Jiwaji University, Gwalior MP

Department of Food Technology

College Syllabus (Non-CBCS)
FOR AFFILIATED COLLEGE
M. Sc. Food Technology

Session -2024-2026

M. Sc. FOOD TECHNOLOGY
FOR AFFILIATED COLLEGE
M. Sc. I SEMESTER SCHEME

Course Code	Course Name	Max Marks			Min Marks	
		IA	EA	TOTAL	IA	EA
101	Food Chemistry	15	85	100	05	29
102	Food Biochemistry & Nutrition	15	85	100	05	29
103	Food Microbiology	15	85	100	05	29
104	Principles of Food Processing & Preservation	15	85	100	05	29
106	Laboratory-I	-	-	100	05	29
107	Laboratory-II	-	-	100	05	29
	Grand Total	-	-	100	-	40

M. Sc. FOOD TECHNOLOGY
FOR AFFILIATED COLLEGE
M.Sc. II SEMESTER SCHEME

Course Code	Course Name	Max Marks			Min Marks	
		IA	EA	TOTAL	IA	EA
201	Fruits & Vegetable Technology	15	85	100	05	29
202	Food Quality control, Laws & Management	15	85	100	05	29
203	Food Engineering	15	85	100	05	29
204	Food Packaging	15	85	100	05	29
205	Laboratory-I	-	-	100	05	29
206	Laboratory-II	-	-	100	05	29
	Grand Total	-	-	100	-	40

M. Sc. FOOD TECHNOLOGY
FOR AFFILIATED COLLEGE
M.Sc. III SEMESTER SCHEME

Course Code	Course Name	Max Marks			Min Marks	
		IA	EA	TOTAL	IA	EA
301	Processing of Cereals, Legumes, oil seeds, & Sugar crops	15	85	100	05	29
302	Dairy Technology	15	85	100	05	29
303	Meat, Fish & Poultry products	15	85	100	05	29
304	Food additives, Spices & Flavor technology	15	85	100	05	29
305	Laboratory-I	-	-	100	05	29
306	Laboratory-II	-	-	100	05	29
	Grand Total	-	-	100	-	40

M. Sc. FOOD TECHNOLOGY
FOR AFFILIATED COLLEGE
M.Sc. IV SEMESTER SCHEME

Course Code	Course Name	Max Marks			Min Marks	
		IA	EA	TOTAL	IA	EA
401	Advances in Food technology	15	85	100	05	29
402	Entrepreneurship & Business management in food technology	15	85	100	05	29
403	Assignment/Personality development (Yoga/Physical Education/ Environment/ Languages/Social Work)	15	85	100	05	29
404	Project Work	15	85	100	05	29
	Grand Total	-	-	100	-	40

101: FOOD CHEMISTRY

Max Marks -85

Objective-To acquaint the students about chemistry of various foods.

Outcome: The student will have an idea of food constituents, importance and their daily dietary allowances; scope and prospects for food industries. Student will understand the changes in food during cooking, processing, storing and even digestion. Knowledge of the chemical components (nutritional value) of food is essential for developing a food product with essential amino acids and fatty acids. This also informs the health importance of food chemistry

UNIT –I

1. Food Chemistry- Definition & importance. Approaches to the study of food chemistry.

2.Carbohydrate: General introduction, classification, structure, properties and functions of carbohydrates. Role of carbohydrate in food industries. Starch, cellulose, gums, pectic substances, Modified starch.

3.Browning reactions in food: Enzymatic and non-enzymatic browning in foods of vegetable and animal origin during storage and processing of foods.

UNIT –II

1.Proteins: General introduction, classification, structure, physical and chemical properties, functions.

2.Purification and denaturation of proteins. The nature of interaction in protein derived from milk, egg protein, meat protein, fish muscle protein, oil seed protein and cereal protein.

3.Modified proteins and application in food industry. Single Cell Protein.

UNIT –III

1.Lipids: General introduction, classification, properties, functions and requirements of food lipids, Vegetable and animal fat, margarine, lard, butter.

2.Refining of crude oil, hydrogenation and winterization, Frying and shortenings.

3.Flavor changes in fats and oils (rancidity, lipolysis), auto-oxidation & biological significance of auto oxidation of lipids & factors affecting lipid oxidation.

UNIT -IV

1.**Vitamins:** General introduction, Fat- and Water-soluble Vitamins, effect of various processing treatments.

2.**Minerals**: General introduction, effect of various processing treatments.

3.**Fortification:** Methods, Significance and applications.

UNIT -V

1.Enzymes: General introduction, Nature, nomenclature, classification, properties and functions of enzymes. Factors affecting rate of enzymatic action.

2.Enzyme activity in different food systems, Introduction of Flavor production by enzymes.

3.Plant pigments and their role in Food Industry: Carotenes, Xanthophylls, Chlorophyll, Bitter Substances and Tannins.

Text books and Reference materials

1. Beltz, H.D. 2005. Food Chemistry. Springer Verlag.
2. Fennema, O.R, 2006, Food Chemistry, Academic Press.
3. Meyer, L.H. 1987. Food Chemistry. CBS publishers and Distributors, New Delhi.
4. N. Shakuntala Manay, foods facts and principles, third revised edition, new age international (p) limited, publishers.

5.Potter N. & Hotchikiss, J.H.(1996), Food Sciences, Fifth Edition, CBS Publishers & Distributors, New Delhi.

102: FOOD BIOCHEMISTRY AND NUTRITION

Max Marks -85

Objective To acquaint the students about Food biochemistry and Nutrition of various foods.

Outcome: To emphasize the need for greater and more efficient utilization of the existing food sources and development of entirely sources of different food groups. Digestion and metabolic pathways of different components knowledge about water & fat soluble vitamin, minerals and recommendatory dietary allowance.

UNIT –I

1.Introduction to different food groups and its importance in nutrition.

2.Carbohydrate: Introduction, digestion, food sources. Metabolic pathways for breakdown of carbohydrates: glycolytic citric acid cycle, gluconeogenesis, glycogenesis, glycogenolysis electron transport chain, ATP balance pentose phosphate pathway

3.Metabolic defects -Diabetes, disease associated with carbohydrates.

UNIT -II

1.Protein: Introduction, Essential amino acids. Food sources, metabolic defects, Metabolism Pathways of proteins (digestion and absorption) -transamination, deamination, decarboxylation, Urea Cycle. Nitrogen balance & nitrogen pool, Evaluation of quality of proteins, deficiency symptoms, prevention and cure.

2.Fat: Digestion: Introduction, digestion, metabolism outlines, essential fatty acids, food sources, Metabolism Pathways - fat and fatty acid, Biosynthesis of Fatty Acids nutritive functions,

Effects of excess and deficiency-: obesity, cardiovascular diseases. Nutritional significance of lipo-proteins.

UNIT –III

1.Fat soluble vitamins: bio-Chemical and physiological role physiological role, bio-availability and requirements .food sources, effects of excess and deficiency.

2.Water soluble vitamins: Salient features, requirements, food sources, effects of excess and deficiency.

3.Minerals: bio-Chemical and physiological role physiological role, bio-availability and requirements, food sources, effects of excess (if any) and deficiency factors affecting utilization.

UNIT- IV

1.Energy metabolism: Basal metabolic requirements and activity, SDA- specific dynamic action of food, respiratory quotient of food, caloric requirement of humans.

2.Recommendatory dietary allowance: concept of balance diet, menu planning in different ages and diseases.

UNIT-V

1.Colorimetry: Introduction, beers & lamberts law, extinction coefficient, general principles of colorimeter, application in food industry.

2.Fluorimetry: Introduction, principle, instrumentation & application, Flame photometry: Instrumentation & application.

3.Spectroscopy: General principle, instrumentation, types-atomic absorption spectrophotometer, UV-Visible, principle, instrumentation & applications

Text Books / References:

1. Modern Experimental Biochemistry, Boyer, Pearson Education
2. Lubert stryer, Biochemistry, Freeman & Co, N.Y.
3. Voet & Voet, Fundamentals of Biochemistry, Jonh Willey & Sons

4.U.Satyanarayana ,U.Chakrapani Biochemistry. 5th Edition.

5. N. Shakuntala Manay, foods facts and principles, third revised edition, new age international (p) limited, publisher.

103 FOOD MICROBIOLOGY

Max Marks -85

Objective To understand the role and significance of different microbes and their activity in food safety, food quality and food shelf-life especially during food production to food storage.

Outcome: Students will be able to understand the principles behind microbiological techniques used in evaluating the quality of food. They will be able to identify the microorganism responsible for food spoilage and the methods to control the food spoilage. It focuses on the study of microbial ecology related to fermentation, preservation, investigation of food borne illness and national and international Food Legislation.

UNIT I

1.**Food microbiology:** Definition, Historical Development, Classification, propagation and importance of Yeast, Mold and Bacteria.

2.Importance of microorganisms in Food science. **Source of contamination Air, water, soil, sewage, post processing contamination.**

3.**Microbial growth:** Definition, growth curves (different phases); Factors affecting the growth of micro-organisms in food – Intrinsic and Extrinsic parameters.

UNIT II

1.**Food Hygiene and Sanitation:** Contamination during handling and processing and its control.

2.**Classification of food & general principle involved in their preservation. Effect on microbes of low temperature & high temperature.**

3.Sterilization, Thermal inactivation of microbes- Concept, determination & importance of TDT, F, Z & D values, pasteurization. **Growth & survival of pathogens in Food.**

UNIT III

1.**Protection and preservation of Foods:** Chemical, Modified atmosphere, Radiation in foods from the microbiological angle.

2.Indicator organisms; rapid methods in detection of microorganisms.

3. Indicators of water and food safety and quality; Microbiological criteria of foods and their Significance. The HACCP and ISO systems for food safety.

UNIT IV

1.**Food spoilage:** Characteristic features and significance of spoilage of different groups of foods - Cereal and cereal products, vegetables and fruits, meat, poultry and sea foods, milk and milk products, packed and canned foods.

2.**Food borne diseases:** Bacterial food borne diseases (Staphylococcal in-toxification, Botulism, Salmonellosis, Shigellosis, Enteropathogenic Escherichia Coli Diarrhea, Clostridium Perfringens gastroenteritis, Bacillus cereus Gastroenteritics), Mycotoxins: Aflatoxicosis, Deoxyni valenol Mycotoxicosis, Ergotism.

UNIT V

1.**Food Fermentation:** Microbial culture in food fermentations and their maintenance & evaluation, factors affecting activity of culture, single and mixed cultures of cultures; Therapeutic value of fermented foods.

2.**Probiotics and Prebiotics:** definition, characteristics, classification, application of probiotics and prebiotics in food industry.

Text books and Reference materials:

1. Essentials of Microbiology; K. S. Bilgrami; CBS Publishers, Delhi
2. Food Microbiology; WC Frazier; Tata McGraw Hill, Delhi
3. Modern Food Microbiology; James M Jay; CBS Publishers, Delhi
4. Microbiology; Pelczar, Chan and Krieg; Tata McGraw Hill, Delhi
5. Fundamental Food Microbiology. Ray B and Bhunia A. 2013. Fifth Edition. CRC Press
6. Microbiology (7th edition). Prescott LM Harley JP and Klejn DA 2006 McGraw Hill, Newyork

104 PRINCIPLES OF FOOD PROCESSING & PRESERVATION

Max Marks -85

Objective: To identify and select preservation methods appropriate for specific foods and to learn the effects of preservation methods on the quality of food.

Outcome: Students shall develop the knowledge of need of food processing and learn various preservation techniques. To impart knowledge on the causes of food spoilage and principles of different techniques used in processing and preservation of foods.

UNIT -I

1.Definition and scope of Food science and technology, historical development of food processing and preservation, general principles of food preservation, Processing and preservation by heat: Blanching, pasteurization, sterilization and UHT processing, canning, extrusion cooking.

2.Baking: Principle of baking and several changes in baked products.

UNIT –II

1.Radiation: Source of radiations, mode of action, effect on microorganisms and different nutrients, dose requirements for radiation preservation of food and safe limits, irradiation mechanism and survival curve, irradiation of packaging materials.

2.Microwave heating: Principles and application in Food processing

UNIT –III

1.Refrigeration: Refrigeration and storage of fresh food, major requirement of refrigeration plant, refrigerated storage of various foods.

2.Freezing: Freezing points of selected food influence of freezing and quality of the food product. Method of freezing, freeze drying, storage, and thawing of frozen food.

UNIT -IV

1.Chemical Preservation: Preservation of food by use of sugar, salt, chemicals, antibiotics & by smoking

2.Concentration: Application in food industry, processes and equipment for manufacture of various concentrated foods and their keeping quality.

3.Fermentation: Application in preservation of food pickling, curing etc.

UNIT -V

1.Drying: Processing and preservation by drying, various methods employed in production of dehydrated food products, selection of methods based on characteristics of foods to be produced.

2.Advantages and disadvantages of different methods, sun-drying, tray or tunnel drying, spray drying, drum drying, fluidized bed drying.

3.Physical and chemical changes during drying control of chemical changes, desirable and undesirable changes. Packaging and storage of dehydrated food products.

Text books and Reference materials

1. Desrosier NW & James N. (2007). Technology of food preservation. AVI. Publishers
2. Fellows, P.J. (2005). Food processing technology: Principle and Practice. 2nd Ed. CRC Publishers
3. Jelen, P. (2005). Introduction to Food Processing. Prentice Hall
4. Potter N.N., Food Science and Technology.

105: LABORATORY-I

Max Marks -85

Objective: To understand the chemistry of food and to develop skills related to quality evaluation of foods using various qualitative techniques.

Outcome: The students shall acquire the practical skills for the sampling of foods and shall be able to carry out quality evaluation foods. They will learn biochemical techniques for estimation of nutritional content in different type of food products. Qualitative analysis of carbohydrates, and Proteins.

1. Qualitative analysis of carbohydrates
2. Qualitative analysis of Proteins
3. Analysis of lipids: acid value, iodine value, saponification value etc.
4. Estimation of carbohydrates in food materials
5. Estimation of proteins in food materials
6. Estimation of crude fiber in food materials
7. Estimation of ascorbic acid in food materials
8. Estimation of calcium in food materials
9. Estimation of cholesterol in food materials
10. Estimation of calorific value of foods
11. Balance diet: food exchange list and steps in diet planning.
12. Diet planning for pre-school, school children, lactating women

Reference Book (105):

1. Weaver CM and Doniel JR 2003. The Food chemistry Laboratory: A manual for Experiment Foods, Dietetics and Food scientist. Secomd Edition. CRC Press.
2. Sehgal S. 2016. A laboratory Manual of Food Analysis I K International Publishing Hors Pvt. Ltd.

106: LABORATORY-II

Max Marks -85

Objective: To understand the microbial techniques and to develop skills related to microbial quality evaluation of foods using various techniques.

Outcome: The students shall acquire the practical skills for the sampling of foods and shall be able to carry out microbial analysis. Introduction to microbiological techniques: Requirements of a microbiology lab, Safety rules to be, analyze food products for possible microbial contamination

A) Processing of Food

1. Determination of moisture in different food samples.
2. Determination of TSS in different food samples.
3. Quality assessment by Blanching and browning control
4. Quality assessment by different drying methods.
5. Determination of acidity and PH different food samples.
6. Determination of ash in food samples.
7. Instruments used for food processing.
8. Determination of gelatinization
9. Stages of sugar cookery
10. Estimation of gluten content
11. Adulteration test in various samples.

B) Food Microbiology Lab

1. Preparation of common laboratory media and study of **Simple** and Compound Microscope.
2. Staining: Gram's staining.
3. Sub culturing of a bacterial strain in liquid and solid medium.
4. Study of growth of E. coli by a spectrophotometer.
5. Study of microbiological quality of milk by MBRT test.
6. Preparation of synthetic medium for yeast and mould and inoculation with standard strains of yeasts and moulds.
7. Microbiological analysis of typical processed food and unprocessed food.
8. Dilution and Plating by spread –plate, pour –plate techniques and **Microbial counting.**
9. Isolation of pure culture.
10. Test for adulteration in different food samples.
11 Evaluation of microbiological quality of Water and MPN test of coliforms.
12. **Determination of Thermal resistance of Enzymes and Microorganisms.**
13. **Determination of activity of starter cultures used in Dairy Industry.**

Reference Book (106 B):

1. Garg N, Garg KL and Mukurji KG. 2010. Laboratory Manul of food Microbiology. I.K international Publishing House Pvt. Ltd.

201: FRUITS AND VEGETABLE TECHNOLOGY — Max Marks -85

Objective: To develop knowledge regarding biochemistry and physiology of fruits and vegetables and their role in pre- and post-harvest changes in product quality.
Outcome: This course aims in providing knowledge about the fruit and vegetable structure, post-harvest physiology and its spoilage. The student shall understand biological, chemical and physical properties of fruits and vegetables and the technologies involved in the processing, preservation and value-addition of fruit and vegetable products.

UNIT -I

1.Introduction, definition, role, importance and status of post-harvest technology.
2.**Fruits and vegetables:** Morphology of fruits and vegetables, maturity indices and methods of maturity determinations.
3.Post-harvest physiological and biochemical changes in fruits and vegetables, ripening of climacteric and non-climacteric fruits; regulations, methods.

UNIT –II

1.**Post harvest disorders-** Factors affecting post-harvest changes, handling and packaging of fruits and vegetables, chilling injury & disease.
2.**Storage practices:** CA and MA, hypobaric storage, pre-cooling and cold storage, Zero energy cool chamber, commodity pre-treatments - chemicals, wax coating, VHT and irradiation. Minimal processing of fruits and vegetables- quality factors for processing.

UNIT –III

1.Preservation by freezing, general methods for freezing of fruits and vegetables; problem relating to storage of frozen products; standards for frozen food products.
2.Dehydration of fruits and vegetables: Methods; packaging, storage, quality control during and after dehydration.

UNIT –IV

1.**Fermentation –Define Fermentation and Fermented Alcohols and Method of preparation and quality control – Vinegar , Wine & Beer.**
2.**Vinegar:** Method of preparation and quality control
3.**Tea, Coffee and Cocoa:** Production and manufacturing.

UNIT –V

1.**Fruits and Vegetables:** Preparation of juice, syrup, squashes, jam, jellies, marmalades, RTS cordials and nectars, fortification and soft drinks.
2.**Tomato products:** Preparation of various tomato products and quality control.
3.**Pectin: Raw material processes and uses of pectin, products based on pectin, manufacturing and quality control.**

References:

1. Bose, T.K. Ed. 1985. Fruits of India: Tropical and Sub-tropical. Naya Prokash, Calcutta. Dauthy, M.E. 1997. Fruit and Vegetable Processing. International Book Distributing Co. Lucknow, India.
2. Hamson, L.P. 1975. Commercial Processing of Vegetables. Noyes Data Corporation, New Jersey.
3. Lal, G., Siddappa, G. and Tondon G.L. 1986. Preservation of Fruits and Vegetables, Indian Council of Agril. Research, New Delhi.
4. Salunkhe, D.K. and Kadam, S.S. Ed. 1995. Handbook of Fruit Science and Technology: Production, Composition and Processing. Marcel Dekker, New York. Salunkhe, D.K. and Kadam, S.S. Ed. 1995. Handbook of Vegetable Science and Technology: Production,
5. Lal G, Siddapa GS & Tandon GL.1986. Preservation of Fruits and Vegetables. ICAR.

202: FOOD QUALITY CONTROL, LAWS AND MANAGEMENT Max Marks -85

Objective: To develop knowledge regarding food quality control and related laws to manage in our food protects.

Outcome: This course aims to impart the knowledge of food safety issues, surveillance and monitoring techniques, Food Labeling as well as sanitation and food allergy. To know the principles of Food Safety and Quality. To apply preventive measures and control methods to minimize the hazards in foods. To know the requirements of FSSAI for different food items.
To learn the principles of HACCP and to develop procedures and approaches to identify food safety hazards in food processing.

UNIT -I

1.Food safety and hygiene: General introduction

2.Food safety concept- Importance of food safety in food processing. Food hygiene and its practices (GMP/GHP, GAP, GLP). Hygiene verification in food industry, Clean in Place (CIP) - Different sanitizers and detergents- Sanitation and hygiene in quality assurance in different food industries

UNIT –II

1.Concept of quality: Quality attributes- physical, chemical, nutritional, microbial and sensory, evaluation.

2.Quality measurement techniques, process design and control and product design and control, TQM.

UNIT –III

1.Food laws and regulations: Introduction about Food safety act 2006, 2011and 2022.

2.Various organizations dealing with inspection and traceability and authentication. FSSAI Certifications (BIS, AGMARK, ISO, FPO, MFPO, PFA, MPO, etc.).

3.PFA specification for food products,

4.International food laws and regulations: FDA, FAO, WHO, CODEX, HACCP with new guideline.

UNIT –IV

1.Concept of product development –product success and failure, factors for success, process of product development,

2.Managing for products success innovation strategy –possibilities for innovation, building up strategy, product design, commercialization, launch, and evaluation product development program for RND in food industry.

3.Cost of Quality, Supplier development, Microbial enumeration, production floor environment monitoring, quality of water (Process/Raw/reuse).

UNIT- V

1.Introduction to sensory evaluation, Selection of sensory panellists; Factors influencing sensory measurements.

2.Sensory quality parameters -Size and shape, texture, aroma, taste, colour and gloss; Detection, threshold and dilution tests Different tests for sensory evaluation– discrimination, descriptive, affective; Flavour profile and tests; Ranking tests; Methods of sensory evaluation of different food products.

3.Selection and training of sensory panel; Detection and threshold tests; Ranking tests for taste, aroma colour and texture; Sensory evaluation of various food products using different scales, score cards and tests.

Text Books / References:

1. Early R.1995.*Guide to Quality Management Systems for Food Industries*. Blackie Academic.
2. Krammer A & Twigg BA.1973. *Quality Control in Food Industry*. Vol. I, II. AVI Publ.
3. Chhabra TN & Suria RK. 2001. *Management Process and Perspectives*. Kitab Mahal.
4. Jhingan ML. 2005. *International Economics*. 5th Ed. Virnda Publ.
5. Reddy SS, Ram PR, Sastry TVN & Bhavani ID. 2004. *Agricultural Economics*. Oxford & IBH.

203: FOOD ENGINEERING

Max Marks -85

Objective: The course provides the knowledge about engineering principles to food materials and food processing operations, food machinery, packaging, ingredient manufacturing, instrumentation and control.
Outcome: The students shall be able to understand the basics of mass and energy conservation, fundamentals of fluid flow dynamics as applied to food processing operations. They will learn planning, designing, improving, as well as maintaining the processing system in food industry,

UNIT -I

1.Mechanical operations in food processing: Introduction, scope and applications
2.Size Reduction process: Principles, theories & laws, energy consideration, equipments & size reduction of solid and liquid food products
3.Mixing & forming: Theory & applications, mixing indices, equipments for solid and liquid foods products.

UNIT –II

1.Process Heat Transfer - Thermal properties of foods such as specific heat and thermal conductivity Modes of heat transfer and overall heat transfer, Fourier's law.
2.Steady state and unsteady state heat transfer, heat exchange equipment. Rheology of foods: Newtonian fluids and non-Newtonian fluids.

UNIT –III

1. Operation in Food engineering
2.Food dehydration: Drying: water activity &microbial growth rate. Mechanism of drying, moisture & drying rate curves, constant and falling rate periods, dehydration equipment & freeze drying.
3.Evaporation: Properties of liquid, heat & mass balance, single & multiple effect evaporation, steam economy, heat recovery, efficiency, equipment & systems.

UNIT - IV

1. Food Storage– Introduction, Storage requirements, Mechanical Handling equipments, Management practices.
2.Chilling, refrigeration & freezing: Introduction, types of freezers, precooling & cold storage, Shelf-life extension requirements, theories, characteristic curve, cooling rate calculations, chilling & freezing equipment, cryogenics, freeze drying, properties of frozen foods.

UNIT-V

Separation processes:
1.Centrifugation: General principles, instrument & types of centrifuges, preparatory & analytical centrifugation & applications
2.Chromatographic Techniques: General introduction to principles, partition & adsorption chromatography-paper, thin layer, gas & liquid, ion exchange & affinity chromatography, gel filtration, HPLC and application in food industry.
3.Membrane filtration technology: Principles of other food processing such as- RO, UF, Dialysis, osmosis, micro-filtration, and nano filtration -outlines

Text Books / References:

1. Heat Transfer: D.Q. Kern, MGH.
2. R.K. Rajput. 2007. Engineering Thermodynamics, 3rd Ed. Laxmi Publications (P) Ltd.,
3. Bangalore. P.K. Nag.2005. Engineering Thermodynamics, 3rd Ed. Tata-McGraw-Hill
4. Basics of Food Engineering, Romeo Toledo
5. Earle RL. 1985. Unit Operations in Food Processing. Pergamon Press.

204: FOOD PACKAGING

Max Marks -85

Objective: The course aims to develop the student's knowledge in various types of packaging food and packaging materials.

Outcome: The students shall gain knowledge on the different types of materials and media used for packaging foods, hazards associated with packaging materials, laws, regulation and the monitoring agencies involved in food safety. They will understand the material Cost reduction strategies and Material substitution like Bioplastic foil are some of the few trends influencing the food packaging landscape.

UNIT -I

1.Introduction to Food Packaging: Packaging terminology- definition, types of packaging.

2. Functions of Food packaging, **selection & design of packaging material for different foods.**

3.Characteristics of food stuff that influences packaging selection.

UNIT –II

1.Packaging material and their properties: Glass, paper and paper board, corrugated fibre board (CFB).

2.Metal & Plastics – Tin and Aluminium, composite containers, collapsible tubes, plastics films, laminations, metalized films, Co-extruded films.

UNIT –III

1.Packaging system and methods: Vacuum packaging, retort processing, microwave packaging, active packaging, intelligent packaging, edible packaging, shrink and stretch packaging.

2.Controlled atmospheric packaging, modified atmospheric packaging.

3.Aseptic packaging, Sterilization of packaging materials.

UNIT - IV

1.Packaging of fresh and processed foods: Packaging of fruits and vegetables, fats and Oils, spices, meat, Poultry and sea foods, dairy products, bakery, beverages, dehydrates and frozen foods.

2.Liquid and powder filling machines – (volumetric and gravimetric), bottling machines. Form Fill Seal (FFS) and multilayer aseptic packaging machines.

UNIT-V

1.Laws, Regulations, Evaluation and Quality control: Shelf life testing, corrosion, tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, their methods of testing and evaluation,

2.Barrier properties of packaging materials-Theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate (GTR) and its measurement, water vapour transmission rate (WVTR) and its measurement,

3. Prediction of shelf life of foods.

Text Books / References:

1. NIIR. (2003). Food Packaging Technology Handbook, National Institute of Industrial Research Board, Asia Pacific Business Press Inc.
2. Ahvenainen, R. (ED.) 2003 Novel Food Packaging Techniques, CRC Press,
3. Han, J.H. (Ed.) 2003 Innovations in Food Packaging, Elsevier Academic Press,
4. Coles, R., McDowell, D. and Kirwan, M.J. (Eds.) 2003 Food Packaging Technology

205: LABORATORY COURSE I

Max Marks -85

Objective: To understand the effect of various preservation techniques on the quality and safety of food products. To evaluate a processing procedure used to preserve a food product.

Outcome: The students will be able to understand and utilize different food preservation techniques. Sampling techniques and preparation of test samples, Estimation of Water activity of food sample. Physical and Chemical evaluation of thermally processed food (Canned or Bottled), Pickling and curing of foods. Dehydration of foods and preparation of fruit juice concentrates and powder, physicochemical analysis of dehydrated food sample.

1. Canning of fruits and vegetables.
2. Dehydration of fruits and vegetables.
3. Preparation of tomato juice.
4. Preparation of tomato puree.
5. Preparation of tomato paste.
6. Preparation of various types of pickles.
7. Preparation of tomato ketchup.
8. Preparation of tomato mock tail.
9. Preparation of tomato soup.
10. Preparation of tomato chutney.
11. Preparation of jackfruit pickles.
12. Preparation of jams
13. Preparation of lime squashes.
14. Preparation of jellys.
15. Preparation of jam marmalades.
16. Pectin determination
17. Determination of chemical preservatives in fruits and vegetables.
18. Blanching of fruits and vegetables for quality estimation.

Reference (205):

1.Lal G, Siddapa G S $ Tandon GL. 1986. Presevation of fruits and Vegetables ICAR.
2.R.P.Srivastava & Sanjeev kapoor Fruit& Vegetables preseravation: principle And Practices Revised And enlarged 3Ed.

206: LABORATORY- II

Max Marks -85

Objective: To understand the effect of various type of packaging materials, impact of packaging materials in different types of food.

Outcome: The students will be able to understand and utilize different type of packaging materials. Moisture content in different type of packaging materials. To perform Test for formal shock resistance in glass bottles etc.

1. Testing of different types of packaging materials.
2. Determine moisture content in given package samples.
3. Test for modified starch in different package materials.
4. Test for water absorbency in corrugated fibre board box.
5. Test for types of adhesive used in CFB.
6. Development of new food products and formulations.
7. To perform flap bend test in CFB.
8. Test for formal shock resistance in glass bottles.
9. Graphical representation of moisture contents in different food products.
10. Determination of shelf lives.

Reference (206):

1. NIIR (2003) Food packaging Technology Handbook, National Institute of Industrial Research Board, Asia Paafic Business Press Inc.
2. Coles, R. Mc Dowell, D. and Kirwan M. J. (EDS) 2003 Food Packging Technology.

301 PROCESSING OF CEREALS, LEGUMES, OIL SEED & SUGAR CROPS Max Marks -85

Objective: To create knowledge about the processing and quality evaluation of cereal grains.

Outcome: Student will acquire the understanding of the technologies used for processing of cereal grains. Understands structure of wheat, Rice, and Corn, Oats & Barley. Baking techniques for cereal's-based products. Processing of legumes, oilseeds and sugar crops, Oil extraction process and its byproducts.

UNIT –I

1.Wheat: Types, structure & composition and physicochemical characteristics.

2.Wheat milling -products and byproducts; factors affecting quality parameters; physical, chemical and rheological tests on wheat flour; additives used in bakery products; flour improvers and bleaching agents-manufacture of wheat-based products and formulation of premixes for bakery products; pasta goods and processed cereal foods for infants.

UNIT –II

1.Rice: Classification, structure & composition, physicochemical characteristics; cooking quality.

2.Rice milling technology: by- products of rice milling and their utilization; Rice bran stabilization, oil extraction and refining, parboiling methods of rice criteria of quality of rice: aging of rice – quality changes; processed products based on rice.

UNIT –III

1.Corn: Types and nutritive value; dry and wet milling, corn products: corn flakes, corn starch, snacks and tortillas etc., production of glucose syrups, dextrose, high fructose corn syrups, modified Corn starches.

2.Barley: composition, milling, malting of barley, changes during malting, uses of malt, **manufacturing of beer.**

3.Oat: composition, types and processing of oat, byproducts of oat milling.

UNIT –IV

1.Legumes and oilseeds: composition, anti-nutritional factors, processing, hydrogenation and storage; processing for production of edible oil, meal, flour, protein concentrates and isolates; development of low-cost protein foods.

2.Oil extraction process –mechanism, oil refining, utilization of biproducts of oil milling.

UNIT –V

1.Processing of sugar crops and tubers- Sugar production and manufacturing,

2.Products of sugars and byproducts of sugar manufacturing, types and grades of sugars (sugar cane, sugar beets and their differences).

Text books and Reference materials

1. Chakrabarthy, M.M. (2003). Chemistry and Technology of Oils and Fats. Prentice Hall.
2. Dendy, D.A.V., & Dobraszczyk, B.J. (2001). Cereal and Cereal Products. Aspen.
3. Hamilton, R.J., & Bhati, A. (1980). Fats and Oils - Chemistry and Technology. App. Sci.Publ.
4. Hoseney, R.S. (1994). Principles of Cereal Science and Technology. 2nd Ed.AACC.
5. Kay, D.E. (1979). Food Legumes. Tropical Products Institute.
6. Kent, N.L. (1983). Technology of Cereals. 4th Ed. Pergamon Press.

302 DAIRY TECHNOLOGY

Max Marks -85

Objective: To impart knowledge about processing of milk and its products and legislation for the quality control of milk and milk products.

Outcome: Students shall acquire knowledge about composition, processing, product development, organization and operations involved in milk processing unit. Impact knowledge about frozen milk products, fermented milk products and evaporated and dried milk products

Unit – I

1.Composition and characteristic of milk, Collection, chilling, transportation, cream separation.

2.Liquid milk processing: standardization, pasteurization, (LTLT, HTST, UHT), homogenization, packaging, storage and distribution of fluid milk.

3.Sanitary aspects: of dairy plant building, equipment and their maintenance. Disposal of dairy plant waste.

Unit – II

1.Technology of fermented milk products: Principles and practices of manufacture, packaging, storage and marketing of Dahi, yoghurt, Shrikhand etc.

2.Butter: Manufacture, packaging, storage and marketing of butter; butter defects and their control.

Unit – III

1.Technology of frozen milk products: Classification, manufacture, packaging, storage and marketing of ice cream, ices, sherbets etc. defects of frozen products and their control.

2.Technology of indigenous milk products: Principles and practices of manufacture, packaging, storage and marketing of ghee, khoa, Paneer, channa and milk based foods.

Unit – IV

1.Technology of evaporated and dried milk: Manufacture of evaporated milks and milk powders, Sweetened and non-Sweetened condensed milk, SMP, WMP, Packaging storage defects and their control.

Unit -V

1.Cheese: Manufacture of hard, semi hard, soft and processed cheeses, Storage, grading and marketing of cheese, Cheese defects and their control.

2.Technology of Dairy by- products: Utilization of skim milk, buttermilk and whey for the manufacture of casein, lactose etc.

References:

1. Robinson RK; 1996; Modern Dairy Technology, Vol 1 & 2; Elsevier Applied Science Pub.
2. Milk & Milk Processing; Herrington BL; 1948, McGraw-Hill Book Company.
3. Modern Dairy Products, Lampert LH; 1970, Chemical Publishing Company.
4. Developments in Dairy Chemistry – Vol 1 & 2; Fox PF; Applied Science Pub Ltd.
5. De S.1980. Outlines of Dairy Technology. Oxford Univ. Press.

303 MEAT, FISH AND POULTRY PRODUCTS

Max Marks -85

Objective: This course shall educate students about the significance and necessity of organized animal products sector, humane slaughtering of animals and poultry and value addition of meat, poultry, egg and fish.
Outcome: Students shall be well versed of all aspects of meat, poultry, egg and fish industry, processing, preservation and quality control composition, pre and post slaughtering process for all products. Fish and its preservation methods. Quality parameters of raw materials and finished goods.

UNIT -I

1.Classification of Edible fish; Commercial handling, storage and transport of raw fish; Average composition of fish; Freshness criteria and quality assessment of fish.
2.Spoilage of Fish; Methods of Preservation of fish: Canning, Freezing, Drying, Salting, Smoking and Curing.
3.Fish products- Fish meal and oil and other important by products.

UNIT -II

1.Meat: Introduction, slaughtering methods, components of carcass viz., Muscle, postmortem glycolysis, conversion of muscle to meat, pre and post slaughter factors affecting the quality of meat.
2.PSE and DFD condition.
3.Preservation of meat and meat products.
4.Meat industry - Importance, application and growth rate in Indian.

UNIT -III

1.Poultry: Pre slaughter care, Ante Mortem examination Slaughter. Dressing and Post mortem Composition of chicken Muscle. Pre and Post Slaughter factors affecting Poultry Meat quality
2.Preservation of poultry Meat; Chilling and Freezing of Poultry Meat. Packaging and Grading. Preparation of products. Cured. Smoked. Canned Barbecue and Curried Poultry.
3.Tenderness of poultry, problem factors in poultry meat. Utilization of poultry industry by products.

UNIT -IV

1.Eggs: Structure Composition and Nutritive Value of Value of Egg. Egg. Proteins and Functional Properties of egg.
2. Factors affecting Egg quality and its Measurements, Industrial use of Egg, Collection. Grading. Cleaning.
3.Washing Packaging and Spoilage of Egg and products preparation.

UNIT-V

1.Raw Material: Quality Parameters and Evaluation Procedures
2. Product Quality; Appearance, Color Texture. Viscosity. Consistency. Flavor Defects. Bacterial Contamination and Foreign Matter.

References:

1. Processed Meats; Pearson AM & Gillett TA; 1996, CBS Publishers.
2. Meat; Cole DJA & Lawrie RA; 1975, AVI Pub.
3. Egg and poultry meat processing; Stadelman WJ, Olson VM, Shemwell GA & Pasch S; 1988, Elliswood Ltd.
4. Developments in Meat Science – I & II, Lawrie R; Applied Science Pub. Ltd.
5. Egg Science & Technology; Stadelman WJ & Cotterill OJ; 1973, AVI Pub.
6. Fish as Food; Vol 1 & 2; Bremner HA; 2002, CRC Press.

404 FOOD ADDITIVES, SPICES & FLAVOR TECHNOLOGY Max Marks -85

Objective: To acquaint students with the additives relevant to the processed food industry for shelf-life extension, processing support, sensory appeal and to familiarize students with the processing of spices.
Outcome: Student shall gain a thorough knowledge of natural and synthetic food additives and their properties in food. They will understand different flavor components arise from the normal biosynthetic processes of animal and plant metabolism. The knowledge of flavorings and other food additives is essential to achieve either flavor intensification or suppression in different food products.

UNIT- I

1.Food additives – Definition, classification, function and safety.
2.Need for food additives in food industry, various additives such as preservatives, antioxidants, emulsifiers, sequestrants, humectants, stabilizers with respect to their functioning and mechanism.

UNIT -II

1.Food Flavor basics: Olfactory perception of flavor and taste, relationship of taste-sweet, bitter, salt, sour, chemicals causing pungency, astringency, cooling effects-properties.
2.Flavor technology; types of flavors, classification of flavors-natural, nature identical and synthetic.

UNIT- III

1.Flavors technology; types of flavors, flavors generated during processing-reaction flavors, flavors composites, stability of flavors during food processing, analysis of flavors, extraction techniques of flavors.
2.Flavor encapsulation-need, methods and application in food industry

UNIT- IV

1.Major spices and Minor spices–Oleoresins and essential oils; method of manufacture; quality control; fumigation and irradiation of spices.
2.Techniques for flavor extraction-supercritical fluid extraction-continuous and semi-continuous methods-effects of types of solvents used, and its role in food industry.

UNIT-V

1.Food Adulteration, definition & types of adulteration, causes & reasons for food adulteration, methods of adulteration and methods of detection. The consumer protection act 1986.
2.Toxicology evaluation of food additives, **Food processing generated toxicants: nitroso compounds, heterocyclic amines.**

Suggested Readings

1.Morton, I.D. & Macleod, A.J. 1990. Food Flavors. Part A, BC. Elsevier.
2. Branen A.L., Davidson, P.M. & Salminen S. 2001. Food Additives. 2nd Ed. Marcel Dekker.
3.Gerorge, A.B. 1996. Encyclopedia of Food and Color Additives. Vol. III. CRC Press.
4.Gerorge, A.B. 2004. Fenaroli's Handbook of Flavor Ingredients. 5th Ed. CRC Press
5.Furia, T.E. 1980, Handbook of food additives, Vol I and Vol II.
6. Fennema, O.R. Ed. 1976. Principles of Food Science: Part-I Food Chemistry. Marcel Dekker, New York.

305 LABORATORY- I

Max Marks -85

Objective: Imparting knowledge about the general methods of quality evaluation, testing and processing cereals and preparation of different type of cereal-based products.

Outcome: The students shall be able to assess the quality of wheat, rice and different type cereals. Preparation of different type of cereal-based products.

1. Detection of adulteration in different types of foods.
2. Determination of moisture content in food product by hot air oven drying method.
3. Determination of yeast quality by its dough rising capacity.
4. Determination of thousand kernel weight of different grains sample.
5. Determination of cooking time in different rice sample.
6. Determination of elongation ratio in different rice sample.
7. Determination of Gluten content in different flour sample.
8. Determination of ash content in flour samples.
9. Determination of Acid insoluble Ash
10. Estimation of fat acidity
11. Determination of Alcoholic acidity
12. Preparation of Bread.
13. Preparation of Biscuits.
14. Preparation of Pizza base.
15. Preparation of Dinner roll.
16. Preparation of Cookies.
17. Preparation of Muffins
18. Preparation of Nankhatai.
19. Preparation of Cakes.
20. Preparation of fermented products.
21. Quality evaluation of different biscuit sample—physical and chemical analysis.
22. To determine the foaming capacity of given flour sample.
23. Determination of protein content of floor by Micro Kheldahl Method
24. Estimation of curcumin in turmeric.
25. Determination of capsaicin in content in chilli.

Reference (305): 1 MIIR 2004. Handbook on spices. National Institute of Industrial Research Board, Asia Pacific Business Press Inc.

2. Pyler EJ. Bakery Science $ Technology. Third Edition. Vols. I,II Sost and Publication.

Lorenz KL.1991 Hand Book of cereaual Science and Technology. Marcel Dekker.

306 LABORATORY- II

Max Marks -85

Objective: Imparting knowledge about the general methods of quality evaluation, testing and processing fresh milk and preparation of different type milk products.

Outcome: The students shall be able to assess the quality of milk and milk products and to develop various milk products. Preparation of different milk products and fat estimation and analysis of fat for milk and milk products,

1. Platform Test of Milk
2. Adulteration tests.
3. Fat estimation in milk by Garbers Methods.
4. Preparation of curd.
5. Preparation of lassi.
6. Preparation of shrikhand.
7. Preparation of ghee.
8. Preparation of khoa.
9. Preparation of chenna and paneer.
10. Determination of total solids in milk, skim milk, butter milk and whey by drying method.
11. Viscosity determination of Milk by Pipette method.
12. Test for fats: Bromothymol blue test.
13. Alcohol test for determining coagulability of milk.
14. Determination of salt content in butter.
15. Casein estimation in milk sample.
16. Preparation of fortified, reconstituted and flavored milks.
17. Sensory analysis of food products: Paired comparison test, Duo-trio test, Hedonic test, Triangle test, Ranking test, Single sample test, Composite scoring test.

Refrences:-

1. Milk and Milk processing, Hurrington BL; 1948, Mc Craw Hill Book Company.
2. De S. 1980. Outlines of Dairy Technology. Oxford University Press.

401 ADVANCES IN FOOD TECHNOLOGY

Max Marks -85

Objective: To understand the importance of various technology used in processing of food.

Outcome: Student will acquire knowledge about improvement in food processing and different application for production and improvement in food nutritional content which can be used in field of food technology.

UNIT- I

1.Historical development and eras of modern food processing.
2.Application of extrusion cooking in food industry; effect of process variables on the physic-chemical and nutritional characteristics of extruded foods.
3.Thermoplastic extrusion cooking-preparation of meat analogues and advantages of meat analogues over natural meat.

UNIT- II

1.Advances in Non-thermal processing of foods: Bio-preservation, Ultrasound in food processing and preservation:
2.Introduction, ultrasound instrumentation, ultrasound processing for enhancement of mass transfer, Ultra-sonification, high-hydrostatic pressure processing, pulsed electric processing.
3. GM foods: Safety of Genetically Modified food: potential toxicity and allergenicity of GM foods.

UNIT- III

1.Introducation of Biostatistics and its application.
2.Population and sample – types of statistical data – collection and classification of data –Frequency tables – Diagrammatic Representation of data – Measures of central tendencies –Mean, Median and Mode: Measures of dispersion – Range, Quartile deviation, standard deviation, Skewness and Kurtosis – Sampling techniques – Simple and Stratified Random Sampling techniques

UNIT –IV

1. Nanotechnology in food -Food and New Ways of Food - Efficient Fractionation of Product, Optimizing Nutritional Values - Applications of Nanotechnology in Foods Sensing, Packaging, Encapsulation.
2. Super critical fluid extraction, antifreeze proteins in food preservation.

UNIT -V

1Kinds of Intellectual property rights—Copy Right, Patent, Trade Mark, Trade Secret and trade dress, Design, Layout Design.
2.Geographical Indication, Plant Varieties and Traditional Knowledge.

Text books and reference materials

1. Lopez, G.F.G. and Canovas, G.V.B. "Food Science and Food Biotechnology" CRC Press, Florida, USA. 2003.
2. Bains, W. Biotechnology from A to Z. Oxford Univ. Press. 2009.
3. Cupp J & Tracy TS. *Dietary Supplements:* Humana Press. 2003.

402 ENTREPRENEURSHIP AND BUSINESS MANAGEMENT IN FOOD TECHNOLOGY

Max Marks -85

Objective: Imparting knowledge about Entrepreneurship, concepts of Management quality functions.

Outcome: Students understands about the different functions Entrepreneurship in food processing, Production, Financial, Marketing Management. Quality and materials managements.

UNIT-I

1.Entrepreneurship in food processing: Concept of entrepreneur and entrepreneurship, quality, functions of an entrepreneur. Current status of entrepreneurship in Indian food industries.

2.Management in food Industries: History, role, need, benefits of Management Development, Management as Science and Art, Management as a Profession, Functions of Management, and Levels of Management

UNIT-II

1.Forms of Business Organisations: Types of Organisations – Concepts, merits and demerits of Line, Line and Staff, Classification of small, medium and large-scale manufacturing industries;

2.Business Organisations, Advantages and Disadvantages of Private Ownership and Public Ownership; Distinction between Sole Proprietary Firm and Partnership Firm.

UNIT-III

1.Production Management: Objectives of Production Management, Qualities and Responsibilities of a Production Manager.

2.Product design and Development, Factors Influencing Choice of Manufacturing Systems, Plant Location, plant layout.

UNIT –IV

1. Management: Need for Finance, Types of Capital, Methods of Raising

2.Marketing Management: Marketing Concepts – Need, Want, Demand, Difference between Selling and Marketing, Marketing Research –Need for and Steps of Marketing Research, Promotion Mix.

UNIT-V

1.Personnel Management: Human Resource Planning – Steps in Manpower Planning, Recruitment and Selection –Difference between Recruitment and Selection Steps in the Selection Procedure; Training and Development – Need for Training, Steps in Training, Training Methods; Performance Appraisal.

2.Quality and Materials Management: Concept of Quality needs and its role, Quality Control and its techniques, Total Quality Management-meaning, role, pillars, PDCA cycle, Importance, Objectives and Functions of Materials Management, Inventory control.

Text Books / References:

1. Production (operations) Management by L.C. Jhamb
2. Entrepreneurship and Management inputs for entrepreneurs in food processing sector by Dinesh Awasthi and Rama Jaggi.
3. Production and Operation Management by R. Panneerselvam (Prentice- Hall of India Pvt.)