisms.
10. Preparation, p^H adjustment and sterilization of media.
11. Propagation of microbial cultures.

II YEAR FOODTECHNOLOGY AND MANAGEMNENT

IIIsemester

MICROBIOLOGY OF FOOD AND WATER

9Hrs

Unit I

Food Microbes

- Microorganisms associated with foods: 1
- Bacteria
  (Gram negative aerobic Rods, Gram negative facultative anaerobic Rods) 2

- Gram Negative anaerobic rods, 1
- Endospore formers Irregular non-sporing gram positive rods 1
- Yeasts & molds their role in food spoilage – 1
- Factors affecting growth of bacteria, mold and Yeast: 2
  (Nutrition, Temperature, pH conditions, Carbon and Nitrogen Sources

- Redox potential, antimicrobial barriers and constituents. 1

Unit II 9Hrs

Microbial Estimation

- Sources of microorganisms – Soil, water, plants and of animal origin 1
- Useful microorganisms – Bacteria, Yeast, mold and fungi 1
- Estimating number of microorganisms, sampling, sample size 1
- Aseptic collection of samples, total cell counts and
  viable cell counts, plate counters. 1

- Indicator organisms 1
- Alternative and Rapid methods for detection of specific microbes and
  toxins : 1

- Dye-reduction tests, Electrical methods, ATP determination – 1
- Pure cultures-preparation, maintenance and preservation – 1
- Microbiological quality control and HACCP 1

Unit III **9Hrs**

Microorganisms associated with food & water

- Microbiology of Food commodities 1
- Contamination, preservation and spoilage & beneficial
  role of microorganisms in

- Cereals, Pulses 2
- Nuts and Oilseeds, 1
- Fruits and Fruit products 1
- Vegetables and Vegetable products 1
- Meat , dairy and their products 1

- Microbiology of water- Contamination and microbial standards 2

Unit IV 9Hrs

Food Preservation

- Heat processing: Pasteurization and appertization 1
- Determination of D and z values 1
- Heat sensitivity of micro-organisms & Spoilage of canned foods 1
- Aseptic packaging, Irradiation 1
- Brief account of microwave 1
- UV and ionizing radiation 1
- Brief account of High pressure processing 1
- Low temperature storage – Chilling and freezing 1
- Effect of chemical and natural preservatives on microbes in food 1

Unit V **9Hrs**

Food Borne Illnesses

- Food borne pathogens 1
- Food poisoning 1
- Food borne infections 1
- Food borne Intoxications
  (*Aeromonas hydrophila, Bacillus cereus, Brucella,*

  Camphylobacter, Clostridium botulinum,Clostridium perfringenes,

  Escherichia coli, Salmonella, Staphylococcus aureus, vibrio, yersininia,

  Listeria) 3

- Hepatitis A and B 1
- Gastroenteritis viruses 1
- Spongiform encephalopathy - occurrence, symptoms,
  Preventive and control measures 1

References:

1. W.C.Frazier: *Food Microbiology (IV edition)* Mcgraw Hill Book Company, New York (1995)

2. James M jay: Modern food microbiology *IV* edition, CBS publishers, New Delhi (1996)

3. M.R. Adams and M.O. Moss, *Food Microbiology,* Second Edition, Panima Publishing corporation, New Delhi. Third reprint 2004.

PRACTICALS - MICROBIOLOGY OF FOOD AND WATER

Objective: To gain knowledge of microorganisms present in foods.

- Introduction and Safety in the food microbiology laboratory 2
- Identification of fungi in bread, pickles, jam, groundnut etc. 2
- Microbiological examination of fresh fruits, vegetables and spices. 2
- Microbiological examination of canned foods (acidic and non-acidic foods) 2
- Microbiological examination of bottled and aseptically packed beverages water (MPN method for determination of coliform count) 2
- Microbiological examination of flour, bread, cakes, sugar and cocoa confectionery products 2
- Microbiological examination of meat, milk and their products 2
- Visit to food microbiology lab. 2

References:

1. Gustavo F Gutierrez-Lopez, Gustavo V Barbosa-Canovas *Food Science and Food Biotechnology:* CRCPress 2003

2. Bibek Ray: *Fundamental Food Microbiology*, (Third Edition) CRC Press December 2003

FOOD PROCESS ENGINEERING – II

Objective: To study the application of engineering aspects in food processing.

Unit – I 9Hrs

Fluid Mechanics

- Flow of Fluids – Concept of viscosity – 1
- Rheology, Newtonian and Non-Newtonian fluids – 1
- Viscometry- types- 1
  determination of rheological Properties of fluids using rotational viscometry-
- Continuous viscosity monitoring and control- 1
- Transportation of Fluids- 1
- Continuity principle and Bernoulli equation- 1
- Reynolds number- 1
- flow measuring instruments: Orifice meter- Venturimeter- Rotometer- 1
- Problems. 1

Unit – II 9Hrs

Heat Transfer Theory

- Heat transfer- types- 1
- Estimation of thermal conductivity of food products- 1
- Fourier's law of heat transfer- 1
- Temperature profile of unidirectional heat transfer through conduction- 1
- Heat transfer by convention- Forced convection and Free convection 1
- Heat transfer by radiation- 1
  Kirchhoff's law- Stephan- boltz man - plank's distribution law-

  Wein's displacements law
- Microwave and direct electric heating – 1
- Temperature measuring devices- various thermometers- 1
- Examples. 1

Unit- III 9Hrs

Heat Transfer Applications

- Steady state heat transfer- calculation- 1
- heat exchanger equipment- types- 1
- local heat transfer coefficients- equation- 1
- heat transfer to non-Newtonian fluids in laminar flow- examples- 1
- unsteady state heat transfer – 1
  Fourier number – Biot number –

- heisler and gurney- Lurie charts- calculations- 1
- evaporation – single effect evaporators- 1
- improving the economy of evaporators- 1
- Dehydration- water activity. 1

Unit – IV 9Hrs

Mass Transfer

• Mass transfer:- Psychometry –	2	
• heat and Mass transfer in dehydration –		1
• Stage of drying-		1
• Prediction of drying from drying rate data-		1
• Types of driers –		1
• Problems-		1
• Extraction- types- principles- systems-	1	
• Problems		1

Unit – V 9Hrs

Physical Separation Process

• Physical separation process- Types		1
• Filtration –		1
• Filtrate flow through filter cake-		
• Types of filtrations – Constant pressure filtration and constant rate filtration	2	
• Reverse osmosis		1
• Sieving and Gravity separation- problems-		2
• Sedimentation		1
• Material handling equipment.		1

Textbooks:

1.Fundamentals of food process engineering, Romeo T. Toledo 2nd edition

CBS Pub. Delhi.

References:

1. Pandey H. *et al.,* "Experiments in Food Process Engineering" 1st edition,CBS Pub. Delhi.

2. R. Paul Singh, "Introduction to Food Process Engineering"3rd Edition. Academic Press, London, 2004.

3. R. E. Earley, "Unit Operations in Food Process Engg".

4. Refrigeration & Air conditioning P Kurmy & Guptha

5. Warren L Macabe, Julian C Smith,Peter Hariot, "Unit Operations of Chemical Engineering".

PRINCIPLES OF ECONOMICS

Objective : To study the trends in market with relation to food sector.

Expected Outcome : Students will be able to get knowledge on basic concepts in Micro Economics, Market forces (demand and supply), market structure and Macro Economic concepts and food safety net for poor and public distribution system (PDS)

Note : With Reference to Food Production & Processing in India

Unit – I **6Hrs**

Scope of Economics

- Introduction- nature and scope of economics- 2
- alternate definitions of economics- 1
- consumption- human wants- classification- 1
- law of diminishing marginal utility- 1
- law of demand and law of supply. 1

Unit – II **6Hrs**

PRODUCTION AND COST ANALYSIS

- Production – production function- 2
- isoquants- law of variable proportion- 1
- cost analysis- perfect analysis- 1
- perfect competition- assumption- 1
- price determination- 1

Unit – III **6Hrs**

PRODUCTS- INCOME

- National income- definition- concepts – 1
- Products- income, expenditure 1
- Value added method of measuring – 1
- Contribution of food production to national income- 1
- Difficulties in the measurements – 1
- Importance of national income. 1

Unit – IV **6Hrs**

FOOD SECURITY IN INDIA

- Food security in India- concepts- 1
- food self sufficiency in India 1
- food securiety- state wise area, 1
- production and yield of food grains- 2
- growth of India food production in the world context 1

Unit- V **6Hrs**

PUBLIC DISTRIBUTION SYSTEM IN INDIA

- Food Security- Public Distribution system in India – 2
- Flaws in food security system- 1
- Reorganization of food security system and safety 1
- Safety net for poor – 1
- Revised public distribution system (PDS 2000) 1

Reference:

1. Agricultural Marketi9ng in India: S.S. Acharya, N.L. Agarwal
2. Marketing of Agricultural Products : Richard L. Kohls and Josheps N. 9th edition.

POST HARVEST TECHNOLOGY OF FIELD CROPS (New)

(Including cereals, pulses, oil seeds and fruits and vegetables)

Credits : 3 **II Year / I Semester**

Subject code : 212105 **No. of lecture hours : 45**

Objective: To understand the principles of cereals, pulses, fruit and vegetable processing.

UNIT-I

9Hrs

Cereal Processing

- Rice- chemical composition 1
- Milling- ageing, processed foods of rice 1
- Para boiling of paddy – principles and methods 1
- Wheat composition, parboiling of wheat: Principles- soaking, steaming, drying 1
- Batch method- continuous process 1
- Wheat milling- enzymes in wheat milling 1
- Flour- dough preparation- utilization 1
- Processing of maize for starch, syrup and poultry feed 1
- A note on convenience and RTE foods 1

UNIT-II

9Hrs

Pulse Processing

- Processing of pulses - Milling, Hulling, Polishing 2
- Milling of pulses- traditional commercial methods 2
- Dry milling of pulses 1
- Milling of pulses by CFTRI method 1

- Processing of oil seeds: groundnut, soybean, sunflower 2
- Processing of oil seeds: mustard and palm 1

UNIT-III

9Hrs

Fruits & Vegetables: Post Harvest changes

- Fruit & Vegetables- Composition 1
- Physico-chemical properties, textural components 2
- Post harvest changes in F&V – Respiration, Ripening 2
- Color, textural changes, changes in fats & organic acids 1
- Commercial canning – canning of fruits & vegetables 1
- Spoilage in canned foods 1
- Ripening effects on quality of fruits and vegetables 1

UNIT-IV

9Hrs

Fruit & Vegetable Processing

- Fruit juices- Squashes and cordials- Preparation 1
- Principles of preservation of fruits & vegetables 1
- Preservation by straining, filtration, clarification 1
- Preservation by addition of sugars, by drying, by carbonation 2
- Preservation by Preservatives and other methods 1
- Packaging technology and storage system 1
- Quality assurance of fruits, vegetables & their products 1
- Non thermal processing of fruits and vegetables 1

UNIT-V

9Hrs

By product & waste utilization

- By products from fruit and vegetable industry – classification 2
- By products from fruit and vegetable industry - Utility, statistics 1
- Waste from fruit and vegetable processing plants 2
- Methods of disposal 2
- Immobilized biocatalysts in food industry 2

References:

1. Chakravarthy A. and Dc I.S, ''PHT of cereals and pulses'', Oxford and IBH Publishing. Co New Delhi, 1981.
2. Thompson AK. Post Harves Technology of Fruits and vegetables. Blacwell Sci. 1995.
3. Kadar, ''Post-harvest Technology of Horticultural Crops'', 2nd Ed, University of California, 1992.
4. Lal G, Siddapa GS & Tandon GL. ''Preservation of Fruits and vegetables''. ICAR, 1986.

Srivastava RP & Kumar S. ''Fruit and Vegetable Preservation – Priciples and Practies''. International Book Distributors. 2003.

SUGAR CONFECTIONERY AND CHOCOLATE MANUFACTURE

Objective: To understand composition and manufacture of various confections

UNIT –I **9Hrs**

- Status of confectionery industries in India – 2
- Types of sugar: granulated, Caster, Icing, Liquid sugars, Brown Sugars, 1
- Molasses, and microcrystalline sugars. 1
- Composition of sugars- 1
- Properties of sugar and sugar solutions – 2
- Glucose syrups and refined glucose syrups in sugar confectionery manufacture. 2

UNIT –II **9Hrs**

- Oils and Fats – uses in confectionery items, 1
- Milk and related products, 1
- Composition of milk and functional properties of its major components, 1
- Application of milk and milk based ingredients. 1
- Colors – Factors influencing choice – natural and Synthetics colors. 1
- Flavoring - Natural and Artificial – 1
- Flavor Strength, factors effecting stability of flavoring compounds. 1
- General technical aspects of industrial sugar confectionery manufacture, 1
- Compositional effects, change of state, evaporation, sweetness and taste. 1

UNIT – III **9Hrs**

- Manufacture of hard-boiled sweets: 1
- ingredients, Prevention of recrystallization and stickiness, 1
- Manufacturing methods of toffee and fudge 1
- Product types: Caramel, toffee and fudge: - 1
- Ingredients, Structure of toffee, formulation, processing, toffee stability. 1
- Cocoa beans, cocoa fruit, pulp. 1
- Cocoa chocolate and related products: 1
- Sequence of processes, 1
- Chocolate recipes, 1
- Cocoa powder, mixing, refining and conching, tempering of chocolates. 1

UNIT-IV **9Hrs**

- Gums and Jellies: Technology and Chemistry of hydrocolloids, 1
- Hydrocolloid pretreatment process, 1

SUGAR CONFECTIONERY AND CHOCOLATE MANUFACTURE

Objective: To understand composition and manufacture of various confections

UNIT –I **9Hrs**

- Status of confectionery industries in India – 2
- Types of sugar: granulated, Caster, Icing, Liquid sugars, Brown Sugars, 1
- Molasses, and microcrystalline sugars. 1
- Composition of sugars- 1
- Properties of sugar and sugar solutions – 2
- Glucose syrups and refined glucose syrups in sugar confectionery manufacture. 2

UNIT –II **9Hrs**

- Oils and Fats – uses in confectionery items, 1
- Milk and related products, 1
- Composition of milk and functional properties of its major components, 1
- Application of milk and milk based ingredients. 1
- Colors – Factors influencing choice – natural and Synthetics colors. 1
- Flavoring - Natural and Artificial – 1
- Flavor Strength, factors effecting stability of flavoring compounds. 1
- General technical aspects of industrial sugar confectionery manufacture, 1
- Compositional effects, change of state, evaporation, sweetness and taste. 1

UNIT – III **9Hrs**

- Manufacture of hard-boiled sweets: 1
- ingredients, Prevention of recrystallization and stickiness, 1
- Manufacturing methods of toffee and fudge 1
- Product types: Caramel, toffee and fudge: - 1
- Ingredients, Structure of toffee, formulation, processing, toffee stability. 1
- Cocoa beans, cocoa fruit, pulp. 1
- Cocoa chocolate and related products: 1
- Sequence of processes, 1
- Chocolate recipes, 1
- Cocoa powder, mixing, refining and conching, tempering of chocolates. 1

UNIT-IV **9Hrs**

- Gums and Jellies: Technology and Chemistry of hydrocolloids, 1

Hydrocolloid pretreatment process,

PRACTICALS - SUGAR CONFECTIONERY AND CHOCOLATE MANUFACTURE

Objective: To prepare and analyze various confections

• Analysis of sucrose (Liquid and sugar Crystals)	3	
• Analysis of confectionery products		3
• Handling of processing equipment in sugar confectionery		3
• Preparation of Hard boiled sweets		3
• Preparation of Chocolate syrup and moulded chocolates	3	
• Preparation of Fudge		3
• Preparation of fondant		3
• Preparation of marshmallow		3
• Study of working principles of Evaporator,		3
• Study of working principles of Crystallizer and Centrifugal machines	3	
• Visit to the Sugar Confectionary Industry.		3
• Cost benefit analysis of Confectionery industry	3	

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

DAIRY TECHNOLOGY

Objective: To study the composition and manufacture of dairy products

UNIT-I **9Hrs**

Processing of Milk

- Milk Industries in India – Role of operation flood program 1
- Definition of milk – Source as food composition and nutritive value 1
- Physical and Chemical Properties of milk 1
- Processing of milk: Receiving of milk, Platform tests, Filtration and
- Clarification, Standardization 2
- Pasteurization methods– Sterilization methods, 1
- Homogenization, Packaging and distribution of milk 1
- Definition – Standardized milk, Single toned, Double toned milk 1
- Manufacture and shelf life of Sterilized bottle milk and flavored milk 1

UNIT-II **9Hrs**

Cream & Butter

- Cream – cream separation, cream separator, 1
- Methods of cream separation- 1
- Factors governing richness of cream, factors governing fat percentage. 2
- Butter- introduction, composition process involved, cream neutralization, addition of starter cultures, cream ripening, churning, packing of butter 2
- Packing- factors influencing churning, over-run in butter, 2
- Butter defects- their causes and prevention. 1

UNIT- III **9Hrs**

Cheese

- Cheese- introduction, history, definition, 2
- Classification, composition, nutritive value, legal standards. 2
- Manufacturing of cheddar cheese, their defects and control 2
- Manufacture of processed cheese their defects and control 1
- Manufacture of Swiss cheese and their defects and control 1
- Manufacture of cottage cheese, their defects and control. 1

UNIT – IV **9Hrs**
Concentrated & Dehydrated Milk Products

- Condensed milk- history, composition, and types 1
- Methods of manufacture, vacuum pan condensing, and defects in condensed milk. 1
- Dried milk (Milk Powder)- history, types, composition of dried milk- 1
- Methods of manufacture- drum drying, spray drying, freeze-drying,Packaging of milk powder- 2
- Properties of dry milk- bulk density, solubility, solubility index, wettability-1 dispersability-
- Defects in dried milk, Reconstitution- instant milk powder- 1
- Malted milk beverages like horlicks, viva, etc. 2

UNIT- V **9Hrs**
Ice Cream

- Ice cream – history, definition, classification, composition 1
- Ingredients sweethearts, stabilizers, flavours, etc- 1
- Preparation of ice cream, calculation of ice cream mix, 1
- Pasteurization of milk, homogenization, ageing, freezing, packaging of ice cream-defects and over run in ice cream. 1
- Indigenous milk products: Rabri, kheer, channa, paneer, rasogolla, ghee, khoa,Kalakhand, srikhand & lassi 1
- Methods of preparation of Indigenous milk products & composition. 2
- Cultured milk products: Dahi / Yoghurt – their composition, 1
- Changes in constituents during fermentation and flavor development. 1

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 & Practices”, 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.

IV Semester

FOOD BIOTECHNOLOGY

Objective: To gain knowledge on biotechnological applications in foods

Unit – I **9Hrs**

Biotechnology & Food

- Biotechnology 1
- Applications of genetics to food production 2
- Impact of biotechnology in food industry 2
- Impact of biotechnology on Food and Nutrition 2
- Impact of biotechnology on the nutritional quality of foods 2

Unit – II **9Hrs**

Fermentation

- Methods of fermentation 1
- application of fermentation 1
- Analytical methods for evaluating fermentation products 1
- Fermentation systems- introduction 1
- Fermentation systems – microbial growth kinetics 1
- Media for fermentation 1
- Working principles of fermentor 2
- Bio products estimation, assay and recovery 1

Unit – III **9Hrs**

Cell Cultures

- Animal cell culture methods 2
- Suspension cultures 2
- Media and propagation of cell lines 2
- Immobilization of microbial and cultured cells 1
- Single cell protein- production- modification- utilization 2

Unit – I **9Hrs**

Tissue Culture & Bacterial culture

- Functional proteins from yeasts - uses in foods 1
- Application of bacterial starter cultures in food industry 1
- Corn sweeteners 1
- Plant tissue culture for lipid production 2
- Enzyme technology and its application 1
- Microbial lipases 1
- Organic acids- citric acid, acetic acid, lactic acid – production methods 2

Unit – V **9Hrs**

Regulations & Standards

- Regulatory aspects for biotechnological methods 3
- GMO/ GEO role in Food industries 3
- Social appraisal of biotechnology in foods 3

References:

1. Dietrich Knorr, " Food Biotechnology" Marcel Decker Publishers, New York, 1982.
2. Bailey and ollis, " Biochemical Engineering Fundamentals" Mc Graw Hill Publications.
3. Shule and kargi, " Bio process Engineering Basic Concepts" Prentice Hall- India.2002.
4. Vedpal malik and padma sreedhar, " Industrial Biotechnology" , Oxford & IBH Delhi.1992.

PRACTICALS - FOOD BIOTECHNOLOGY

Objective: To culture and characterize the relation between organisms and foods

- Isolation of useful organisms from Agri-based foods 3
- Isolation of useful organisms from dairy products 3
- Preparing bacterial starter cultures 3
- Microbial growth kinetics 6
- Effect of temperature and P^H on growth of microbes 3
- Batch, fed batch and continuous cultures – estimation of Monod parameters 3

- Study of activity of enzymes in food fermentation 3
- Cell disruption techniques 3
- Product enrichment operation 3

References:

1. Dietrich Knorr, " Food Biotechnology" Marcel Decker Publishers, New York, 1982.
2. Bailey and ollis, " Biochemical Engineering Fundamentals" Mc Graw Hill Publications.
3. Shule and kargi, " Bio process Engineering Basic Concepts" Prentice Hall- India.2002.
4. Vedpal malik and padma sreedhar, " Industrial Biotechnology" , Oxford & IBH Delhi.1992.

BAKING SCIENCE & TECHNOLOGY

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

UNIT-1 **9Hrs**

- Bread types, quality assessment and formulations 2
- Ingredients: wheat flour, components and functions; proteins carbohydrates, lipids and enzymes 1
- Miscellaneous flours (rye, tricale) 1
- shortenings; functions, sources, types and mechanisms 1
- sweeteners; functions; types 1
- yeast; functions, types and factors influencing the fermentation 1
- Minor ingredients; yeast foods enzymatic supplements, oxidizing agents, salt, dairy and egg products, mold inhibitors, dough strengtheners/ softeners and enrichment 2

Unit – II

9Hrs

- Bread making process; straight dough - rapid processing 1
- mechanical dough development 1
- Mixing and dough processing; functions of mixing, mixer types 1
- fermentation, dough transfer system, dough make up 1
- dividing rounding and pre-moulding 1
- first proving moulding panning and proving Process; developments 1
- Baking process, stages, baking reactions and bread cooling 1
- thermal reactions keeping properties of bread and related products 1
- Bread spoilage and staling, factors and control measures 1

Unit – III

9Hrs

- Biscuits; biscuits, cookies and crackers 1
- ingredient and their functions, wheat flour, granulation, Shortening, sweeteners, chemical leaveners 2
- Baking powder, function, composition, and reactive rates, neutralizing value 1
- Preparation of biscuits dough's mixing objectives, mixer types 2
- fermentation of shaped dough pieces 1
- Biscuit baking, heat transfer mechanism, changes during baking 2
- Cooling, packaging and storage 1

Unit – IV

9Hrs

- Cakes: cake varieties, ingredients and their functions 2
- wheat flour, components; shortening, egg, baking powder icing, confectionery coating, minor ingredients 2
- formulations, formula balance 1
- cake mixing objectives and methods 2
- Batter specific gravity, temperature and P^H, baking reactions 2

Unit – V

9Hrs

- Wafers: fermentation, ingredients and their function 2
- flour, water, shortening, aerating agent and minor ingredients 2
- mixing, storage and depositing of wafer butter, baking, cooling and conditioning of wafer sheets 2
- Frozen dough products 1
- Fat bread technology 1
- Starches-sources, composition, properties, modifications methods and applications in bakery industry 1

References:

1. Cauvain & LindaS.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, EJ "BakingScience& Technology" Vol.-I &II, 3rd edition ,sopsland Pub. Kansas, U.S.A 1988.
4. Pomeraz. Y, "Wheat chemistry & Technology" Vol.I & II , 3rd edition A.A.C.C.
5. Wade.P , "Biscuits Cookies & Crackers" Vol.I , Elsveir. 1998.
6. Almond , "Biscuits Cookies & Crackers "Vol.II , Elsveir 1998.

APPLIED STATISTICS

Objective: To study the basic statistical techniques in relation to food analysis

Unit – I

9Hrs

- Measures of central tendency
  - Mean 1
  - Mode 1
  - median for grouped and ungrouped data 1
  - merits and demerits 1
- Measures of dispersion- range 1
- quarterly deviation- mean deviation 1
- standard deviation- merits and demerits for grouped and ungrouped data 2
- co-efficient of variation- simple problems 1

Unit – II

9Hrs

- Correlation – types of correlation 1
- scatter diagram- Karl Pearson's coefficient of correlation 2
- rank correlation- non- repeated and repeated ranks - simple problems 1
- Regression lines- regression equations 1
- fitting of linear regression equation 2
- fitting of linear regression equation of Yon X and X on Y -Simple problems 2

Unit – III

9Hrs

- Sampling – types of sampling- purposive sampling 1
- random sampling and stratified sampling 1
- definition of null hypothesis- alternative hypothesis 1
- type- I error- Type II error- level of significance 1
- Test of significance for large samples 1
- test signification for single proportion 1
- test signification for difference proportion 1
- test signification for single mean- test signification for difference of means 1
- test signification for difference of standard deviation- simple problems 1

Unit – IV

9Hrs

- Chi- Square Test: Chi – Square Test for goodness of fit 2

- chi-square test for independence of attributes 1
- yate's correction 1
- T- test: - t- test for single mean 1
- t- test for two means 1
- paired t- Test 1
- t- test for significance of the correlation of coefficient 2

Unit – V

9Hrs

- Analysis of Variance 1
- F-Test- analysis of variance- assumptions 2
- ANOVA in one way- classification 2
- two – way of classification 2
- simple problems 2

References:

1. S.C. Gupthaand V.K. Kapoor, "Fundamentals of Mathematical statistics", sulthan /Chand & Sons, New Delhi.2002.

2. S.C. Gupthaand V.K. Kapoor, "Stastistical Methods", sulthan /Chand & Sons, New Delhi. 2000.

3. V.K.Kapoor "Problems and solution in statistics" 3rd edition sulthan chand & Sons, New Delhi.2000.

CHEMISTRY AND TECHNOLOGY OF FOOD OILS AND FATS

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

Unit – I 9Hrs

Composition & Classification of Fats

- Fat - Definition, Importance 1
- Chemical composition of fats 2
- Triglycerides – their structure and composition 2
- Mono glycerides and diglycerides 1
- Free fatty acids – phosphatides 1
- Sterols – fatty alcohols 1
- Tocopherols 1

Unit – II 9Hrs

Characteristics of fat

- Nutritional aspects of fats and oils 1
- Metabolism – fat level in the diet and effect on health 1
- Non-allergenicity of edible oils 1
- Fat reduction in foods 1
- Factors affecting physical characteristics of fats and oils 1
- Chemical reactions of fats and fatty acids 1
- Important characteristics of oils from;
    - coconut, cotton seeds, Palm 1
    - Sunflower, sesame, safflower, rice bran, rape seed 1
    - Mustard, Linseed, soybean, castor and lard 1

Unit – III 9Hrs

Processing of fats

- Processing methods of oils – Degumming, refining, bleaching 1
- Deodorizing, fractionation, Hydrogenation, inter esterification & esterification 1
- Common products preparation – Salad and cooking oils 1
- shortenings (baking and frying fats) 1
- Hard butters, margarine and spreads 1
- Dressings for food -(Mayonnaise and Salad dressings) 1
- Pourable – type dressings, reduced calorie dressing 1
- Toppings, coffee whiteners, confectionaries coatings 1
- Low Fat spreads for traditional breakfast foods 1

Unit – IV **9Hrs**

Value Added Products from fats

- Growing demands on oils & lipids from traditional and convenience food markets in terms of quality 1
- Functional, sensory and nutritional strengths 1
- Technologies to improve the edible oil pool in India 1
- Stability of oils and fats 1
- Value added products from vegetable oil refining industry: lecithin, wax 2
- Value added products from vegetable oil refining industry: Vitamin-E, oryzanol 2
- Alternative methods for extraction & processing of oils 1

UNIT – V **9Hrs**

By Product Utilization

- Value added products from non-traditional oils and fats 2
- By-products from bran oil and oil refining industry 2
- Utilization of lingo cellulosic waste from oil industry 1
- Bakery fats with zero trans fatty acids 2
- Refining procedures for edible oils with a note on analytical techniques in lipids 2

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.

PRACTICALS - CHEMISTRY AND TECHNOLOGY OF FOOD OILS AND FATS

Objective: To carryout physicochemical analysis of oils and fats

- Common Test methods for Fats
  - 1) Cold Test 2
  - 2) Colour, (Lovibond) 2
  - 3) Dropping point 2
  - 4) Flavour 2
  - 5) FFA 2
  - 6) Melting Point 2
  - 7) Oil stability index 2
  - 8) Peroxide Value 2
  - 9) solid fat index 2
  - 10) Solid fat content 2
  - 11) Total lipids and thiobarbituric acid reactive substances (TBARS) 2
  - 12) Karl-Fischer titration- application 2

- B) Oil Seeds 6
  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

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.

III YEAR FOOD TECHNOLOGY AND MANAGEMENT

V SEMESTER

FOOD PROCESSING WASTE MANAGEMENT

Objective : To study the utilization of various industrial wastes

Unit- I
9Hrs

- Types of wastes from Food processing industries effects in environment- Environmental legislation 1
- sources of waste water-effluent guidelines and standards 1
- methods of sampling waste waters-individual and composite sampling 1
- sample preservation and handling 1
- Characterization of waste water- definitions 1
- determination of oxygen demands 1
- Ecosystem approach in environmental management- types of ecosystems 1
- biological cycles, their impact 1
- environmental impact assessment (EIA); environmental management plan (EMP) 1

Unit- II
9Hrs

- Introduction to waste water treatment 1
- UNIT concept of treatment- classification of waste water treatment system 1
- Physical and physico-chemical treatment screening and screening equipment 1
- sedimentation –types of sedimentation and sedimentation equipment 1
- Theory and practice of coagulation and flocculation 1
- Floatation and floatation equipment 1
- Precipitation, chlorination 1
- Fundamentals of reverse Osmosis, ion exchange and electro dialysis 1
- Energy conservation in food processing industry 1

Unit –III
9Hrs

- Biological oxidation of waste water 1
- Role of biological organisms 1
- Microorganism and microbial reactions 1
- microbial growth curve 1
- Aerobic process-Description working of aeration equipment 2
- description and working of activated sludge processes 1

- extended aeration, contact stabilization 1
- aerated lagoons and stabilization ponds 1

Unit – IV

9Hrs

- Description, working of trickling filters 1
- rotating biological contractors 1
- activated bio-filtration 1
- Biological fluidized bed reactor 1
- IFBBR, packed column reactor 1
- Cell immobilization as a tool in wastewater treatment 1
- Anaerobic process –description and working of anaerobic filters 2
- Anaerobic digestion equipment 1

Unit – V

9Hrs

- Management of waste by products:
  - Sugar 1
  - fruits and vegetable 1
  - Meat, fish 1
  - oil and fat 1
  - Dairy and cereals 1
- Recovery of useful materials from effluents by different systems 2
- Utilization of food industry wastes 2

Note: Visit to food processing industries, wastewater treatment units.

Text Book

1. Herzaka A and R G, 1981. Food industry wastes, disposal and recovery. Applied Science Pub, London**.**

References:

1. Lawrence K W and Wang MUS, "Handbook of industrial waste treatment", Marcel Dekker, Inc, New York.1992.

2. Lee B H, "Fundamentals of food biotechnology", VCH Publishers,Inc, New York.1996.

FOOD SAFETY, QUALITY CONTROL AND SENSORY EVALUATION

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

Unit – I

12Hrs

- Food safety: characterization and risk analysis 4
- Food hazards: Physical, chemical and biological Systems for food safety. 4
- Hazard Analysis Critical Control Point (HACCP) and its implementation. 4

Unit – II

12Hrs

- Qualify assurance: Theoretical and practical considerations 2
- Description of different systems: GAP, GMP, TQM, ISO. 3
- Indian food standards- voluntary and obligatory standards
- (PFA, FPO, MMPO, Meat and Meat Products order, AGMARK etc.) 3

- Food safety and standards act (FSSA) 2
- Codex alimantarius 1
- Worldwide food safety issues. 1

Unit- III

12Hrs

- Sampling methods- random and statistical methods 2
- Quality assurance 2
- Quality control and testing of raw material and finished products in
- cereals, fruits and vegetables, 3
- dairy, confectionery, beverages, 3
- meat and egg processing plants 2

Unit –IV

12Hrs

- Sensory evaluation- Requirements and methods. 3
- Sensory parameters: colour, flavour, texture, taste, aroma, general acceptability. 3
- Subjective and objective test of sensory parameters. 6
- (Differential tests, Descriptive test, Rating tests, Sensitivity threshold test)

Unit-V **12Hrs**

- Cleaning In Place (CIP) 2
- Different Sanitizers and detergents 3

- Sanitation and hygiene in quality assurance in different food industries

- (Fruits and vegetables, Meat, Milk, and Cereal based). 5
- Cost of quality 1
- Supplier development. 1

Text Books

1. Schmidt R H and Rodrick G E, " Food safety handbook". JohnWiley and Sons Inc.2003.

2. Jones J M, " Food Safety". AACC. Paul, Minn, USA 1992.

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 Official

   Analytical Chemists", Arlington 1995.

TECHNOLOGY OF MEAT, FISH, POULTRY & THEIR PRODUCTS

Objective: To study the various aspects of meat processing technology.

Unit – I

12Hrs

- Sources of meat and meat products in India 2
- Its importance in national economy 2
- microscopic structure of meat 2
- Physico-chemical properties of meat 2
- Nutritive value of meat 1
- Effect of feed, breed and management on meat production and quality 1
- Conversion of muscle to meat 2

Unit – II

12Hrs

- Premortem inspection and care of animals 2
- stunning types, slaughtering types 2
- Slaughter house operations 2
- dressing, anti- and postmortem changes in carcass composition 4
- grading of meat and meat cuts 2

Unit – III

12Hrs

- Processing and preservation of meat:
  - canning, freezing 2
  - salting, Dehydration 2
  - Aging, pickling and smoking of meat 2
- Spoilage and its control 2
- Communited and non-communited meat products 2
- Meat by- products 2

Unit – IV

12Hrs

- Poultry: Classes of poultry meat 1
- Commercial methods of slaughtering, dressing 2
- Post-slaughter handling, storage and preservation of poultry meat 2
- Spoilage and its control 2
- Freezing of poultry (whole and cuts) 1
- Eggs: Composition, handling, candling washing, coating, packaging and storage 2
- Egg processing (Egg powder manufacturing) 1
- Spoilage and its control 1

FOOD PACKAGING

Objective: To study the effect of packaging materials on shelf life of food.

Unit – I **12Hrs**

- Introduction to packaging 1
- Packaging operation 1
- package-functions and design 2
- Principle in the development of protective packaging 1
- Deteriorative changes in foodstuff 2
- packaging methods for prevention 2
- shelf life of packaged foodstuff 1
- methods to extend shelf life 2

UNIT- II

12Hrs

- Food containers:
  - wooden boxes, crates, plywood and wire bound boxes 2
  - corrugated and fiber board boxes 2
  - textile and paper sacks 2
  - Metal containers, tin plate, corrosion of containers 2
- Food packages-bags, pouches, wrappers, cartons 2
- other traditional package 2

UNIT- III

12Hrs

- Flexible packaging materials and their properties;
  - Paper, metal foils 3
  - polymers, and laminates 3
- Packaging additives 2
- Considerations in the packaging of perishables and processed foods 2
- Aluminum as packaging material 2

UNIT-IV

12Hrs

Evaluation of packaging **1**

- material and package performance 2
- packaging equipment 2
- Metering and filling of different foods 2
- Aseptic filling of foods 2
- Labeling requirements 1
- Bar coding- Printing 1

- package standards and regulation 1

UNIT-V 12Hrs

- Trends in latest packaging 1
- Modified Atmospheric Packing (MAP) 2
- Controlled Atmospheric Packaging (CAP) 2
- Oxygen scavengers, Shrink packaging 2
- aseptic and retortable pouches 1
- Flexible and laminated pouches 1
- Biodegradable packaging 1
- Active packaging 1
- Packaging of different food materials-
    - Fruit and vegetables, meat, milk and egg products, oils, RTE foods 1

Textbooks

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

APPLICATIONS OF COMPUTER SCIENCE

Credits :2 **III year/ I Sem**

Subject code. 213106 **No.of lecture hours:30**

Objective: To study the applications of computer and its techniques in food industry.

Unit –I

6Hrs

- History of computers, generations of computers 1
- characteristics of computers 1
- data representation – number system 1
- binary, octal and hexadecimal 1
- Conversion from one number system to another 1
- Hardware, Software, Translators, Compilers and interpreters 1

Unit – II

6Hrs

- System software, application software 1
- simple operating concepts, flowchart 1
- algorithms with simple examples 1
- DOS commands – Internal and external commands 2
- file management and directory structure 1

Unit – III

6Hrs

- **WINDOWS** **3**
  - working with windows explorer
  - creating a new directory, copy files from one directory to another, deleting files.
  - Control panel- background, Mouse settings, screen saver
- **M.S-WORD** **3**
  - Creating a new document, designing documents setting margins, headers and footers, tabs & tables
  - Formatting a document editing – find and replace text
  - Protecting documents, Mail Merge and Newsprint.

Unit – IV

6Hrs

- **POWERPOINT** 2
  - Creating, opening and saving presentations
  - Working on different views - Working with slides
  - Formatting paragraphs, drawing and working with objectives
- **EXCEL** 4
  - Creating a new worksheet-select, edit (Copy, move, format, setting column width etc.)
  - Referencing cells (Addressing methods).
  - Functions-logical, mathematical, statistical, date and time.
  - Formulae, charts, macros.
  - Creating an excel database-sort and filter database. Performing what –if analysis on worksheet data.
  - Analysis data with pivot tables.

Unit- V

6Hrs

ACCESS

- Access basics: Database, tables, records, fields 1
- The database window: Tables, Queries, forms, reports, Macros, and modules 1
- Creating a table, setting field properties, modifying the structure, setting primary key, adding and deleting fields 1
- Entering table data. Creating forms 1
- Queries on data- select query, update query, delete Query, Append query 1
- Designing reports 1

References:

1. Deepak Bharihoke, "Fundamentals of Information Technology".
2. Sharon Crawford and Neil J. Salkind, " ABCs of Windows",BPB Publications.

PRACTICAL - APPLICATIONS OF COMPUTER SCIENCE

Objective : To inculcate practical knowledge of computers and its application in food industry.

- MS – Word:
  - Resume, Timetable 1
  - Mail Merge, Newsprint 2
  - Business Letter, Report using format features 2
  - syllabus using bullets and numbering 1
- Excel:
  - Payroll Processing 2
  - Tax Assessment 1
  - Memorandum of Marks 1
  - Sorting a database 1
  - Filtering data 2
  - Creating charts & other application problem 2

References:

1. Deepak Bharihoke, "Fundamentals of Information Technology".
2. Sharon Crawford and Neil J. Salkind, " ABCs of Windows",BPB Publications.

VI semester
PRINCIPLES OF MARKETING

Objective: To study the principles of marketing with reference to food industry

Unit – I

9Hrs

- Introduction to marketing – marketing, meaning 1
- definition of marketing Vs selling 2
- Marketing social responsibilities – environment scanning 2
- Macro and Microenvironment – factor – agriculture policy 2
- WTO and Indian agricultural Challenges and priorities in the global economy 1
- Health and nutrition in India w.r.t agriculture and food industry 1

Unit – II

9Hrs

- Marketing process testing 2
- segmentation and position activities 2
- demand measurement and sales forecasting methods 3
- marketing costs – marketing margins 2

Unit – III

9Hrs

- Marketing mix elements – marketing mix meaning 1
- product – product decisions 2
- stages in new product development 2
- product life cycle – stages and strategies 2
- Price – meaning and importance – pricing policies 2

Unit – IV

9Hrs

- Channels of distribution – Types of channels 2
- marketing of farm products : 2
    - marketing functions
    - packaging – transportation
    - grading and standardization
    - storage and processing 1
- Marketing of processed Food products 1
- Promotion – definition – promotion mix variables 2
- design of promotion program (Reference to Food Industry) 1

Unit – V

9Hrs

- Consumer behavior- definition – stages in buying process 3
- Factors affecting consumer behavior 2
- Role of perception 2
- Environmental and group influences (w.r.t Food Industry) 2

References:

1. Principle of practices of Management: L.M. Prasad
2. Marketing Management: Philip Kotler, Pearson education, Asia 2001
3. Business policy and strategic management: W.G'lveck & L.R. jauch, Mc Graw hill 1998
4. Consumer behavior: Schiffman & Knauk, Prentice Hall of India 6th edition 1997.

FOOD SUPPLY CHAIN MANAGEMENT

Objectives: To study concepts and basics of supply chain with reference to food industry

Unit – I
9Hrs

- Introduction – Concept of supply chain management (SCM) 2
- Objectives and functions of SCM 1
- Logistics management, logistics to supply chain management 2
- Conceptual framework of SCM 1
- Supply Chain Strategy and operating model for supply chain 2
- Balance business score and framework 1

Unit – II
9Hrs

- Customer focus in supply chain alignment theory 3
- Competitive situation, developing customer service strategy 3
- value chain and value delivery system for SCM 3

Unit – III
9Hrs

- Inventory management in supply chain as an element of customer service 2
- Logistics management, transportation in supply chain 2
- factors effecting transport selection 1
- formulating supply chain strategy 1
- strategic development criteria logistics implication 1
- channel design and management 1
- development of integrated logistic strategy 1

Unit – IV
9Hrs

- Strategic partnerships and alliances 1
- collaborative advantages, strategic relationships in logistics 1
- Best practice and bench marketing 2
- JIT, Re engineering of supply chain 1
- Optimization of the supply chain 2

Unit – V
9Hrs

- Optimization design and management of supply chain 1
- customer led business 1
- developing the logistics organization for effective supply chain management 1
- Issue in labor management and labor relations 1
- Retailing and supply chain interface 1
- managing the external supply chain 1
- managing internal supply chain 1
- Logistics in maximizing profitability and cash flow 1
- organizational design requirements for retail supply chain management 1

References:

1. Sinchi D, Levi, Kaminski Philip and Sim Chi, Levi E , "Designing and Management of the Supply Chain", Mc Graw Hill, 2000

2. Gattorna JL and Walters DW, " Managing the Supply chain, Macmillan business". 1996.

FOOD STORAGE AND INFESTATION CONTROL

Objective: To study the principles and design of storage and pest control techniques

Unit – I **9Hrs**

- Method of storage and care of un-processed and minimally processed foods;
  - cereals, Grains 2
  - Fruits, Vegetables and Tubers 2
- Principles of grain storage – Physical, Chemical and Biological 2
- Storage structures – Design of ware houses and sanitation 2
- Economic aspects of storage 1

Unit –II **9Hrs**

- Causes of losses in stored foods: Quality, Weight, Monetary, and others 2

- Scientific and socio economic factors affecting food storage 2
- methods of processing for efficient storage practices 2
- Mill and Factory Sanitation problems 1
- storage handling, Processing, Packaging and transport for infestation control 2

Unit – III

9Hrs

- Biological agents affecting the storage: Insects 1
- Food preferences and composition of food Vs insect infestation 2
- Moulds: distribution of microbiology of fungi on bulk grains and dried foods 2
- methods of estimation of micro flora on grains 2
- rodents – Types, behavior 2

Unit – IV

9Hrs

- Classification of pesticides and their importance in infestation control 1
- Physico – Chemical properties 2
- Pesticide formulation 1
- health hazards 1
- principles of fixing tolerance limits 1
- mode of action of pesticide 1
- equipments and appliances used 2

Unit – V

9Hrs

- Types of fumigants 1
- Physico-Chemical properties and applications 2
- equipments and appliances used 1
- Control measures: Insects – Pest proofing bags, Cartoons, Packages, Ware houses 1
- Principles and applications of durofume process 2
- ballooning technique – multiple fumigation and vacuum containers 2

Reference:

1) PJ.Wechmann,"Post Harvest Physiology of Vegetables",Marcel decker Inc. New York, 1997 .
2) Pantastico,"Post Harvest Physiology, Handling and utilization of tropical and subtropical fruits & Vegetables", AVI Publications.

3) Handling and Storage of Food Grains inTropical and Subtropical areas : D.W.Hall,1980, Oxford and IBH – Delhi

PRACTICALS - FOOD STORAGE AND INFESTATION CONTROL

Objective: To examine, identify pests important in relation to food and evaluate their effect on storage properties.

• Infestation in stored food grain-control measures	3	
• Gowdown sanitation and hygiene	3	
• Inspection and categorization of food grains		3
• Detection and estimation of infestation in foods	3	
• Estimation of losses due to infestation- cost/ benefit analysis		3
• Analysis of pesticide and fumigant residues in foods		3
• Handling of equipment used in the application of pesticides and fumigants	3	
• Protective demonstration of fumigation techniques, infestation techniques		3
• Pesticide formulations. Grading and inspection of grains	3	
• Warehouses, regulated markets and rural storage structures		3

Reference:

1) PJ.Wechmann,"Post Harvest Physiology of Vegetables",Marcel decker Inc. New York, 1997 .
2) Pantastico,"Post Harvest Physiology, Handling and utilization of tropical and subtropical fruits & Vegetables", AVI Publications.
3) Handling and Storage of Food Grains inTropical and Subtropical areas : D.W.Hall,1980, Oxford and IBH – Delhi

PRODUCTION AND OPERATIONS MANAGEMENT

Objective: To understand the principles of production and operations management and their application in food industry

Unit- I **9Hrs**

Production & operations management

- Introduction to production and operations management 1
- Definition of production and operations management 2
- Evaluation of production management as operation management 2
- Role of operations management in total management system 2
- Interface between the operation systems and systems of other functional areas 2

Unit – II **9Hrs**

Production planning & control

- Production planning and control: basic functions 1
- Production cycle- characteristics of process technologies 2
- Project, job, shop, assembly 1
- Continuous-inter relationship between product life cycle and process life cycle 2

- Plant capacity and line balancing 1
- Plant layout- different types of layouts 1
- Location and the factors influencing location (With reference to agro based industry) 1

Unit – III **9Hrs**

Maintenance management

- Maintenance management objectives 1
- Failure concept, reliability 1
- Preventive and breakdown maintenance- Replacement policies 1
- Quality control- standards and specifications 1
- Quality assurance and quality circles 1
- Statistical quality control- control charts for average 1

- Range fraction defective and number of defects 1
- Total quality management 1
- ISO certification improvement of productivity 1

Unit – IV **9Hrs**

Materials management

- Materials management- need, use and importance 2
- Materials requirement planning- materials budgeting 2
- Techniques for prioritization of materials 1
- Sour of supply of materials 1
- Selection evaluation and performance of suppliers 1
- Make or buy decisions and its implications under various circumstances 1
- Vendor rating- determinants of vendor rating 1

Unit – V **9Hrs**

Stores management

- Stores management – objectives of stores management 2
- Requirements for efficient management of stores 2
- Safety stock- inventory control- types of inventory – Costs 2
- Systems of inventory control- ABC, VED, and FNSD analysis 1
- Different systems of inventory control- JIT, LIFO, and FIFO systems of inventory control 1
- Value analysis- average pricing 1

References:

1. Everett A DAM.JR. AND RONALD J.Elbert: Production and Operation Management, Cincepts, Models and andBehavior, Prentice Hall InternayionalLtd-1995

2.Joseph G Monks: Operations Management, theory and problems McGraw Hill NewYork, 1987.

3.Hamild Noori andRisselRADford: production and operations Manqagement, Total Quality and Responsiveness, McGrAawHlls-1995.

FINANCIAL ACCOUNTING FOR MANAGEMENT

(NOTE: WITH REFERENCE TO FOOD INDUSTRY)

Credits : 3 **II – Year / II- sem**

Subject code : 212204 **No. of lecture hours:45**

Objective: To study the basics in accountancy applicable in food auditing

UNIT – I

9Hrs

- Accounting concepts and conventions 2
- Accounting cycle; Definition of transaction and accounts 1
- Classification of accounts 1
- Accounting equation; Process of accounting 2
- Books of original entry, Ledger, Trail Balance 3

UNIT – II

9Hrs

- Preparation of presentation of final statements 2
- Trading Account 2
- Profit & Loss Account 2
- Balance Sheet 3

UNIT – III

9Hrs

- Inventory valuation: Types of Inventory 2
- Costs-Systems of inventory Control – ABC, VED analysis 2
- LIFO, FIFO 1
- Simple Average 2
- Weighted Average methods 2

UNIT – IV **9Hrs**

- Financial Analysis: Financial Statement analysis 3
- Scope and purpose 2
- Ratio analysis – Liquidity, Activity, Profitability ratios 4

UNIT – V

9Hrs

- Funds Flow Analysis: Concept of Funds 2
- Ascertaining Funds from operations 2
- Sources of funds; Uses of funds 1
- Preparation and analysis of funds flow statement 2
- Preparation and analysis of Cash flow statements 2

REFERENCES:

1. Gupta R.L. Radhaswamy, " Advanced Accounting" Vol.I, Sultan Chand publications.
2. S.N. Maheswari, "Accountancy – I" Vikas publishers.
3. Walter B. Megis, "Accounting the Basis for Business decisions", 13th edition, McGraw Hill publications.

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