DEPARTMENT OF LIFE SCIENCE AND BIOTECHNOLOGY

SCHOOL OF SCIENCES

CSJM UNIVERSITY KANPUR

Learning Outcome Based Curriculum

M.Sc. Food Technology

(Introduced from Academic Year 2007 -2019)

DEPARTMENT OF LIFE SCIENCE & BIOTECHNOLOGY

FOOD TECHNOLOGY PROGRAMME

PREAMBLE

MSc programme in Food Technology was developed in the year 2007 with the vision to provide synergies between the two pillars of economy –Food industry and agriculture and to achieve food science, food production, food processing, food technology, food safety, food management, entrepreneurship development, food processing and rural development; agriculture and industry linkage through food processing, quality assurance for safe food, research and development on functional foods. Food technology has proved useful in improving nutrient value to nourish world communities. Therefore, Governments of the India have been focusing on Research in Food Technology. Consequently the field is brimming with opportunity. More and more industries in India are adapting to global standards. Hence there is an increased need of trained professionals.

VISION:

To create competent professionals in the field of food processing and nutrition that can contribute towards the economic development of the glove as well as the nation

MISSION:

- Providing a strong theoretical and practical background across the food science discipline with an emphasis on developing sustainable resources to cater food and nutrition related challenges
- Create favorable environment for innovation to translate theoretical knowledge into practical applications
- Inculcating professional ethical values, innovative research capabilities and leadership abilities
- Holistic development of the youth through the process of self evaluation and continuous improvement

MSc FOOD TECHNOLOGY PROGRAMME OUTCOME	
The Expected Programme Outcomes on completion of M.Sc. Food Technology	
PO1	Provide students with theoretical knowledge and practical abilities required to work in the food
PO2	industry, research centres, and food-related national and international organizations
PO3	To make the students competent in developing the foods of the future by utilizing technologies such as food fermentations, applications of enzymes in food processing, food product development, nutraceuticals, nutritional and functional foods.
PO4	To keep students abreast with the rapid developments reported within technology and biological science that is creating completely new ways of developing various processed food.
PO5	To impart an understanding of modern food processing and profound knowledge of technology associated with the development of healthy and safe foods.
PO6	Develop confident and competent individuals, able to adapt to the changing fabric of society through their professional expertise and personal traqit.

MSc FOOD TECHNOLOGY PROGRAMME SPECIFIC OUTCOMES

Food scientists and technologists are versatile, interdisciplinary, and collaborative practitioners in a profession at the crossroads of scientific and technological developments. As the food system has drastically changed, from one centered around family food production on individual farms and home food preservation to the modern system of today, most people are not connected to their food nor are they familiar with agricultural production and food manufacturing designed for better food safety and quality. The Post Graduate (Degree) Department of Food Technology endeavours to develop professionals skilled at advancing the science of food by:

MSc FOOD TECHNOLOGY PROGRAMME SPECIFIC OUTCOMES	
PSO1	An ability to apply the knowledge of underlying chemistry, properties and effects of processing on food components and use the techniques, skills, and modern tools necessary food processing operations
PSO2	Demonstrate knowledge and understanding of technology and management principles, manage projects efficiently in food science and technology and multidisciplinary environments after consideration of economical and financial factors
PSO3	An ability to design and conduct experiments, as well as to analyze and interpret data
PSO4	An ability to apply knowledge for production of safe food and shelf-life extension of food products
PSO5	An ability to identify, formulates, and solve food science and technology problems
PSO6	An ability to extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze and interpret data
PSO7	Contribute individually/in group(s) to the development of scientific/technological knowledge in food science and technology.

SEMESTER I

MFT 101: Principles of Food Processing

Course Objective:-

The course aims to provide systematic knowledge and understanding of the scope of Food Science and Technology, historical development and principles of food preservation. The course also covers various aspects of processing and preservation techniques employed in the food sector.

Course Learning Outcomes:-

Upon successful completion of the course, the student:

1. Gain knowledge of principles of Unit operations involved in food processing industry.

2. Learn fundamentals of food processing technology and its process.

3. Understand concepts of various engineering principles and processing and preservation methods and their application.

4. Understand various post processing operations important from industrial point of view.

UNIT I

Introduction: Definition and scope of Food Science and Technology, historical development of food processing and preservation, general principles of food preservation.

UNIT II

Preservation by heating: Principles of the method, Types of microorganisms, bacterial load. sterilization and commercial sterility, thermal resistance of the microorganisms and enzymes..

Canning and bottling: General aspects of canning and bottling, processing operations exhausting and sealing, retorting, ultra-high temperature processes, determination of thermal process time. processing equipments. canning/ bottling of various food products.

Chemical preservation: Preservation of foods by use of sugar, salt. chemicals and antibiotics and by smoking. Effect of various food processing operations on the nutrients of foods.

UNIT III

Refrigeration and freezing preservation: Refrigeration and storage of fresh foods, major requirements of a refrigeration plant, controlled atmospheric storage, refrigerated storage of various foods, freezing poini of selected foods, influence of freezing and freezing rate of the quality of food products. methods of freezing, storage and thawing of frozen foods.

UNIT IV

Drying and dehydrations: Sun drying of various foods. water activity and its effect on the keeping quality, sorption isotherms and their use. Characteristics of food substances related to their dehydration behaviour, drying phenomenon, factors affecting rate of drying. methods of drying of various food products, type of driers and their suitability for different foods; intermediate moisture foods. Concentration (Evaporation): Application in food industry processes and equipment for manufacture of various concentrated foods and their keeping quality, Properties of liquid, single and multiple effect evaporation.

UNIT V

Radiations: Sources of radiations, effect on microorganisms and different nutrients; Radiation units and doses for foods, dose requirements for radiation preservation of foods, safe limits, irradiation mechanism and survival curve. Irradiation of packaging materials. Microwave Heating: Principles and application in food processing.

Reference Books

Food Processing Technology by P.J. Fellows, Woodhead publishing ltd. Food Science by N.N. Potter, CBS publishing.

Physical principles of Food Preservation. Vol. II by M. Karel, O.R. Fenema and D.B. urd, Maroel, Dekker Inc. New York.

MFT 102:

Food Chemistry

Course Objective:-

The main objective of this course is to understand and learn about the various components of food like water, carbohydrates, proteins, enzymes, lipids, vitamins, pigment and reactions involved in food products and also covers some basic concepts of human nutrition.

Course Learning Outcomes:-

Upon successful completion of the course, the student :

1- Will have an overview of human nutrition and learn about the water properties its bonding and Chemistry.

2- Will be able to understand classification structure and properties of Carbohydrates, its role in Food Industry and also know about different carbohydrates like sugar, starch, cellulose, glucans, hemicelluloses, gums, pectic substances, polysaccharides and Browning reaction in foods.

3- Learn about the classification structure properties purification and denaturation of protein and its interaction and also understand about various types of proteins from different food product also have a clear understanding of nature, classification and properties of food enzyme its activity in different food system and immobilization of enzyme.

4- Have a clear understanding of classification physico-chemical properties of food lipids also knows about refining of crude oil different fat product and flavour changes in fats and oils.

5- Learn about the roles effects of various processing treatments on food lipids, minerals and pigment also know about Browning reaction in foods.

UNIT I

Energy Metabolism: Basal metabolic requirements and activity, Recommended Dietary allowances. Concept of balanced diet. Menu planning. Water: properties, bonding and chemistry.

UNIT II

Carbohydrates: Classification, structure and properties of carbohydrates. Role of carbohydrates in food industry. Sugar, starch. cellulose. glucans. hemicelluloses, gums. pectic substances, polysaccharides. Browning reaction in foods: Enzymatic and non-enzymatic browning in foods of vegetable and animal origin during storage and processing of foods.

UNIT III

Proteins: Classification, structure, properties, purification and denaturation of proteins. Protein interaction and degradation. protein-protein interaction, protein-lipid complexes and protein-carbohydrate complex. Major protein systems and factors affecting them, the nature of interaction in proteins derived from milk. Egg proteins. meat proteins, fish muscle proteins, oil seed proteins and cereal proteins, Metabolic antagonists associated with food proteins. concepts of protein quality, dietary requirements, deficiency symptoms.

Enzymes: Nature, classification and properties of food enzyme, enzyme activity in different food systems. commercial availability. Food enzyme technology. Immobilization of enzymes, removal of toxicants through enzymes. flavour production by enzymes.

UNIT IV

Lipids: Classification and physico-chemical properties of food lipids. Refining of crude oils, hydrogenation and winterization. Vegetable and animal fat, margarine, lard. butter. Frying and shortening. Flavor changes in fats and oils. lipid oxidation, factors affecting lipid oxidation, auto-oxidation, biological significance of auto-oxidation of lipids.

UNIT V

Vitamins: Role of vitamins in food industry, effect of various processing treatments and fortification of foods. Minerals: Role of minerals in food industry, effects of various processing

treatments.

Biological changes in foods: Plant pig< ents and their roles in food industry. Bitter substance and tannins.

Browning reactions in foods: enzymic and non enzymic browning in foods of vegetables and animal origins during storage and processing of foods.

Reference Books

Belitz HD.1999. food Chemistry. Springer Verlag.

DeMan JM. 1976. Principles of Food Chemistry. AVI. Fennema OR.1996. food Chemistry. Marcel Dekker. Meyer LH. 1987.

MFT 103: Instrumentation and Analytical Techniques

Course Objective:-

The objective of this course is to make the student understand the principle and techniques of various analytical techniques like chromatography, electrophoresis, spectroscopy, flourimetry and microscopy this course also covers basic knowledge of chemical preparation concepts of molar moral and normal solutions.

Course Learning Outcomes:-

Upon successful completion of the course, the student :

1- Will be able to understand about preparation of chemical solution, concepts of molar molal and normal solution pH and buffers.

2- Learn about the principle and working of different chromatography techniques like paper, thin layer, gas liquid, Ion exchange, HPLC and affinity chromatography.

3- Understand about the general principle of Electrophoretic techniques, paper and gel electrophoresis.

4- Clear understanding of Spectroscopy, Beer's and Lambert's law, general principle of colourimetry and spectrophotometer and atomic emission spectroscopy, IR spectroscopy.

5- Learn about the flourimetry, spectroflourometers, flame photometry and Atomic absorption spectrophotometer and know-how of microscopy.

UNIT I

Preparation of chemical solutions: Concept of molar. molal, and normal solutions. pH and Buffers: Importance and measurement .

L'NIT II

Chromatographic techniques: General principles. Partition and adsorption chromatography. Paper, thin layer, gas liquid. ion exchange and affinity chromatography. Gel filtration. Introduction to High Pressure Liquid Chromatography.

UNIT III

Electrophoretic Techniques: General principles. Paper and gel electrophoresis. Polyacrylamide gel electrophoresis.

UNIT IV

Spectroscopy: Beers and Lambert s Law. Extinction coefficient. General principles of colorimeters and spectrophotometers, Atomic spectroscopy, Emmission spectroscopy. IR spectroscopy.

UNIT V

Flourimetry: Spectroflourometers. Flame photometry and atomic absorptionspectrophotometry. Use of radioisotopes. Microbiological assays. Microscopy

Reference Books

Hand Book of Food Analysis by Nollet & Toldra, CRC publishing ltd.

Hand Book of Analysis- & Quality Control for Fruit & Vegetable Products by Rangana. Tata Mcgraw hill publishing.

Introduction to the chemical analysis of foods by Nielson, CBS publishing.

MFT 104: Research Methodology, Statistics and Computer Applications

Course Objective:-

To provide student understanding about the basic concepts, approaches and methods in conducting research. The course also cover the basic concepts theories and methods in statistics, learn basic statistical procedures for research and understand application of statistical techniques for analysis and interpretation and also application of computer in food technology.

Course Learning Outcomes:-

Upon successful completion of the course, the student :

1- Learn and understand about approach to research also student are able to formulate the problem, collect data and design it and do the analysis of data.

2- Will be able to understand about the sampling designs, scaling techniques, experimental design and processing of data.

3- Will be able to understand about the basic concepts theories and methods in statistics learn basic statistical procedures like measures of central tendency, measures of variability, correlation and analysis of variance (ANOVA).

4- Learn about use of computers for preparing and presenting documents, spreadsheet etc and also know about computer application in food technology.

Section A

UNIT I

Scientific Approach to Research: Meaning, significance, types of research studies.

Research Process: Formulating the problem, objectives. hypothesis, Experimental design, sample design, collecting data: observation, interview. questionnaire. case study. focus group discussion, analysis of data, interpretation, Report writing, Nutritional/Fo d eillance.

UNIT II

Sampling design: Census vs. sample survey. Steps, types.

Scaling techniques: Continuum. Reliability, Validity, Scale construction techniques.

Experimental designs: Randomized Block design

Processing of data: Development of code book.

Section B

UNIT III

Measurements: Nature ot measurements, types of measurement scale, Frequency distribution, graphical presentation of data.

Measures of Central Tendency: Computation of mean, median and mode, their uses.

Measures of variability: Computation of mean deviations, Quartile deviation and standard deviation, their uses.

Correlation: Regression. Meaning, Spearman and Pearson's techniques of correlation, linear regression. Chi Square.

Tests of significance of difference between means: t-test. Analysis of Variance (ANOVA): One way and two ways. Applications to food quality assessments

Section C

UNIT IV

Computer Applications: use of computers for preparing and presenting documents, spreadsheets,appropriate statistical and other relevant packages, internet.

Computer application in food technology, response surface methodology.

Reference Books

Aggarwal BL. 2003. Basic Statistics. New Age.

Gupta SP. 2004. Statisiical Methods. S. Chand & Sons.

Elhance, D.L. (2008). Fundamentals o1 Statistics. Kitab Mahal. Patna

SEMESTER II

MFT 201: Post harvest Technology of Horticultural Crops

Course Objective:-

The course aims to provide knowledge of principles and technical aspects to understand and learn about the chemical composition along with the pre and post harvest changes of fruits and vegetables. It also involves the overall handling, storage and preservation techniques of fruits and vegetables,

Course Learning Outcomes:-

Upon successful completion of the course, the student :

1- Will be able to understand the chemical composition of fruits and vegetables and learn about various types of pre and post harvest changes
2- Will be able to ingrain the understanding of post-harvest management of fruits and vegetables.
3- Will be able to understand about the maturity indices of different fruits and vegetables
4- Will be able to gain knowledge about processing and preservation techniques and quality aspects of fruits and vegetables
5- Will be able to understand and learn about the use of food additives in fruit and vegetable preservation.

UNIT I

Fruits and vegetables as living products: Chemical composition; pre and post harvest changes. maturity standards for storage. desirable characteristics of fruits and vegetables of processing

Post harvest handling of fresh fruits and vegetables: Role of plants growth regulators in relation to storage; physical and chemical treatment to increase the shelf-life, conditions for transportation and storage, disease and injuries during marketing.

UNIT II

Storage of fresh fruits and vegetables. Containers: Tin, glass and other packaging materials used in fruits and vegetables preservations. Canning and bottling: quality of raw materials, preparation of materials, preparation of syrups and brines, canning and bottling, effect o1 canning and bottling on nutritive value, spoilage of canned foods, detection and control.

Fruit and vegetable juices: Preparation of juice. syrups. squashes. cordials, and nectars; concentrations and drying of juice. packaging and storage and concentrations and powders; fortified and soft drinks. Preparation of preserve and candied fruits

UNIT III

Preservation by freezing, general methods for freezing of fruits and vegetables; problem relating to storage of frozen products; standards for frozen food products.

Dehydration of fruits and vegetables: Methods. packaging, storage. quality control during and after dehydration.

UNIT IV

Pickles and chutneys: Preparation of various types of pickles- theory and practice; preparation of sauces and chutneys; problems relating to the shelf life of pickles and chutneys: quality control. Tomato products: preparation of various tomato products. food standards and quality control.

Pectin: Raw materials; processes and uses of pectin; products based on pectin manufacture and quality control.

UNIT V

Food additives: Use in fruit and vegetable preservation.

Vinegar: General methods of preparation, food standards and quality control. Uses

Utilization of waste front fruit and vegetables processing plant

Reference Books

Lal G, Siddapa GS & Tandon GL.1986. Preservation of Fruits and Vegetables. ICAR.

Salunkhe DK. Bolia HR & Reddy NR. 1991. Storage, Processing and NutritionalQuality of Fruits and Vegetables. Vol. I. Fruits and Vegetab1es. CRC.

Thompson AK. 1995. Post Harvest Technology of Fruits and Vegetables. BlackwellSci.

MFT 202:

Food Microbiology

Course Objective:-

The primary objective of the course is to know the important genera of microorganisms associated with food and their characteristics and to understand the role of microbes in fermentation, spoilage and food borne diseases. It also enables to understand the concept of preservation and microbial safety in various food operations.

Course Learning Outcomes :-

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

1- Understand the important genera of microorganisms associated with food and their characteristics, their growth pattern and parameters

2- Comprehend the role of the microorganisms in spoilage of foods and methods of their preservation.

3- Knowledge about the beneficial role of microorganisms and different types of fermented foods.

4- Identify the role of microorganisms in food borne diseases and control measures

5- Understand the laboratory techniques to detect, quantify, and identify microorganisms in foods.

UNIT I

General characteristics of microorganisms: Classification and identification of yeasts, molds and groups of bacteria important in food industry. Source of contamination: Air, water, soil, sewage, post processing contamination. Intrinsic and extrinsic factors influencing growth of microorganisms in foods.

UNIT II

Classification of foods and general principles involved in their preservation. Effects on microbes of: Low temperature preservation. lethal effects of chilling, freezing and thawing; high temperature preservation. Heat resistance of microorganism, heat penetration and thermal processing. Pasteurization, sterilization, canning and dehydration: chemical preservation and its toxic effects; irradiations.

UNIT III

Food fermentations: Bacterial. yeast and mold cultures: single and mixed cultures, propagation, maintenance and evaluation of cultures; factors affecting activity of cultures, bacteriophages, residual antibiotics and chemicals.

UNIT IV

Microbiology of fermentation: Fermented milks. Cereal foods. vinegar, oriental Goods. alcoholic beverages. Therapeutic value of fermented foods. Food Biotechnology: Use of biotechnologically improved enzymes in food processing industry

UNIT V

Food spoilage: Spoilage of fresh and processed fruit and vegetables, spoilage of meat, fish, eggs and poultry products. microbial toxins.

Pathogens in foods: Microbial infections and intoxications. Growth and survival of pathogens in food. Food borne diseases. Investigation and control.

Reference Books

Food microbiology by V. Ramesh, MJP publishing.

Food microbiology by W.C. Frazier, Ist Edition by Mcgraw Hill Pub. Co. New York.
Modem Food Microbiology. J.M. Jay. CBS publishe.

MFT 203: Packaging

of Food materials

Course Objective:-

To impart comprehensive overview of the scientific and technical aspects of food packaging and to instill knowledge on packaging machinery, systems, testing and regulations of packaging.

Course Learning Outcomes: -

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

1- Comprehend the overview of the scientific and technical aspects of food packaging

2- Understand packaging machinery, their types , systems and testing

3- Understand the overall process of packaging from material handling to package sterilization techniques, cushioning, unitizing and containerization

4- Discover the evaluation of packaging materials. toxicity, corrosion prevention and minimization of transport losses

5- Have an insight to food packaging laws and regulations

UNIT 1

Definitions and functions of packaging and packaging materials. Packaging requirements and selection of packaging materials; types of packaging materials: paper: pulping, fibrillation and beating, types of paper and their testing methods; Glass: composition, properties, methods of making bottles and jars; Metals: Tin plate containers, tinning process, components of tin plate, tin free steel (TFS), types o1 cans, aluminum containers, lacquers: Plastics: types of plastic films, laminated plastic materials, coextrusion, edible films and biodegradable plastics.

UNIT II

Properties of materials such as tensile strength, bursting strength. tearing resistance, puncture resistance, impact strength, tear strength, their methods of testing and evaluation; 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, prediction of shelf life of foods.

Different packaging systems for dehydrated foods, frozen foods, dairy foods, fresh fruits and vegetables, meat, poultry and sea foods.

UNIT III

Process of Packaging: Material handling, filling, air removal, sealing, retorting, Modified atmosphere packaging, vacuum and gas packaging. Package sterilization techniques, cushioning, unitizing, palletizing, stacking and containerization.

UNIT IV

Quality Control: Evaluation of Packaging materials. toxicity, corrosion prevention, shelf life testing, minimization of transport losses, Hazards in handling and storage and packaging and their minimization.

UNIT V

Packaging Laws and Regulations, Standards of Weights and Measures Act, Advancement in packaging

Technology: Smart packaging, Active packaging, Anti-m i crobial packaging

Reference Books

Coles R, McDowell D and Kirwan MJ, Food Packaging Technology. CRC Press, 2003

Robertson GL, Food Packaging — Principles and Practice, CRC Press Taylor and Francis Group. 2012

Paine FA and Paine HY. A Handbook of Food Packaging, Blackie Academic and Professional, 1992

MFT 204: Food Engineering

Course Objective:-

To understand the principle of Unit operation and to acquaint with fundamentals of food engineering and its process. It will also enable to understand the basics of thermal processing and other advanced technologies and their applications.

Course Learning Outcomes :-

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

1- Understand and comprehend the principle of unit operations

2- Students can be familiarized with basic principles of refrigeration, freezing, fluid flow, heat and mass transfer, steam, psychrometrics etc. from food industrial point of view

3- Students can apply these principles for solving numericals and problems

4- Understand other technologies like extrusion, fortification with applications

UNIT I

Size reduction process: Principles, theories and laws, energy considerations, equipments. Mixing and forming. theory and applications. mixing indices. equipments for solid and liquid. Fluid flow, laminar, turbulent and transitional ranges, velocity distribution profiles, basic equations, thermal velocity calculations.

Mass, Energy balance and Heat transfer: Steam injection, steam infusion, plate heat exchangers, tubular heat exchangers and scraped surface heat exchangers

UNIT II

Pasteurization: Theory and application, pasteurization of packaged and unpacked foods, pasteurization calculations, equipments. Thermal processing: Death kinetics, thermal death curve, decimal reduction time. Z-factor. heat penetration curve, process time calculations. mathematical curve, process time calculations. Mathematical and graphical solutions. Chilling, refrigeration and freezing: theories. characteristics curve, cooling rate calculations.

UNIT III

Evaporation: heat and mass balance. steam economy, heat recovery, efficiency, process calculations, Food dehydration: constant and falling rate periods. drying rate calculations.

UNIT IV

Separation processes: Filtration and centrifugation. theories and mathematical descriptions, constant rate and constant pressure filtration. equipment. Membrane Technology- Reverse osmosis and Ultra filtration, Micro filtration

UNIT

Advanced Technologies: Extrusion: Theory and applications. extrusion cookers and cold extrusion. single and twin screw extruders. design considerations., Supercritical gas extraction. Advances in fortification: Synthetic nutrients. Techniques of food fortification. Stability of nutrients in relation to processing. Encapsulations: design and structure of microcapsules,

release rate and mechanism. Techniques of micro encapsulation, advantages and application of encapsulation. Non thermal processing, electric processing, Ohmic heating.

Reference Books

S. K. Sharma, S.I.Mu1vaney. and S.S.H.Rizvi, food Process Engineering: Theory and Laboratory Experiments. Wiley and Sons. 2000

H. Pandey, H.K. Sharma, R.C.Chouhan, B.C. Sarkar and M.C. Bera, Experiments inFood Process Engineering, CBS Publishers and Distributors. 2004

M.A. Rao, S.S. H.Rizvi and A.K.Dutta Engineering properties of Foods, 3rd ed., Marcel Dekker. 2005

SEMESTER III

MFT 301: Processing of Cereals, Pulses and Oilseeds

Course Objective:-

To understand and learn about the different types of cereals, pulses and oilseeds, its structure, composition, milling and processing of products by products.

Course Learning Outcomes:-

Upon successful completion of the course, the student :

1- Will be able to understand the structure, composition of different types of grains and learn about various types of enzyme present in wheat it's milling and processing of various types of wheat products like, bread, biscuit etc.

2- Will be able to understand the structure, composition, milling operation of rice. It will also important knowledge of how the utilization of rice milling by product is done and know about processing of rice for different product.

3- Will be able to understand about the structure, composition and anti- nutritional factors of legumes. Students will also learn about various methods of cooking and processing.

4- Will be able to understand about the structure, composition, wet and dry milling of corn and different processing method for manufacturing corn products like- corn grits, meal and flour, corn flakes, corn syrup, cornstarch, corn steep liquor, corn oil and canned corn and also learn the composition and processing methods of millets like barley, sorghum,

oats etc.

5- Will be able to understand and learn about the composition and processing of oil seed as protein concentration and what is the properties and uses of oilseed meal, technologies used for vegetable protein isolates, what are the various barrier compounds in the utilization of oilseed protein and how to reduce them and also learn about low cost protein foods made from Oil seed

UNIT I

Wheat Technology: Structure and composition of grain, enzymes of wheat and their role in the manufacture of wheat products: principles of wheat milling and its effect on composition of flour. aging of flour, by-products, chemical improvers bleaching and maturing agents. property of dough and its rheology, manufacture of wheat products bread, biscuits etc.; formulation of premixes for bakery products; pasta goods and processed cereal foods for infants.

UNIT II

Rice Technology: Composition, type of proteins, starch content. amylose and amylopectin fractions; presence and effect of lipases; distribution of vitamins; mineral, and proteins in rice grain and its relation to milling; rice milling operations and its effect on nutritive value; cooking quality; by-products of rice milling and their utilization; processed and prepared mixes based on rice.

UNIT III

Legumes: Composition, anti-nutritional factors, processing methods, methods of cooking.

UNIT IV

Corn Technology: Composition. processing of corn for manufacture of corn grits, meal and flour; manufacture of com flakes, com syrup, comstarch, corn steep liquor, corn oil and canned corn. Composition and Processing of millets like barley, sorghum, oats etc.

UNIT V

Oilseeds: Composition, processing of oilseeds as protein concentrations, properties and uses of oilseeds meals, technology vegetable protein isolates: Barrier compounds in the utilization

of oil seed proteins. Low cost protein foods from oilseeds.

Reference Books

Chakrabarty MM. 2003. Chemistry and Technology of Oils and Fats. Prentice Hall.

Dendy DAV & Dobraszczyk BJ. 2001. Cereal and Cereal Products. Aspen.

Hamilton RJ & Bhati A. 1980. Fats and Oils - Chemistry and Technology. App. Sci.Publ.

MFT 302: Processing of Milk and Milk Products

Course Objective:-

The primary objective of the course is to build develop clear understanding of various aspects of milk processing and technologies used to develop various milk product

Course Learning Outcomes :-

Student will be able to

1- Understand the physicochemical properties of milk and various technologies and techniques involved from collection to distribution of milk.

2- Understand the technology of fermented milk products and manufacturing techniques, storage, marketing and defects of cheese and butter.

3- Understand the technology of frozen milk products technology of evaporated and dried milk technology of condensed milk and their defects and control.

4- Understand the technology of dairy by product and their utilization, technology of indigenous milk product and process of manufacturing.

5- Learn about sanitary aspects of dairy plant and application of membrane technology in dairy industry

UNIT I

Introduction: Physicochemical properties of milk. Platform tests. Chemical composition and nutritive value of milk. Factors affecting composition of milk. Importance of milk industry in

India: Collection. chilling. transportation, cream separation, standardization, pasteurization. sterilization, homogenization, packaging. storage and distribution of fluid milk, Ultrahigh temperature processed milk.

Preparation of various iypes of milks: Toned. homogenized. fortified. reconstituted and flavoured milk.

UNIT II

Technology of fermented milk products: Principles and practices of manufacture, packaging, storage and marketing of Dahi, cultured butter milk, acidophilus milk etc. Preparation of soft curd milk. vitaminized milk. standardized milk. filled milk and imitation milk.

Cheese: Manufacture of hard, semi hard, soft and processed cheeses. Storage, grading and marketing of cheese. cheese defects and their control. Butter: Manufacture, packaging, storage and marketing of butter: butter defects and their control, margarine.

UNIT III

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

Technology of evaporated and dried milk: Manufacture of evaporated milks and milk powders.

Packaging storage defects and their control.

Technology of condensed milk: Manufacture of condensed milks, Packaging storage defects and their control.

UNIT IV

Technology of dairy by products: Utilization of skim milk. buttermilk and whey for the manufacture of casein, lactose etc. Technology of indigenous milk products: Principles and practices of manufacture, packaging, storage and marketing of ghee, Khoa, Chhena, shrikhand. paneer, rasogulla. gulabj and Milk based foods.

UNIT V

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

plant waste. Application of membrane technology in dairy industry.

Reference Books

Aneja RP, Mathur BN, Chandan RC & Banerjee AK. 2002. Technology ofIndian Milk Products. Dairy India Pub1.

De 5.1980. Outlines of Dairy Technology. Oxford Univ. Press.

Rathore NS et a1. 2008. Fundamentals of Dairy Technology - Theory &Practices. Himanshu Pub1.

MFT 303: Quality

Control Food Standards and Food Laws

Course Objective:-

Purpose of this course is to enable the student to understand the concept and methods of quality assurance raw material and finished product quality analysis sensory evaluation techniques and different food standards and laws of national and international

Course Learning Outcomes: - Student will be able to

6- Have a clear understanding about the quality assurance food quality and food safety.

7- Have knowledge of various quality parameters of raw material and finished food and evaluation procedure and have clear understanding of sensory analysis of food.

8- Understand about various food standards and laws of national international level and also have knowledge of nutritional labeling.

9- Will be able to describe the procedure of quality certification and accreditation.

10- Will have gained insight on water quality and its analysis and waste treatment using various methods.

UNIT I

Quality Assurance: Introduction, Importance and Difference. Food Quality and Food Safety: Scope end difference.

UNIT II

Raw materials: Quality parameters and evaluation procedures. Finished product quality: Appearance, colour, texture. viscosity, consistency, flavour.

Sensory evaluation: Selection of panel of judges. sensory characteristics of foods, types of tests.

UNIT III

Food standards and laws: International — Concept of Codex alimentarius. HACCP, GMP. GHP, USFDA, ISO 9000, ISO 22000, ISO 14000. National — Introduction of BIS/IS, Food Safety and standards — 2006. Food Safety and standard regulation 2010, FPO, MPO. MMPO, Agmark.

Prevention of food adulteration Act: Food Adulteration: definition, common adulterants in different foods, contamination, methods of detection. Food additives and legislation; coloring matter, preservatives, poisonous metals, antioxidants and emulsifying and stabilizing agents, insecticides and pesticides. PFA specification for food products. Nutritional labeling

UNIT IV

Quality Certification & Accrediation: Introduction and procedure.

UNIT V

Water Quality: Water standards and Analysis physical, chemical and microbiological characteristics of water analysis. Waste treatment: Fundamentals of Physical, Biological & Chemical waste treatments

Reference Books

Early R.1995.Guide to Quality Management Systems for Food Industries.Blackie Academic.

Krammer A & Twigg BA.1973. Quality Control in Food Industry. Vol. I, II. AVIPubl

MFT 304:

Entrepreneurship in Food Processing

Course Objective:-

The purpose of this course is to enable the students to understand the concepts of entrepreneurship, planning and designing, plant location, plant layout, network analysis, human resource planning, marketing, operations research. Overall aim is to build entrepreneur in food processing and impart some business knowledge in students.

Course Learning Outcomes :-

Upon successful completion of the course, the student

1- Will have acquired knowledge of general design consideration, financial analysis, plant location and layout and student will be able to plan and design service facilities.

2- Will be able to do the analyze the plant cost and profitability and learn about network analysis of planning, scheduling and management activities and also various building material for building the plant.

3- Will be able to plan and design the marketing system and also have an understanding of worker safety and plant hygiene.

4- Will have attained knowledge of demand and supply, sample survey techniques, consumer trends and behavior.

5- Understand, about operation research and able to apply inventory control, linear programming, queuing theory and forecasting methods.

UNIT I

Aggregate Planning-: General design considerations. Financial Analysis, plant location and plant layout. Flowcharts and their design, equipment selection.

Planning and Design of service facilities, economic plant size

UNIT II

Analysis of plant costs and profitability: Network analysis of planning, scheduling and management activities. Requirement in respect of building and building materials.

UNIT III

Human resource planning: Planning and design of marketing system, worker's safety and plant hygiene

UNIT IV

Introduction to Marketing and economics: Demand. Supply, Sample survey techniques, marketing information, consumer mends, consumer behaviour.

UNIT V

Introduction io Operations Research: Definition, applications. Inventory control, Linear Programming.QueuingTheory,TransportationandAssignment.Forecasting

Reference Books

Chandra P. 2005. Project Management. Tata McGraw Hill.

Gopal Krishan P & Nagarajan K. 2005. Project Management. New Age.

Hisrich RD & Peters MP. 2002. Entrepreneurship. Tata McGraw Hill.

Kaplan JM. ?003. Patterns of Entrepreneurship. John Wiley & Sons.

Nandan H. 2007. Fundamentals of Entrepreneurship Management. Ptentice Hall

SEMESTER IV

MFT 401:

Industrial Food Fermentation

Course Objective:-

This course will facilitate in understanding various concepts and application of microbes for the development of various conventional fermented foods, production of baker’s yeast, alcoholic beverages beer, wine and distilled beverages. The course also covers microbial production of various organic acids and different fermentation processes.

Course Learning Outcomes: - On completion of the course, students are expected to be able to -

1- Will learn about various nutritional requirements of microorganism used for fermentation and understand basic needs of a fermentation process like sterilization in ocular development etc.

2- Acquires knowledge about conventional fermented food production process of Baker's yeast alcoholic beverages like beer, wine and distilled beverages.

3- Learns about the microbial production of various organic acids, amino acid, vitamins and enzymes.

4- Understands different types of fermentation processes.

UNIT I

Charactaterstics. Nutritional requriment and maintenanace of microorganism used for fermentation. Basic needs of a fermentation process: Sterilization, inoculum development, aeration, agitation, temperature p^H control and aseptic operation.

UNIT II

Conventional fermented food, production of baker's yeast. Alcoholic beverages: Beer, Wine and distilled beverages.

UNIT III

Microbial production of organic acids (acetic, citric, propionic etc.) amino acids (L-lysine, L-glumic acid etc.) vitamins (Riboflavin. cynanocobalamine etc) and Enzymes (lipase, protiose amylase etc.

UNIT IV

Solid state and submerged fermentation process. Single cell protein and hydrocarbon fermentation.

Reference Books

Industrial Microbiology, RH Patel, Laxmi House Publication

Industrial Microbiology. LE Casida. JR, New Age International Publishers

Industrial Microbiology (An introduction), Michael J Waites, Neil L Morgan. John S Rockej and Gary Higton

MFT 402: Technology of Meat, Fish and Poultry Products

Course Objective:-

Purpose of this course is to introduce the student to the technology of meat fish and poultry students will gain an understanding of scope of meat industry in India and know about the various physical and chemical composition of meat poultry and fish the course also covers various processing preservation methods of meat and poultry feed it also aims to develop knowledge of utilization of by product.

Course Learning Outcomes: - On completion of the course, students are expected to be able to -

1- Learns about the scope of meat industry structure, chemical composition, and nutritive value of meat and also gain knowledge of various changes in postmortem, meat cut, meat tenderization and utilization of by products.

2- Understand preservation techniques used for meat and poultry.

3- Learns about the catching to transportation processing and preservation techniques and spoilage of fish.

4- Acquires knowledge about eggs its structure, composition and nutritive value. Students are also able to do internal evaluation of eggs and grade them, also learn about preservation and production processes of various egg product.

5- Gain knowledge of poultry chemical composition and nutritive value of poultry and learn about ante and post-mortem examination, methods of stunning, slaughter, scalding and dressing and also utilization of poultry by products.

UNIT I

Scope of meat & meat products industry in India. Structure of meat tissue. Chemical composition and nutritive value of meat Mechanism of muscle contraction and relaxation. Postmortem changes-factor affecting post-mortem changes, thaw rigor and cold shortening Properties of fresh meat. Meat carcass grading and cuts. Restructured meat products, Pre rigor processing of meat. Meat tenderization -and its techniques. Utilization of meat industry by-products

UNIT II

Preservation of meat & poultry- chilling, freezing, curing, smoking, canning, dehydration. irradiation. freeze drying. antibiotics, microwave, chemicals

¥!NIT **III**

Catch, handling and transportation of fish, spoilages. processing and preservation of fish. shell fish and other sea products.

UNIT IV

Eggs - siructure, composition, nutritive value and functional properties of eggs. Internal quality of eggs- evaluation, egg grading. Preservation and maintenance of internal quality of eggs, Egg products-Egg powders, frozen eggs. egg foams, factors influencing foaming.

UNIT V

Poultry -types, factors affecting quality, chemical composition and nutritive value of poultry meat Poultry dressing - ante and post-mortem examination. methods of stunning, slaughter, scalding & dressing. Tenderness of poultry, problem in poultry meat. Utilization of poultry industry by-products._

Reference Books

Govindan TK. 1985. Fish Processing Technology. Oxford & IBH. Hut

YH. 2001. Meat Science and Applications. Marcel Dekker. 32Kerry J.

et a1. 2002. Meat Processing. Woodhead Publ. CRC Press.

Pearson AM & Gillett TA. 1996. Processed Meat 3rd Ed. Chapman & Hall.

MFT 403: Food Plant Safety and Waste Management

Course Objective:-

Understand the industrial hygiene and safety aspects safety element risk analysis and assessment reduce system disaster planning and management and know about waste management and its treatment by various methods.

Course Learning Outcomes: - Student will

1- Understand the importance of industrial hygiene and safety aspects related to toxicity noise pressure etc.

2- Learn about the safety elements of food plant risk analysis and assessment also understand about the procedure to follow when release of hazardous material from tanks and pipes

3- Understand about the relief system, disaster planning and management regulation and also learn about the legislation and government role in safety of food plant.

4- Develop insight of characterization of waste of food processing industry and treatment methods.

5- Will be able to learn the various techniques used in treating the waste generated at food processing industries and know about advanced water treatment, handling and disposal of sludge.

UNIT I

Industrial hygiene and safety aspects related to toxicity, noise, pressure, temperature, vibration, radiation etc.

UNIT II

Safety elements: site of layout, process stages. Risk analysis and assessment. Prevention of losses. pressure relief, provision for fine fighting release of hazardous material from tanks

and pipes.

UNIT III

Relief system: Types and Location. Disaster planning and management regulation, legislation and government role related to safety of food plant.

UNIT IV

Characterization of waste water generated from food processing industries and its treatment by physical and chemical methods.

UNIT V

Biological oxidation: Activated sludge process. tricking filter, rotating biological contractor, lagoons, oxidation ditches. Anaerobic digestion and compositing Advance water treatment system: use of membrane, ion exchange . electro dialysis. magnetic separation. Handling and disposal of sludge.

Reference Books

Plant sanitation for food processing and food service. Y H Hui, CRC publication

Principles of food sanitation, Norman G Marriott and Robert B Gravani

Food safety management Programms, Debby Newslow

MFT 404: Industry Training/ Project/ Dissertation

Course Objective:-

To train the students for working in industry, accomplish small objectives of research, have the basic knowledge of research, writing and presenting.

Course Learning Outcomes: - Student will

1- Learn about the safety elements of food plant risk analysis and assessment, product manufacturing and packaging.
2- Generate idea of research and how to achieve objective.
3- Develop research hypothesis, work plan.
4- Will be able to use statistical tool for analaysing problem and write research

paper.