छत्रपति शाहू जी महाराज विश्वविद्यालय, कानपुर

CHHATRAPATI SHAHU JI MAHRAJ UNIVERSITY, KANPUR

(पूर्ववर्ती कानपुर विश्वविद्यालय कानपुर)

Formerly Kanpur University, Kanpur – 208024

A Documentary Support

For

Metric No. – 1.1.1

Programme Outcomes & Course Outcomes

Under the

Criteria - I

(Curriculum Design and Development)

Key Indicator - 1.1

In

Metric No. – 1.1.1

M.Sc. Food Technology

Co-ordinator
Internal Quality Assurance Cell
CSJM University, Kanpur

(Registrar)
C.S.J.M.University
Kanpur

REGISTRAR
C.S.J.M. UNIVERSITY
KANPUR

CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY, KANPUR

STRUCTURE OF SYLLABUS FOR THE

PROGRAM: M.Sc., SUBJECT: FOOD TECHNOLOGY

Learning Outcome based Curriculum Framework

For

M.Sc. Food Technology

Department of Food Technology

School of Life Science and Biotechnology

Chhatrapati Shahu Ji Maharaj University Kanpur

CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY, KANPUR

STRUCTURE OF SYLLABUS FOR THE

PROGRAM: M.Sc., SUBJECT: FOOD TECHNOLOGY

Program Educational Objectives (PEOs)

Post-Graduates of Food Processing Technology program will be able to,

PEO1: To inculcate in-depth knowledge of Food Engineering and Technology with an ability to analyze, evaluate, design, discriminate, interpret, create and integrate existing and new knowledge.

PEO2: To analyze technological problems and judge independently to create information for conducting research and think to conceptualize and carry out the solutions of a potential problem and derive out optimal solutions in the area of Food Processing Technology.

Program Outcome (PO):

PO1: An ability to apply the knowledge of science, microbiology and technology

PO2: An ability to apply the knowledge of underlying chemistry, properties and effects of processing on food components

PO3: An ability to use the techniques, skills, and modern tools necessary food processing operations

PO4: Demonstrate knowledge and understanding of technology and management principles, manage projects efficiently in food science and technology and multidisciplinary environments after consideration of economic and financial factors

PO5: An ability to design and conduct experiments, as well as to analyze and interpret data

PO6: An ability to apply knowledge for production of safe food and shelf-life extension of food products

PO7: An ability to identify, formulates, and solve food science and technology problems

PO8: 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

PO9: Contribute individually/in group to the development of scientific/technological knowledge in food science and technology.

PO10: Communicate effectively on complex engineering activities with the engineering

community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO12: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Program Specific Outcome (PSO)

PSO 1: To inculcate technical writing and communicating ability for effective documentation and presentations and develop strong research aptitude through research work to enable the students to opt for higher levels of learning in the field of Food Processing Technology.

PSO 2: To acquaint and equip students with professional and intellectual integrity, ethics of research and scholarship, impact of research outcomes on professional practices and responsibilities to contribute positively in the sustainable development of society.

PSO 3: To enable the students to get engaged in lifelong learning independently with the vigor and zeal and become capable to start-up their own businesses.

CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY, KANPUR

STRUCTURE OF SYLLABUS FOR THE

PROGRAM: M.Sc., SUBJECT: FOOD TECHNOLOGY

Proposed Syllabus (According to NEP-2020) for MSc. in Food Technology (Degree)

Syllabus Developed by			
Name of BOS Convenor / BOS Member	Designation	Department	College/University
Prof S K Awasthi	Dean, Faculty of Life Sciences	Life Science & Biotechnology	CSJM, University, Kanpur
Prof. Nand Lal	Professor, Head & Convenor	Life Science & Biotechnology	CSJM, University, Kanpur
Prof. Neelam Pathak	External Expert	Biochemistry	RMLAU, Ayodhaya
Prof. Ram Narain	External Expert	Biotechnology	VBS Purvanchal University, Jaunpur
Prof. B N Mishra	External Expert	Biotechnology	Institute of Engineering & Technology, Lucknow
Prof. Varsha Gupta	Professor	Life Science & Biotechnology	CSJM, University, Kanpur
Prof. Rolee Sharma	Professor	Life Science & Biotechnology	CSJM, University, Kanpur
Dr. Shilpa Deshpande Kaistha	Associate Professor	Life Science & Biotechnology	CSJM, University, Kanpur

IST YEAR / IST SEM						
COURSE CODE	**TYPE**	**COURSE TITLE**	**MIN CREDITS**	**CIA**	**ESE**	**MAX. MARKS**
L050701T	CORE	PRINCIPLES OF FOOD PROCESSING	4	25	75	100
L050702T	CORE	FOOD CHEMISTRY	4	25	75	100
L050703T	CORE	INSTRUMENTATION AND ANALYTICAL TECHNIQUES	4	25	75	100
L050704T	CORE	RESEARCH METHODOLOGY, STATISTICS AND COMPUTERAPPLICATIONS	4	25	75	100
L050705P	PRACTICAL	PRACTICAL	4	25	75	100
	PROJECT	REVIEW WRITING PRESENTATION/ INTERNSHIP/PROJECT				-
		TOTAL	20			500
IST YEAR / IIND SEM						
L050801T	CORE	POST HARVESTING TECHNOLOGY OF HORTICULTURAL CROPS	4	25	75	100
L050802T	CORE	FOOD MICROBIOLOGY	4	25	75	100
L050803T	CORE	FOOD PACKAGING	4			100
L050804T	OPEN ELECTIVE	SENSORY EVALUATION	4	25	75	100
L050805T		QUALITY CONTROL FOOD STANDARDS AND FOOD LAWS				
L050806P	PRACTICAL	PRACTICAL	4	25	75	100
L050807R	PROJECT	REVIEW WRITING PRESENTATION/ INTERNSHIP/PROJECT	8			100
	MINOR ELECTIVE	FROM OTHER DEPARTMENT	4	25	75	100

CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY, KANPUR

STRUCTURE OF SYLLABUS FOR THE

PROGRAM: M.Sc., SUBJECT: FOOD TECHNOLOGY

	TOTAL		32			700
IIND YEAR / IIIRD SEM						
L050901T	CORE	PROCESSING OF CEREALS, PULSES & OILSEEDS	4	25	75	100
L050902T	CORE	PROCESSING OF MILK AND MILK PRODUCTS	4	25	75	100
L050903T	ELECTIVE	BIOSAFETY AND INTELLECTUAL PROPERTY RIGHTS (IPR)	4	25	75	100
L050904T		ENTREPRENEURSHIP IN FOOD PROCESSING				
L050905T	ELECTIVE	FOOD BIOTECHNOLOGY	4	25	75	100
L050906T		SPICE AND PLANTATION CROP TECHNOLOGY				
L050907P	PRACTICAL	PRACTICAL	4	25	75	100
	PROJECT	RESEARCH PROJECT DISSERTATION/INDUSTRY TRAINING/SURVEY				-
	TOTAL		20			500
IIND YEAR / IVTH SEM						
L051001T	CORE	INDUSTRIAL FOOD FERMENTATION	4	25	75	100
L051002T	ELECTIVE	TECHNOLOGY OF MEAT, FISH AND POULTY PRODUCTS	4	25	75	100
L051003T		PROCESSING OF FRUITS AND VEGETABLES				
L051004T	ELECTIVE	NUTRACEUTICALS AND FUNCTIONAL FOODS	4	25	75	100
L051005T		BAKERY, CONFECTIONERY, AND CONVENIENCE FOOD TECHNOLOGY				
L051006T	ELECTIVE	FOOD PROCESS ENGINEERING	4	25	75	100
L051007T		FOOD ENGINEERING				
L051008P	PRACTICAL	PRACTICAL	4	25	75	100
L051009R	PROJECT	RESEARCH PROJECT DISSERTATION/INDUSTRY TRAINING/SURVEY	8			100
	TOTAL		28			600
GRAND TOTAL			100			**2300**

NOTE:

1.*A MINOR ELECTIVE FROM OTHER FACULTY SHALL BE CHOSEN IN 1ST YEAR (EITHER Ist /IInd SEMESTER) AS PER AVAILABILITY.

2. In both years of PG program, there will be a Research Project or equivalently a research-oriented Dissertation as per guidelines issued earlier and will be of 4 credit (4 hr/week), in each semester. The student shall submit a report/dissertation for evaluation at the end of the year, which will be therefore of 8 credits and 100 marks

3. Research project can be done in form of Internship/Survey/Field work/Research project/ Industrial training, and a report/dissertation shall be submitted that shall be evaluated via seminar/presentation and viva voce.

4. The student straight away will be awarded 25 marks if he publishes a research paper on the topic of Research Project or Dissertation.

CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY, KANPUR

STRUCTURE OF SYLLABUS FOR THE

PROGRAM: M.Sc., SUBJECT: FOOD TECHNOLOGY

SEMESTER I

L050701T: 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 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 equipment's. 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.

L050702T: 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 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 foodsystems. 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 pigments 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.

L050703T: 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, fluorimetry 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 fluorimetry, spectrofluorometers, 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.

UNIT 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, Emission spectroscopy. IR spectroscopy.

UNIT V

Fluorimetry: Spectrofluorometer, Flame photometry and atomic absorption spectrophotometry. Use of radioisotopes. Microbiological assays. Microscopy

Reference Books

1. Handbook of Food Analysis by Nollet & Toldra, CRC publishing ltd.
2. Handbook of Analysis- & Quality Control for Fruit & Vegetable Products by Rangana.Tata Mcgraw hill publishing.
3. Handbook Introduction to the chemical analysis of foods by Nielson, CBS publishing.

L050704T: 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 covers 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 can formulate the problem, collect data, 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 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/Food 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 of 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): Oneway 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

1. Aggarwal BL. 2003. Basic Statistics. New Age.
2. Gupta SP. 2004. Statisiical Methods. S. Chand & Sons.
3. Elhance, D.L. (2008). Fundamentals o1 Statistics. Kitab Mahal. Patna

L050705P: PRACTICALS

Course Objective: -

To develop an understanding about the advanced analytical and instrumental techniques. To describe bio-chemical analysis of food components and different standard chemical solutions.

Course Learning Outcomes: -

Upon successful completion of the course, the student:

1. They will acquire the knowledge about handling different instruments used in food
2. Students will get introduction different types of chemical reactions used for identification of carbohydrates
3. They will be able to estimate FFA content in given oil sample
4. They will be able to perform estimation of protein and reducing sugar from food sample.
5. They will be able to perform chemical composition, antioxidant activity, different standard chemical solution etc.

Practical List: -

1. Preparation of standard solutions for chemical analysis ie HCl, H_2SO_4, NaOH etc.
2. Determination of pH and acidity of foods
3. Determination of proximate composition of foods: Moisture, protein, fat, total ash, crude fibre, calorific value
4. Determination of Calcium content in food
5. Determination of Antioxidant activity in food
6. Determination of Iron in food by spectrophotometry
7. Estimation of reducing and non-reducing and total sugars in cereals, fruits, vegetable products
8. Determination of starch content in food products
9. Estimation of fats and oils: free fatty acids, saponification value, RM number TBA test, Iodine value
10. Estimation of adulteration test in different food samples
11. Qualitative analysis of compounds by chromatography: TLC, Paper Chromatography
12. Use of electrophoresis in determination of proteins

*****Number of practicals may vary, it will depend on the availability of food materials, Instruments, chemicals etc.
*Demo practical classes given by virtually/video/practically

References

Plummer, D.T. (2001) An Introduction to Practical Biochemistry, 3rd edn., McGraw Hill Ltd. New Delhi

Sawhey, S.K. and Singh, R. (2002) Introductory Practical Biochemistry, Narosa Publication House, New Delhi

Jayramann, J. (2008) Laboratory Manual in Biochemistry, New Age International, New Delhi.

Ranganna S 1986. Handbook of analysis and quality control for fruit and vegetable products. Tata McGraw Hill Pub Col. Ltd., New Delhi, India, pp 1112.

AOAC (1990). 15th Official methods of Analysis. Association Official Analysis Chemists, Washington D. C. USA.

SEMESTER II

L050801T: 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, storage, 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

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

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

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

L050802T: 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 publisher

L050803T: Food Packaging

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 I

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

L050804T: Sensory Evaluation

Course Objectives:

Sensory evaluation and by product utilization of food is an interdisciplinary research field that is rapidly developing and expanding. The objective of lectures in the first year of the master's degree program is to ensure that students acquire essential knowledge of Sensory evaluation and byproduct utilization of food in food industry, its acquaint with sensory quality parameters, and methods of sensory evaluation of foods.

Course Learning Outcomes: -

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

1: To analyze the basic concepts of sensory evaluation and requirements of a sensory laboratory.
2: To illustrate criteria for selection of sensory panelists, sensory quality parameters and factors affecting sensory measurements.
3: To define different sensory tests like discrimination, descriptive, affective; flavor profile and tests; ranking tests, detection, threshold and dilution tests.
4: Summarizes by-product utilization of different fruits such as apple, grape, papaya, orange, citrus, mango.
5: The course will provide an understanding about nutritional quality of foods and its assessments like Digestibility, Biological value, NPU, PER, etc.

Unit I

Introduction to sensory analysis, general testing conditions, Requirements of sensory laboratory; organizing sensory evaluation programmers.

Unit II

Selection of sensory panelists; Factors influencing sensory measurements; Sensory quality parameters -Size and shape, texture, aroma, taste, color and Gloss.

Unit III

Subjective and objective sensory evaluation: Different tests for sensory evaluation– discrimination, descriptive, affective; Flavor profile and tests; Ranking tests, Detection, threshold, and dilution tests. Texture analyzer, Colorimeter, Electric tounge, Electric nose, Quality control; storage stability testing; Nutritional Quality of foods and its assessments: Physicochemical and phytochemicals parameters of different foods.

Unit IV

Food proteins (Digestibility, Biological value, NPU, PER),

Unit V

Space Food: What is food preservation. food important for astronauts. The NASA diets**.** Nutrition in space. Methods for preservation of space foods.

References Book

1. Herbert Stone, Joel L. Sidel, (2012), "Sensory Evaluation Practices", Academic Press Publishers.

2. Maynard A. Amerine, Rose Marie Pangborn, Edward B. Roessler, (2013), "Principles of Sensory Evaluation of Food", Elsevier Publications.

3. Harry T. Lawless, Hildegarde Heymann, (2010), "Sensory Evaluation of Food: Principles and Practices", Springer Science & Business Media.

L050805T: 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

1. Have a clear understanding about the quality assurance food quality and food safety.
2. Have knowledge of various quality parameters of raw material and finished food and evaluation procedure and have clear understanding of sensory analysis of food.
3. Understand about various food standards and laws of national international level and also have knowledge of nutritional labeling.
4. Will be able to describe the procedure of quality certification and accreditation.
5. 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 ofjudges. 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

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, Il. AVIPubl

L050806P: PRACTICALS

Course Objective: -

To develop an understanding about the phytochemicals and microbial properties of different foods and food products. To describe packaging material used in different food products for their storage, transportation etc.

Course Learning Outcomes: -

Upon successful completion of the course, the student:

1. They will acquire the knowledge about handling different instruments used in food
2. Students will get knowledge of different types of packaging materials used in food.
3. They will be able to estimate phytochemicals properties of different foods
4. They will be able to perform microbial properties of food

Practical List: -

1. Analysis of canned food products for chemical and microbiological spoilage
2. Determination of ascorbic acid content in food products
3. Methods for the preparation of different types of agar
4. Determination of tannins in food products
5. Preparation of squash, cordial
6. Determination of different adulteration test.
7. Pectin determination in fruits and vegetables
8. Determination of chemical preservatives in fruits and vegetable products
9. Use of flame photometry in estimation of trace elements like Na and K
10. Determination of microbial counts: total viable count, thermophilic, proteolytic, lipolytic and aerobic spore formers, coliform counts, yeast, and mold counts
11. Determination of chemical composition of different foods.
12. Determination of activity of starter cultures used in dairy industry
13. Determination of thermal resistance of enzymes and micro-organisms

*****Number of practicals may vary, it will depend on the availability of food materials, Instruments, chemicals etc.

*Demo practical classes given by virtually/video/practically

References

1. Plummer, D.T. (2001) An Introduction to Practical Biochemistry, 3rd edn., McGraw Hill Ltd. New Delhi
2. Sawhey, S.K. and Singh, R. (2002) Introductory Practical Biochemistry, Narosa Publication House, New Delhi
3. Jayramann, J. (2008) Laboratory Manual in Biochemistry, New Age International, New Delhi.
4. Ranganna S 1986. Handbook of analysis and quality control for fruit and vegetable products. Tata McGraw Hill Pub Col. Ltd., New Delhi, India, pp 1112.
5. AOAC (1990). 15th Official methods of Analysis. Association Official Analysis Chemists, Washington D. C. USA.

L050807R: Review writing/Presentation/Internship/Project

Course Objectives:

To enlighten the students about the organization and functioning of food research systems at national and international levels. Research ethics, and rural development programs and policies of Government

Course Outcomes:

Upon successful completion students should be able to:

1. Students will learn about how to search research articles and reviews related to food products.
2. They will learn how to implement their ideas in innovative product development.
3. They will understand the process of product standardization.
4. They will acquire knowledge about sensory evaluation methods used in industry. CO5: They will learn the quality control of products.
5. They will learn about cost estimation, sales and marketing of food products.
6. They will learn about maintenance of different equipment's and their standardization.
7. They will understand the procurement of raw material.

-Note:

- They will learn SOPs for different equipment's and instruments.
- They will understand about different food laws, different certifications required for food industry.
- They will learn about how auditing and accreditation is carried out. CO12: They will acquire knowledge about packaging material testing and their use in different food products.
- Students will learn about nutritional labeling of food products.
- They will understand how to maintain data and carryout statistical analysis of food products.

CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY, KANPUR

STRUCTURE OF SYLLABUS FOR THE

PROGRAM: M.Sc., SUBJECT: FOOD TECHNOLOGY

SEMESTER III

L050901T: Processing of Cereals, Pulses & 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 enzymes 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 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 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, corn starch, 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

1. Chakrabarty MM. 2003. Chemistry and Technology of Oils and Fats. Prentice Hall.
   Dendy DAV & Dobraszczyk BJ. 2001. Cereal and Cereal Products. Aspen.
2. Hamilton RJ & Bhati A. 1980. Fats and Oils - Chemistry and Technology. App. Sci. Publ.

L050902T: 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, ultra-high temperature processed milk.

Preparation of various types of milks: Toned. homogenized. fortified. reconstituted and flavored 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, marketing of ghee, Khoa, Chhena, shrikhand. paneer, rasogulla, 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

1. Aneja RP, Mathur BN, Chandan RC & Banerjee AK. 2002. Technology ofIndian Milk Products. Dairy India Pub1.
2. De 5.1980. Outlines of Dairy Technology. Oxford Univ. Press.
3. Rathore NS et a1. 2008. Fundamentals of Dairy Technology - Theory &Practices. Himanshu Pub1.

L050903T: Biosafety and Intellectual Property Rights (IPR)

Course Objectives

1. To acquaint students with the principles of bioethics
2. To familiarize students with biosafety concepts related to genetically modified crops, laboratory and assessment procedures
3. To understand the importance of Genetically modified crops with case studies
4. Students to get understanding of different aspects of intellectual property rights
5. Students to get understanding of patent and its relevance in food technology

Course Learning Based Outcomes

1. The student will gain an understanding of processing techniques utilized in the bakery and confectionery industry
2. The student will comprehend the role of convenience food technology as an important aspect of commercial foo

Unit I Bioethics: The principles of bioethics Legality, morality and ethics, autonomy, human rights, beneficence, privacy, justice, equity etc.

Bioethics and food biotechnology: The expanding scope of ethics from biomedical practice to modern food technology, ethical conflicts in food biotechnology - interference with nature, fear of unknown, unequal distribution of risks and benefits of food biotechnology, bioethics vs. business ethics

Unit II Biosafety concepts and issues: Biosafety concepts and issues, Rational vs. subjective perceptions of risks and benefits, relationship between risk, hazard, exposure and safeguards, biosafety concerns at the level of individuals, institutions, society, region, country and the world.

Biosafety in the laboratory and process industry: Laboratory associated infections, bioprocess industrial hazards, assessment of biological hazards and levels of biosafety, prudent biosafety practices in the laboratory and process industry, Biosafety assessment procedures in India and abroad

Unit III Food Biotechnology and food safety.GM-food debate and biosafety assessment procedures for biotech foods & related products, including transgenic food crops, case studies of relevance.

Hazards and risk: Difference between hazard and risk, risk management, risk groups, different biosafety levels, protocols, containment

Unit IV General Principles of International dimensions of IPR, Introduction to Intellectual Property, Philosophical Justification of Intellectual Property, Western Theories on Private and IP, Indian Theory on Private Property, International Scenario, Economic Development and IPR Protection

Unit V Introduction to Patents, Patentable subject-Matter, Procedure for Obtaining of Patents, Working of Patents, Infringement –Compulsory License., GATT and WTO, WTO and Economic Development, TRIPs Agreement and Its relation with other International IPR Treaties, TRIPs Agreement TRIPs and Environment., Biotechnology and IPR, Biotechnology and Law, Patenting Biological Invention, Plant Varieties Protection, Food Security, Genetic Engineering and Biotechnology, Biotechnology and International Treaties UPOV, Convention on Biological Diversity, TRIPs, ITPGRFA. Relevance to Food Technology

References

1. Thomas JA, Fuch RL, Biotechnology and Safety Assessment, 3 rd Ed, Academic Press. 2002
2. Fleming DA, Hunt DL, Biological safety Principles and practices, 3rd Ed, ASM Press, Washington. 2000
3. William H. Lesser and Robert T. Masson, An Economic Analysis of the Plant Variety Protection Act, 1983
4. Carlos M. Correa, Oxford Commentaries on The GATT. WTO Agreements, Oxford UniversityPress. 2007.
5. Alfredo Ilardi and Michael Blakeney (Ed.), International Encyclopedia of Intellectual Property Treaties (2004), Oxford University Press.

L050904T: 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 behavior.

UNIT V

Introduction io Operations Research: Definition, applications. Inventory control, Linear Programming. Queuing Theory, Transportation and Assignment. Forecasting

Reference Books

i. Chandra P. 2005. Project Management. Tata McGraw Hill.
ii. Gopal Krishan P & Nagarajan K. 2005. Project Management. New Age. Hisrich RD & Peters MP. 2002. Entrepreneurship. Tata McGraw Hill.
iii. Kaplan JM. ?003. Patterns of Entrepreneurship. John Wiley & Sons.
iv. Nandan H. 2007. Fundamentals of Entrepreneurship Management. Ptentice Hall

L050905T: Food Biotechnology

Course Objective: -

For understanding of basic concepts of Food Biotechnology. To ensure that students would acquire good knowledge of biological sciences, food science or food technology and a basic knowledge of bio-chemistry and microbiology.

Course Learning Outcomes: -

Upon successful completion of the course, the student

1. The subject Fundamental Biochemistry is designed to under graduate students of biotechnology for describing basic concepts of biophysical chemistry, bimolecular and their types.
2. The course aims to provide an advanced understanding of the core principles and topics of Biochemistry and their experimental basis, and to enable students to acquire a specialized knowledge and understanding.
3. To discuss how Bimolecular provides basis for structural and chemical biology including nucleic acid structure and interactions
4. The course prepares the student to understand the biological material and its relation to living matter and elaborates the structure and functions of different bimolecular.
5. To explore basic information about characteristics, structure and reproduction of various organisms, classification, and evolutionary trends.

UNIT I

Basic principles of food fermentation technology, Types of fermentation: sub-merged/solid state. Batch/continuous fermentation, Fermenter design, operation, measurement, and control in fermentation. Principles of down-stream and up-stream processing and product recovery. Industrial spirit production. Biochemistry and technology of fermentation.

UNIT II

Enzyme technology: - General introduction and historic background-General terminology, Types of Enzymes- Constitutive and induced enzymes, intracellular and extracellular enzymes; sources of enzymes; classification of enzymes; isolation and purification of enzymes. Industrial Enzymes- Thermophilic enzymes, amylases, lipases, proteolytic enzymes in meat and leather industry, enzymes used in various fermentation processes, cellulose degrading enzymes, Metal degrading enzymes. Enzyme application in food industry.

UNIT III

Wine technology: - Modern enology philosophy. World and domestic wine production. Technological diagrams of white, rose, red, sparkling, and yellow wines. Science application in oenology. Wine categories, Technological trends in modern beer brewing. Classical and modern

malt production, malting yield, malt properties. New trends in brewing, fermentation, and beer stabilization. Beer categories.

UNIT IV

Basic principles of gene cloning, application of molecular cloning in foods with example of Golden Rice. Development techniques for new plant varieties and animal species, Transgenic and GM foods, Immobilized enzymes. Production of bio-colors and bio-flavors, FSSAI regulation.

UNIT V

Application of Biotechnology to Food products: - Bacteria-based products; dairy, meat, fish and vegetable products, vinegar, and additives. Yeast- based products; food yeasts, alcoholic beverages, and bread. Other microbial based products; enzymes, microbial biomass protein (MBP), additives and "smart foods". Testing and analysis of genetically modified foods; protein-based methods to detect the transgene product and DNA- based methods to detect the transgene or associated marker or regulatory sequences. Safety evaluation of novel food products, Benefits, and risk of GM foods.

Reference Books

1. Fundamental of Enzymology: Nicholas Price & Lewis Stevens
2. Biochemistry textbooks by stryer, Voet and Lehninger (Relevant Chapters)
3. Stanbury, Whitaker & Hall- Principles of Fermentation Technology

L050906T: Spices and Plantation Crop Technology

Course Objective: -
To impart basic knowledge about the importance and production technology of spices and plantation crops.

Course Learning Outcomes: -

Upon successful completion of the course, the student

1. To know about the importance of various types of spices which are used in the food industry and their applications
2. To understand the processing steps involved in spice processing
3. To know about value added products from spices
4. To know various processing steps involved in plantation crop processing

UNIT I
Spice processing: Introduction, classification, composition and functions. Major international quality specifications of spices. Spice processing, spice reconditioning, spice grinding, post-processing treatments. Introduction to Gas chromatography, HPLC, AAS, Spectrophotometer.

UNIT II
Processing of Major Spices: Major spices: Pepper, cardamom, ginger, clove, nutmeg, vanilla, cinnamon, chilli and turmeric – method of manufacture; chemistry of the volatiles; enzymatic synthesis of flavour identical.

UNIT III
Spice extractives: Value added spice products: Spice volatile oils, spice oleoresins, Use of spice extractives, replacement of spices with oils and oleoresins, alternative products, Ground spices, processed spices, organic spices, curry powders.

UNIT IV
Plantation crops- cashew processing: Composition, Structure and characteristics of cashew nut, uses, Traditional method of cashew processing, General processing, Cashew apple processing, cashew by product - CNSL.

UNIT V: Sugarcane and Cocoa processing: Production and processing of sugarcane, Cocoa: varieties, Processing of cocoa – Fermentation and Drying, storage. Manufacture of chocolate- conching, enrobing, milk chocolate, white chocolate, dark chocolate, cocoa butter, wafer coated chocolate, cocoa powder.

References Book

1. J.S.Purthi, (2003) (2001), "Minor Spices and Condiments: Crop Management and Post Harvest Technology", ICAR publication, 1st Edition,
2. Handbook of Fruit Science and Technology: Production, Composition, Storage, and Processing. D. K. Salunkhe, S. S. Kadam, CRC Press, 1st Edition, 1995.
3. N.K.Jain,(1989), "Global Advances in Tea Science", Aravali Books International, 1st Edition.

L050907P: Practical

Course Objective: -

To develop an understanding about the processing of cereal and dairy products and their quality evaluation using different instruments.

Course Learning Outcomes: -

Upon successful completion of the course, the student:

1. They will acquire the knowledge about physical property of food
2. They will get knowledge of different food processing
3. They will be able to estimate chemical properties of different baked and dairy foods.
4. They will be able to perform sensory evaluation of food sample.
5. They will be able to perform adulteration test in different food products

Practical list:-

1. Determination of physical properties of different cereals (wheat, rice etc.)
2. Determination of cooking quality of rice
3. Experimental baking of selected cereals products bread and biscuits
4. Sedimentation value of wheat flour
5. Chemical properties of cereal grains and its products
6. Manufacture of soya milk and milk products
7. Manufacture of dairy products i.e. butter, paneer, cheese, Channa etc.
8. Manufacture of fermented cereal products
9. Platform test for raw milk
10. Determination of fat content in milk powder and ice cream products
11. Determination of milk adulterants: starch, urea, formaldehyde, and sugar
12. Operation, cleaning, sterilization of dairy plant machinery involved in fluid milk processing
13. Preparation of toned, homogenized, fortified, reconstituted, and flavored milk
14. Manufacture of fermented milk
15. Manufacture of ice creams, ices, and sorbet
16. Sensory analysis of food products
    a. Paired comparison test
    b. Duo-trio test
    c. Hedonic test
    d. Triangle test
    e. Ranking test
    f. Single sample test

g. Composite scoring test

*****Number of practicals may vary, it will depend on the availability of food materials, Instruments, chemicals etc.
*Demo practical classes given by virtually/video/practically

References

Plummer, D.T. (2001) An Introduction to Practical Biochemistry, 3rd edn., McGraw Hill Ltd. New Delhi

Sawhey, S.K. and Singh, R. (2002) Introductory Practical Biochemistry, Narosa Publication House, New Delhi

Jayramann, J. (2008) Laboratory Manual in Biochemistry, New Age International, New Delhi.

Ranganna S 1986. Handbook of analysis and quality control for fruit and vegetable products. Tata McGraw Hill Pub Col. Ltd., New Delhi, India, pp 1112.

AOAC (1990). 15th Official methods of Analysis. Association Official Analysis Chemists, Washington D. C. USA.

L051001T: 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

Characteristics. Nutritional requirement and maintenance 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. cyanocobalamin etc.) and Enzymes (lipase, protiose amylase etc.

UNIT IV

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

Reference Books

1. Industrial Microbiology, RH Patel, Laxmi House Publication
2. Industrial Microbiology. LE Casida. JR, New Age International Publishers
3. Industrial Microbiology (An introduction), Michael J Waites, Neil L Morgan. John S Rockej and Gary Higton

\

L051002T: 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 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 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 connection 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

UNIT III

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

UNIT IV

Eggs - structure, 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

1. Govindan TK. 1985. Fish Processing Technology. Oxford & IBH. Hut
2. YH. 2001. Meat Science and Applications. Marcel Dekker. 32Kerry J.
3. et a1. 2002. Meat Processing. Woodhead Publ. CRC Press.
4. Pearson AM & Gillett TA. 1996. Processed Meat 3rd Ed. Chapman & Hall.

L051003T: Processing of Fruits and Vegetables

Objectives: Study of Fruits and vegetable technology, students know how fruits and vegetables are industrially processed. They learn various ways of designing and monitoring processing chains with the emphasis on how quality, safety, authenticity, etc. of raw materials, processes and products are preserved.

Course Learning Based Outcomes

1. To comprehend the structure, composition, physiological development, post-harvest handling methods, processing and preservation of fruits and vegetables.
2. To illustrate the technology of Fruits and vegetables products like juices and pulps, concentrates and powders, squashes and cordials, beverages, jam, jellies, sauces, etc.
3. To describe the preservation methods and processing ways of spices develop value added products from them.
4. Identify the method of production of dry fruits, tea and coffee
5. To demonstrate the processing and chemical composition of cocoa beans, cocoa processing and manufacturing process for chocolate.

Unit I

Structural, Compositional, and nutritional aspects of fruits and vegetables. Physiological development: Growth, Maturation, Ripening and Senescence. Post-harvest handling including controlled and modified storage. Techniques of processing and preservation of fruits and vegetables by refrigeration and freezing, canning and bottling, drying and dehydration.

Unit II

Technology of Fruits and vegetables products: Juices and pulps, Concentrates, and powders, squashes, and cordials. Beverages, Jams, Jellies and Marmalades. Candies and crystallized fruits. Tomato products: Puree, Paste, Ketchup, Sauce and Soup, Chutneys, Pickles.

Unit III

Spices: Introduction, Preservation and processing spices of India; spice extracts, Spice oils and oleoresins.

Unit IV

Composition, Structure and characteristics of dry fruits. Composition, Production and processing of Tea leaves and its types. Production and processing of coffee cherries. Soluble/ Instant coffee, Use of chicory in coffee, decaffeinated coffee

Unit V

Production, processing and chemical composition of cocoa beans. Cocoa processing and various products of cocoa. Manufacturing process for chocolate, Enrobed and other confectionary products.

Reference Books

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

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

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

4. Kadar AA. Post-harvest Technology of Horticultural Crops. 2nd

5. Ed.Universiity of California.

L051004T: Nutraceuticals and Functional Foods

Course Objective

Understand the various nutraceutical and functional foods that can be incorporated for value added food products

Course Learning Based Outcomes

1. Understand concepts of nutraceutical and functional foods and their significance
2. In detail understanding of their role in disease prevention
3. Understand different components of nutraceuticals with beneficial effects with their mode of action
4. Development and storage of functional foods

Unit I

Concept on Nutraceuticals: nutraceutical and functional foods, nutraceutical as new dietary ingredients, biological significance of nutraceuticals, nutraceuticals and dietary supplement, world market for nutraceuticals, regulatory issues

Unit II

The role of nutraceuticals/functional foods in disease prevention: angiogenesis and cardiovascular diseases, cancer, diabetes, cholesterol management, obesity and inflammation dosage levels,

Unit III

Health benefits of nutraceuticals, natural pigments (chlorophyll, chlorophyllin, carotenoids) anthocyanins, glucosinolates, isoflavonoids, phytoestrogens, omega-3 and omega-6 fatty acids, antioxidants, phytosterols; dosage for effective control of disease or health benefit with adequate safety

Unit IV

Prebiotics and probiotics: usefulness of probiotics and prebiotics in gastrointestinal health and other benefits, beneficial microbes; prebiotic ingredients in foods; types of prebiotics and their effects on gut microbes, resistant starch, fructo-oligosaccharides as probiotic food components

Unit V

Definition, development of functional foods, isolation, storage, processing and stability of phytochemicals/bioactive compounds. Nutrigenomics: nutrigenomics an introduction and its relation to nutraceuticals.

References Books:

1. Brigelius-Flohé, J & Joost HG. (2006). Nutritional Genomics: Impact on Health and Disease. Wiley VCH.
2. Cupp J & Tracy TS. (2003). Dietary Supplements: Toxicology and Clinical Pharmacology.

Humana Press.
3. Gibson GR & William CM. (2000). Functional Foods - Concept to Products.
4. Goldberg I. (1994). Functional Foods: Designer Foods, Pharma Foods.
5. Losso JN. (2007). Angi-angiogenic Functional and Medicinal Foods. CRC Press
6. Neeser JR & German BJ. (2004). Bioprocesses and Biotechnology for Nutraceuticals. Chapman & Hall.
7. Robert EC. (2006). Handbook of Nutraceuticals and Functional Foods. 2nd Ed. Wildman.
8. Shi J. (2006). Functional Food Ingredients and Nutraceuticals: Processing Technologies. CRC Press.
9. Webb GP. (2006). Dietary Supplements and Functional Foods. Blackwell Publ.

L051005T: Bakery, Confectionary and Convenience Food Technology

Course Objectives

1. To acquaint students with the principles of bakery and confectionery
2. To familiarize students with processing techniques, quality parameters, and nutritional comparisons of baked products

Course Learning Outcomes

1. The student will gain an understanding of processing techniques utilized in the bakery and confectionery industry
2. The student will comprehend the role of convenience food technology as an important aspect of commercial food

Syllabus

Unit I.

Principles of Baking, Raw Material and their Role – flour, leavening agents, sugars, fats, additives, spice.

Unit II.

Types of Bakery Products and Technology for their Manufacture – dough and batters; cakes, pies, pastries, bread, biscuits, Icings and Fillings Quality Parameters of Bakery Products - chemistry of dough and batters;

Unit III.

Rheological testing and interpretation of data; sensory evaluation, Staling and Nutrient Losses in Bakery Products, Sanitation and Hygiene in a Bakery Unit, Equipment used in the Bakery Industry

Unit IV.

Principles of Confectionery Manufacture, Raw Material, and their Role – interfering agents, inversion of sugars, etc. Types of Confectionery Products and Technology for their Manufacture, Quality Parameters of Confectionery Products, Nutrient and other Losses in Confectionery Products, Sanitation and Hygiene in a Confectionery Unit, Equipment used in the Confectionery Industry, Manufacture of Indian Confectioneries

Unit V.

Convenience Food Technology- importance, nutritional value and quality parameter of convenience food. Raw material, types, and manufacture of sugars, chocolates, chewing gum and lozenges. Pan Coating: hard and soft panning, problems in coating, glazing, polishing, and tableting

References Books

1. Dubey SC. 2002. Basic Baking. The Society of Indian Bakers, New Delhi.
2. Francis FJ. 2000. Wiley Encyclopedia of Food Science & Technology. John Wiley & Sons.
3. Manley D. 2000. Technology of Biscuits, Crackers & Cookies. Second Edition. CRC Press.
4. Pyler EJ. Bakery Science & Technology. Third Edition. Vols. I, II. Sosland Publ.
5. Qarooni J. 1996. Flat Bread Technology. Chapman & Hall.

L051006T: Food Process Engineering

Course Objectives

To understand the concept of rheological and thermal properties of foods on measuring the various engineering properties of food products.

Course Learning Based Outcomes

1. To study the various engineering properties of food materials under different condition
2. To study about the different methods of determining the quality and properties of different foods

UNIT I

Process time calculations; Sterilizers and accessories used in canning industries; Engineering aspects of pasteurizer; homogenizer, evaporators (basic principle and single-effect evaporator) and concentrators used in food industries; Seaming machine.

UNIT II

Construction of cold storage; Different types of freezers including plate contact freezer, air blast freezer, cryogenic freezing and refrigerated vans.

UNIT III

Various types of driers (basic principle and drying time) – Tray drier, roller drier, spray drier, fluidized bed drier, freeze drier and solar drier.

UNIT IV

Heat exchangers (including paraflow HEs); Extruders – Basic principles and types, Difference between single- and twin-screw extruders; Kneader; Oil expeller.

Thermal Properties of Foods: Definitions - specific heat, enthalpy, conductivity and diffusivity, surface heat transfer coefficient. Measurement of thermal properties like specific heat, thermal conductivity and thermal diffusivity

UNIT V:

Aerodynamic property-definition-drag coefficient, terminal velocity - application in handling and separation of food materials. Frictional property-coefficient of friction, angle of repose, angle of internal friction, application in food handling and storage

Reference Book

1. The Fundamentals of Food Engineering; Charm SE; 1963, AVI Pub.

2. Bakery Technology & Engineering; Matz SA; 1960, AVI Pub.

3. Dictionary of Food Science & Technology, Blackwell Publishing

4. Engineering Properties of Foods; Rao MA & Rizvi SSH; 1986, Marcel Dekker Inc. 5. Fundamentals of Food Process Engineering; Toledo RT; 2nd ed, 2000, CBS Publishers. 6. Food process engineering, D. R. Heldman and R. P. Singh

L051007T: 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, psychrometric etc. from food industrial point of view
3- Students can apply these principles for solving numerical and problems
4- Understand other technologies like extrusion, fortification with applications

UNIT I

Size reduction process: Principles, theories and laws, energy considerations, equipment's. Mixing and forming. theory and applications. mixing indices. equipment's 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, equipment's. 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

L051008P: PRACTICAL

Course Objective: -

To develop an understanding about the fermentation and properties of fermented products. To manufacturing of different fruits and vegetables, bakery and meat products and their quality analysis.

Course Learning Outcomes: -

Upon successful completion of the course, the student:

5. They will acquire the knowledge about handling different instruments used in food
6. Students will get knowledge of different types of fruits and vegetables, bakery, and meat products
7. They will be able to estimate quality analysis of different foods
8. They will be able to understand fermentation and properties of fermented products

Practical List: -

1. Manufacturing of fermented beverage
2. Quality analysis of fermented beverages
3. Manufacturing of jam, jelly and squash
4. Manufacturing of fruit candy
5. Drying of fruits and vegetables and their powder production
6. Determination of different adulteration test.
7. Pectin determination in fruits and vegetables
8. Determination of chemical preservatives in fruits and vegetable products
9. Quality analysis of bakery flour
10. Quality analysis of egg
11. Determination of chemical composition of different foods.
12. Manufacturing of different preserves
13. Blanching test of fruits and vegetables
14. Determination of lycopene
15. Determination of phytochemicals

*****Number of practicals may vary, it will depend on the availability of food materials, Instruments, chemicals etc.

*Demo practical classes given by virtually/video/practically

References

6. Plummer, D.T. (2001) An Introduction to Practical Biochemistry, 3rd edn., McGraw Hill Ltd. New Delhi
7. Sawhey, S.K. and Singh, R. (2002) Introductory Practical Biochemistry, Narosa Publication House, New Delhi
8. Jayramann, J. (2008) Laboratory Manual in Biochemistry, New Age International, New Delhi.
9. Ranganna S 1986. Handbook of analysis and quality control for fruit and vegetable products. Tata McGraw Hill Pub Col. Ltd., New Delhi, India, pp 1112.
10. AOAC (1990). 15th Official methods of Analysis. Association Official Analysis Chemists, Washington D. C. USA.

L051009R: Project/Training (Research Project/Dissertation/Industrial Training/Survey)

Course Objectives:

This course objective is to impart competent skills to thrive in research institutions and industries.

Course Outcomes:

Upon successful completion students should be able to:

1: In-plant Training is intended to expose the students to an environment in which they are expected to be associated in their future careers.

2: The students will gain hands-on experience in one or more commercial establishments.

1. List the objectives and state the hypothesis of the research project.

2. Outline the methodology that will be followed to achieve the listed objectives.

3. Employ the finalized methodology to solve the problem which has been undertaken.

4. Analyze the data which has been generated by carrying out several experiments.

5. Evaluate the data – accuracy and precision, sources of errors, specificity, sensitivity and detection limits, regression analysis, reporting results.

6. Organize the inferences to prove the hypothesis.

Note:

1. Project/training work will involve experimental work.
2. Students are required to do an individual research project/Industrial training.
3. Students are required to submit a report for assessment and need to demonstrate the working of research/training findings.
4. Students will be asked their choice for Project/Industrial work at the end of II semester and all formalities of topic (if they choose project) and mentor selection will be completed by this time.
5. The IPR rights of all such work lie with the University only