JAYOTI VIDYAPEETH WOMEN'S UNIVERSITY, JAIPUR

Faculty of Agriculture and Veterinary Science

Department of Food and Biotechnology

SYLLABUS

MASTER OF TECHNOLOGY IN FOOD TECHNOLOGY

(M. TECH. FT)

SESSION – 2022-23

DURATION – 2YEARS

PROGRAM DETAIL

Name of Program	-	Master of Technology (M. Tech.)
Program Code	-	M. Tech. FT
Mode of Program	-	Semester
Duration of Program	-	2yrs/ 4Semester
Total Credits of Program	-	88
Curriculum Type and Medium Choice	-	English

Program Outcomes

M.Tech. FT is a course which will suffice the needs of the food industry with the knowledge of Food technology. Food technology is a science subject, which applied to various processes related to food to produce food products which are quality assured. The course is so formulated to assess the risks and management and the potential of food industry.

Specific Program Outcomes

Postgraduates will be able to decide and apply appropriate tools and techniques in making better Food & Nutrient supplements. Postgraduates will be able to demonstrate knowledge of project and finance management when dealing with Food technology Engineering problems.

SYLLABUS DETAIL

I SEMESTER

S. No.	Credit	Name of Course
1	3	Statistical Methods
2	1	Statistical Methods Lab
3	4	Advances in Food Engineering
4	3	Advances in Food Analysis
5	1	Advances in Food Analysis Lab
6	3	Food Safety & Quality Assurance
7	1	Food Safety & Quality Assurance Lab
8	5	Advances in Post Harvest Technology of Fruits , Vegetables and Plantation Crops
9	1	Advances in Post Harvest Technology of Fruits & Vegetables Lab
Total	21	

II SEMESTER

S. No.	Credit	Name of Course
1	4	Advanced Food Process Technology
2	3	Advances in Cereal Science & Technology
3	1	Advances in Cereal Science & Technology Lab
4	3	Food Additives and Contaminants
5	1	Food Additives and Contaminants Lab
6	3	Technology of Frozen Foods
7	1	Technology of Frozen Foods Lab
8	3	Novel Food Packaging
9	1	Novel Food Packaging Lab
10	1	Industrial Visit
Total	21	

III SEMESTER

S. No.	Credit	Name of Course
1	3	Advanced Milk And Milk Products Technology
2	1	Advanced Milk And Milk Products Technology Lab
3	4	Nutraceuticals And Functional Foods
4	3	Food Rheology And Texture
5	1	Food Rheology And Texture Lab
6	4	Advanced Meat, Fish, Poultry And Egg Technology
7	4	Research Methodology
8	2	Pre Dissertation Training (60 Days) (After II Sem during summer vacation)
Total	22	

IV SEMESTER

S. No.	Credit	Name of Course
1	25	Dissertation/ Project-New Product Development (NPD)
Total	25	

SYLLABUS DETAIL

FIRST SEMESTER

Course Name: Statistical Methods

Total- 4 (3T+1P)

Courses Outcome- The objective of this course is to (1) Describe the basic concepts and principles of statistics. (2) Understand the role of statistics and computer applications to conduct research studies. (3) Apply statistical techniques to research data for analyzing. (4) Interpreting the data meaningfully and differentiate between the qualitative and quantitative methods of analysis of data. (5) Suitably apply data reduction strategies and illustrate data using various graphical methods. (6) Use appropriate parametric and non-parametric statistical tests. (7) Draw the conclusions and interpretations from the analysis of data using various statistical softwares.

UNIT I (Basics of Tabulation of Data & Central Tendency)

Theory (1 Credits)

Classification and tabulation of data, Frequency distribution, Histogram, Frequency polygon and frequency curve, cumulative frequency curves, Measures of central tendency: mean, median, mode; Measures of dispersion: range, mean deviation, variance and standard deviation.

Practicals: (1 credits)

Sr. no.	Name of practical	Nature
1	To find out Mean	Practical/Practice
2	To find out Median	Practical/Practice
3	To find out Mode	Practical/Practice

UNIT II (Probability, Correlation, Regression & Sampling)

Theory (1.0 Credits)

Elementary Probability Distribution, Correlation: Positive and negative correlation and calculation of Karl Pearson's coefficient of correlation. Regression, Sampling: concept of population and sample, Sampling distribution and standard error.

UNIT III (Vital Statistics & ANOVA)

Theory (1.0 Credits)

Hypotheses testing: null and alternative hypothesis, T-test, Chi-square test, goodness of fit test and homogeneity of samples, F-test. ANOVA: one way and two way analysis of variance, Design of experiments. Use of statistical packages for data analysis (SPSS).

Text Books:

1. Elements of Mathematical Statistics; S.C. Gupta and V.K. Kapur; Sultan Chand & Sons, New Delhi **2. 2.** Elements of Biostatistics; S. Prasad; Rastogi Publications, Meerut

Suggested Readings:

1. Basic Statistics:-B.L.Agarwal
2. Principles and Procedure of Statistics:-A Biometrical Approach:-R.G.D. Steel and J.H.torrie

3. Fundamentals of Applied Statistics, S.C. Gupta and V.K. Kapur; Sultan Chand & Sons, New Delhi.

References/Correlation with Ancient Indian Literature:

1. Sankhyā: The Indian Journal of Statistics Published by: Indian Statistical Institutehttps://www.springer.com/statistics/journal/13171
2. The Sulba Sutrashttp://www-history.mcs.st-and.ac.uk/Projects/Pearce/Chapters/Ch4_2.html
3. History of Hindu Mathematics, Asia Publishing House, Bombay, 1962https://link.springer.com/article/10.1007/BF02836134

ADVANCES IN FOOD ENGINEERING

Courses Outcome- The objective of this course is to (1) To acquaint with fundamentals of food engineering and its process (2) Understand engineering properties of foods, their significance in equipment design.

UNIT-I ((2-0) (Overview of Food engineering)

Engineering properties of foods, their significance in equipment design. Constraints and need of innovation. Challenges for food engineering. Tools and concepts in process design microbial survivor curves, general method for process calculation. Sterilization of continuous flowing fluid. Fluid flow handling systems for Newtonian liquids, force balance on a fluid element flowing in a pipe, derivation of Bernoulli equation. Measurement of viscosity, capillary tube viscometer. Flow characteristics of non-Newtonian fluids. Properties of non-Newtonian fluids. Velocity profile of a power law. Pumps-characteristics, types and selection.

UNIT-II (1 -0) (Thermal Properties of Foods)

Thermal properties of foods. Steady state and unsteady state heat transfer: Conduction in multilayered systems. Estimation of convective heat-transfer coefficient. Forced and free convection. Estimation of overall heat-transfer coefficient. NTU method for designing heat changers. Design of a plate heat exchanger, Design of a tubular heat exchanger.

UNIT-III (1-0) (Frozen Properties of Foods)

Pressure-sure-enthalpy charts. Frozen-food properties. Freezing point curves, phase diagrams, methods of freeze concentration, design problems. Freezing o foods, freeze concentration and drying , freezing time: plank's equation and Pham's method, theory of ultra-filtration and reverse osmosis, selection and types of membranes and properties, Properties of steam. Steam traps Methods of estimating steam consumption.

Recommended text books:

1.Rao, M. A., Rizvi, S. S. H. and Datta A.K. (2005). *Engineering Properties of Foods*: CRC Press.
2. Heldman, D. R. (2007). *Food Process Engineering*:AVI Publications.

Reference Books

1. Toledo, R. T. (1997). *Fundamentals of Food Process Engineering* (2 ed.): CBS Publications, New Delhi.
2 Rizvi, S. S. H. and Mittal, G. S. (1992). *Experimental Methods in Food Engineering*: Van Nostrand Reinhold.
3. Chanes J.W., Gustavo (2002) Engineering and Food for the 21st Century CRC Press.
4. Theodoros V.C., Food Engineering Handbook (2011) CRC Press

ADVANCES IN FOOD ANALYSIS

4(3T+1P)

Courses Outcome- The objective of this course is to (1) Develop an understanding and methodologies of instrumental techniques in food analysis. (2) Understand the mechanisms and principle behind various analytical techniques.

UNIT-I (Overview of Spectroscopy & Chromatography)
(Theory 1)

Spectroscopy: UV-Visible spectroscopy, Atomic absorption spectroscopy, Flame photometry, Fluorescence spectroscopy, Emission spectroscopy, Mass-spectroscopy, Fourier Transform Infra-Red.

Methods of separation and analysis of biochemical compounds and macromolecules:Principles and applications of Gas Chromatography, High Performance Liquid Chromatography, Thin layer chromatography.

(Practicals 0.5)

S.No.	Practicals
1	Determination of titratable acidity in foods using a potentiometric titration
2	Diastatic activity of honey, determination of hydroxymethylfurfural in honey
3	UV-Visible Spectro-photometric analysis of a carotenoid

UNIT-II (Overview of instrumentation)
(Theory 1)

Microscopic techniques: Light microscopy, Scanning electron microscopy, Transmission electron microscopy, particle size analysis, Thermal techniques in food analysis: Differential scanning calorimetry and Thermo gravimetric analysis.

(Practicals 0.25)

S.No.	Practicals
1	thin layer chromatography (TLC) of food colors,
2	Microstructural and partical size analysis of starch
=3	Determination of thermal properties of food samples

UNIT-III (1-0.5) (Molecular Analysis)

(Theory 1)

Electrophoresis: Different kinds of electrophoresis, western blotting, gel documentation, DNA analysis: DNA purification, PCR-based analysis, DNA fingerprinting.

(Practicals 0.25)

S.No.	Practicals
1	Extraction of different types of proteins and identification using electrophoresis
2	DNA Extraction of Plant Tissue

Recommended text books:

1. Pare, J. R. J. and Bélanger, J. M. R. (2015). *Instrumental Methods of Food Analysis*: Elsevier

2. Pomeranz, Y. and Meloan, C. E. (1996). *Food Analysis: Theory and Practice* (3 ed.): CBS Publications, New Delhi

Reference Books

1. Winton, A. L. (2001). *Techniques of Food Analysis:* Agrobios, Jodhpur.

2. Sharma, B. K. (1994). *Instrumental Methods of Chemical Analysis*: Krishna, Meerut.

3. Skoog, D. A., Holler, F. J. and Nieman, T. A. (1998). *Principles of Instrumental Analysis* (5 ed.): Harcourt, Singapore.

4. Gopalan, R., Subramanian, P. S. and Rangarajan, K. (2008). *Elements of Analytical Chemistry*: Sultan Chand & Sons

FOOD SAFETY AND QUALITY ASSURANCE

4(3T+1P)

Courses Outcome- The objective of this course is to (1) Understand various areas of Food Safety & Quality Assurance. (2) Grasp knowledge of the quality assessments of food products.

UNIT-I (Food Quality Management)

(Theory 1)

Sampling, specification, labeling,safety and quality assessment of fruits and vegetable, cereals, dairy products, meat, fish, poultry and processed food products, Sensory evaluation: Introduction, panel screening, selection methods, interaction and thresholds

Developments, objective and functions of food safety and quality assurance, Quality enhancement models, Statistical Quality Control for food industry, Food Quality Management Systems, implementation of quality control programmes, Quality control tools, Quality control charts for food plant sanitation, Food Safety Management Systems, Causes of failure of Food Safety Programs

(Practical 0.5)

S.No.	Practicals
1	Measurement of the water activity (aw) of raw and cooked food using Awmeter
2	Assessing the texture of raw and cooked food using penetrometer
3	Extraction of pigments from various fruits and vegetables and influence of heating time and pH
4	Performance of the sensitivity tests for four basic tests (Sweet, salty, sour and bitter)
5	Identification and ranking of food product attributes using Sensory evaluation scales (Hedonic rating, Ranking difference, Triangle test)

UNIT-II (Indian Food Law & Regulations)

(Theory 1)

Indian food laws and regulations, Food safety acts, Regulations for waste disposals, Codex alimentarious, ISO series, World Trade Organization, Food and Agricultural Organization, World Health Organization, Food safety and legislation in USA and Europe, Technical Barriers in Trade, Enforcers of food laws approval process for food additives, additives food labeling, Intellectual Property Right, HACCP and its application.

(Practical 0.25)

S.No.	Practicals
1	Sensory evaluation of milk and detection of flavor defects in milk
2	Qualitative tests for fats and oils, spices and condiments
3	Determination of thermal properties of food samples

UNIT-III (Food Adulteration)

(Theory 1)

Food adulteration: Types of adulterants, Common adulterants for foods like milk and milk products, honey, wheat flours, edible oils, cereals, condiments (whole and ground) pulses, coffee, tea, confectionery, baking powder, non-alcoholic beverages, vinegar, besan and curry powder

(Practical 0.25)

S.No.	Practicals
1	Detection of adulteration in food products viz. honey, other sweetening agents, spices (whole and powder)
2	Detection of adulteration in food products viz. pulses, oils, cereals, sweets, tea, coffee

Recommended text books:

1. Lawless, H. T. and Heymann, H. (2013). *Sensory Evaluation of Food: Principles and Practices*: Springer, New Delhi.

2. Shapton, D. A. and Shapton, N. F. (1993). *Principles and Practice for the Safe Processing of Foods*: Heinemann, Oxford.

Reference Books

1. Schmidt, R. H. and Rodrick, G. E. (2003). *Food Safety Handbook*: John Wiley, New Jersey.

2. Rees, N. and Watson, D. (2000). *International Standards for Food Safety*: Aspen, America.

3. Anjaneyulu, Y. and Marayya, R. (2009). *Quality Assurance and Quality Management in Pharmaceutical Industry*: Pharma, Hyderbad.

4. Ho, S. K. M. (1999). *Operations and Quality Management*: ITP, London.

ADVANCES IN POST-HARVEST TECHNOLOGY OF FRUITS, VEGETABLES AND PLANTATION CROPS

5(4T+1P)

Courses Outcome-The objective of this course is to (1) Gain knowledge on different pre-processing operations involved before processing of fruits and vegetables. (2) Develop an understanding on various post-harvest disorders and diseases of fruits, minimising the losses by suitable packaging and minimal processing operations.

UNIT-I (Production & Assessment of Fruit Quality)

(Theory 1)

Fruit and vegetable production, classification, structure and composition; Importance and scope of post-harvest management of fruits and vegetables in Indian economy, Pre-harvest factors affecting post-harvest quality, post-harvest losses,Maturity indices and standards for selected fruits and vegetables, instrumental methods of maturity determination, standards and specifications for fresh fruits and vegetable, Assessment of Fruit Quality, advances in non-destructive quality measurement of fruits and vegetables.

(Practical 0.5)

S.No.	Practicals
1	Studies on morphological features of some selected fruits and vegetables, maturity indices and quality evaluation of fresh fruits
2	Effects of pre-cooling and types of storage on quality of fruits and vegetables
3	studies on use of chemicals for ripening and Studies of regulations of ripening of banana, mango, papaya

UNIT-II (Advanced Harvesting & Post Harvesting Operations)

(Theory 1)

Advanced harvesting tools and their design aspects, advances in Post-Harvest Handling operations; Cleaning, washing of fruits and vegetables, types of cleaners, screens, types of screens, rotary screens, vibrating screens, machinery for cleaning of fruits and vegetables (air cleaners, washers), cleaning efficiency, care and maintenance; Sorting and grading: Sorting, grading, methods of grading,Size grading, color grading, specific gravity grading, screening, equipment for grading of fruits and vegetables, grading efficiency, care and maintenance, Separation: Magnetic separator, de stoners, electrostatic separators, pneumatic separators.

(Practical 0.25)

S.No.	Practicals
1	Effects of pre-processing treatments on shelf-life of fruit, edible coating, preparation of fruit juice concentrate powders and their quality evaluation
2	estimation of browning and various pigments in pulp and products
3	estimation of chemical additives in processed fruit products

UNIT-III (Effects of Post Harvesting on Fruits & Vegetables)
(Theory 1)
Post-harvest physiological and biochemical changes in fruits and vegetables; ripening of climacteric and non-climacteric fruits; changes duringripening; Role of ethylene in fruit ripening, ripening chambers, Field heat of fruits and vegetables and primary processing operations Post harvest treatments, advances in pre-cooling, equipment Commodity pretreatments-chemicals, types of coating, pre-packaging, irradiation, blanching, peeling and other pre-processing operations; transportation and storage operations, Mechanism and Advances in CA and MA, hypobaric storage, cold storage design, Zero energy cool chamber
Post-harvest disorders chilling injury and diseases,Biological, Physical and Chemical Control of postharvest Diseases, advances in drying and packaging of fruits and vegetables, cushioning materials used in packaging of fresh fruits, Minimal processing.
(Practical 0.25)

S.No.	Practicals
1	dehydration of fruits and measurements of dehydration and rehydration ratio
2	Studies on minimal processing of fruits.

UNIT IV (Post Harvest Technology of Ornamental Crops):
(Theory 1)
Processing and properties of major and minor spices, essential oils & oleoresins, adulteration. Processing of Tea, Coffee and Cocoa, Variety and Products.
(Practical 0.25)

S.No.	Practicals
1	Adulteration Determination in Spices
2	Adulteration Determination in Tea and Coffee

Recommended text books:

1. Haard, N.F. and Salunkhe, D.K. (1975). *Postharvest Biology and Handling of Fruits and Vegetable:* AVI, Westport.

2. Kader, A. A. (1992). *Post-harvest Technology of Horticultural Crops,* (2ed.): University of California, Division of Agriculture and National Resources, California.

Reference Books

3. Salunkhe, D.K. and Kadam, S.S. (2005). *Handbook of Fruit Science and technology, Production, Composition, Storage, and Processing*: Marcel Dekker, USA.

4. Thompson, A.K. 1995. *Post-Harvest Technology of Fruits and Vegetables*: Blackwell publication.

5. Wills-Ron B.H. and Golding,J.B. (2015). *Advances in Postharvest Fruit and Vegetable Technology*: Taylor and Francis, CRC Press.

6. Siddiqui, M. W., (2015).*Post-Harvest Biology and Technology of Horticultural Crops: Principles and Practices for Quality Maintenance*:Apple Academic Press Inc.

SECONDSEMESTER

ADVANCED FOOD PROCESS TECHNOLOGY

Courses Outcome- The objective of this course is to (1) Develop an appreciation about need of different emerging techniques used in food processing and preservation. (2) Apply their knowledge on high pressure processing, pulsed electric processing, irradiation and hurdle technology in various food industries.

UNIT-I (Membrane Technology & Supercritical Fluid Extration) (2-0)

Membrane Technology**:** Introduction to pressure activated membrane processes, RO/UF/NF applications and technology, Food Irradiation:radiation sources, absorbed dose, regulations, advantage and limitations of food irradiation - nutritional and microbiological changes in irradiated foods.

Supercritical Fluid Extraction: Property of near critical fluids (NCF), solubility and efficiency of NCF extraction, equipment and experimental techniques used in NCF extraction and industrial application, Microwave Energy in Foods: working principle of magnetron, microwave blanching, sterilization and finish drying, Ohmic and Ultrasound Processing of Foods:Principle of ultrasound – fundamentals – ultrasound as a processing and preservation method–Effect on properties of foods, Properties and generation of ultrasonic, ultrasonic imaging, application of ultrasonic as an analytical tool and processing techniques, Basics of ohmic heating,electrical conductivity- generic configurations- treatment of products.

UNIT-II (Processing of Foods) (1-0)

High Pressure Processing of Foods: Principles and concept – applications to food systems effect on quality, textural, Nutritional and microbiological quality – factors affecting the quality, applications in food processing, Pulsed Electric field Processing of Food(PEF): Principles Mechanism of action-PEF treatment systems,main processing parameters – PEF Technology – equipments – mechanism of microbial and enzyme inactivation- safety aspects– processing of liquid foods using PEF –process models – comparison of high pressure processing and PEF –Enzymatic inactivation by PEF, examples – microbiological and chemical safety of PEF foods, Oscillating magnetic field.

UNIT-III (Advanced Techniques in Food Processing) (1-0)

Hurdle Technology: Concept, chemical and biochemical hurdles- organic acids–plant derived antimicrobials, Antimicrobial enzymes, bacteriocin, applications of hurdle technology, Advanced Techniques in Food Processing: Application of technologies of high intensity light,Nanotechnology: Principles and mechanism Radio-frequency heating and drying applications; Hybrid drying technologies-combined microwave vacuum drying, combining microwave vacuum drying with other processes.

Recommended text books:

1. Sun, Da-Wen (2005). *Emerging Technologies for Food Processing*:Academic Press.

Reference Books

2. Barbosa- Canovas, G. V., Tapia, M. S. and Cano, M. P. (2004). *Novel Food ProcessingTechnologies*:CRC Press.

3. Leistner L. and Gould G. (2002). *Hurdle Technologies –Combination Treatments for Food Stability, Safety and Quality*: Kluwer Academics /Plenum Publishers, New York

ADVANCES IN CEREAL SCIENCE AND TECHNOLOGY

Courses Outcome- The objective of this course is to (1) Comprehend the recent advancement in the major cereal grains quality and processing aspects. (2) Grasp the basic and advanced milling methods for wheat, rice, maize.

UNIT-I (Status & Future of Cereal Grains in India)
Theory (1)
Present status and future prospects of cereal grains in India, food grain production and consumption trends. Coarse grain processing.Wheat kernel structure, wheat grading, roller flour milling, influence of wheat type and grain quality on flour yield, grain hardness and its relevance to end product quality, advances in wheat cleaning, conditioning and milling, wheat flour component interactions (protein-starch, protein-lipid and starch-lipid) and their influence on end product quality, advances in isolation, biochemical characterization, micro-structural and functionality of wheat gluten proteins.
(Practical 0.5)

S.No.	Practicals
1	Grading of wheat varieties, milling quality of hard and soft wheat varieties
2	effect of conditioning on the flour extraction rates
3	effect of grains parameters on the flour yield and quality
4	quality assessment of wheat gluten

UNIT-II (Advances in role of wheat proteins) Theory (1)
Advances in role of wheat proteins in dough and gluten visco-elasticity, micro-structure of dough, conversion of dough foam structure to bread sponge structure during bread baking, concept of gas retentionin wheat dough during fermentation and baking, advances in bread making processes, effect of wheat components and ingredients on the growth of yeast during fermentation operation, bread staling and its prevention, production of variety biscuits, breads and pasta products.
(Practical 0.25)

S.No.	Practicals
1	damaged starch and bread flour quality
2	effect of damaged starch of flour on biscuit quality
3	factors affecting water absorption of wheat flour
4	effect of ingredients and processing parameters of yeast growth

UNIT-III (Paddy, Rice & Barely varieties, their composition) Theory (1)
Paddy varieties, their composition and quality characteristics, advances in methods of paddy parboiling, advantages and limitation of parboiling, paddy dehusking processes, Rice ageing, accelerated ageing, modern rice milling, factors affecting head rice yields and losses at different stages of milling, rice mill machinery, Rice based products and their quality. Methods of rice bran oil extraction and refining.
Dry and wet milling of maize, modern methods of maize processing, gluten and starch separation, maize starch conversion into value added products, acid hydrolysis, enzyme hydrolysis, processing for dextrose, malto-dextrin and other products, Barley varieties, composition and quality characteristics, malting process and industrial applications of barley malt and malt products.
(Practical 0.25)

S.No.	Practicals

1	assessment of dough rheology using doughLab and mixolab, bread, biscuits, noodles making potential of different wheat flours
2	quality assessment of bakery products

Recommended text books:

1. Kulp K. & Ponte J. G. (2014).*Handbook of Cereal Science & Technology,2nd edition*: CRC press.

Reference Books

2. Wrigley C.W. &Batey I. L. (2010).*Cereal grains, assessing and managing quality,* CRC press.
3. Dendy D. A. V. &Dobsasoczyk B. J. (2001).*Cereal and Cereal Products, Chemistry and Technology*: An ASPEN publication.
4. Owens G. (2000).*Cereal Processing Technology*: CRC Press.
5. Faridi H. &Faubin J. M. (1997).*Dough Rheology & Baked product Texture*: CBS Publishers.

FOOD ADDITIVES AND CONTAMINANTS

4(3T+1P)

Courses Outcome- The objective of this course is to (1) Understand the role of food additives in manufacturing of food products. (2) Have the knowledge regarding permissible additives and their limits in the processed food.

UNIT-I (Properties & Functions of Additives)

(Theory 1)

Additives in food processing and preservation: Classification, need, properties, functions and safety, quality evaluation of additives, Food labeling, Laws and regulations for food additives

Chemistry, uses and functions: Chemical preservative, bio-preservatives, fortification, antioxidants, emulsifiers, humectants, stabilizers, chelating agents, pH control agents and acidulants, texturizing agents, plasticizers, flavor enhancers, enzymes, coloring agents, sweeteners, flavoring agents

UNIT-II (Food contaminants)

(Theory 1)

Food contaminants: biological, chemical, physical and environmental contaminants, Inorganic and organometallic food contaminants, Sources and their impact on human health

(Practical 0.5)

S.No.	Practicals
1	Detection of non-permitted food additives in market food samples, sweets, ice-creams and beverages products
2	estimation of antioxidants
3	Estimation of residual sulphur dioxide in beverages
4	Estimation of benzoic acid in tomato sauce and fruit beverage

UNIT-III (Food contaminants from industrial wastes)

(Theory 1)

Food contaminants from industrial wastes: Heavy metals, polychlorinated polyphenyls, dioxins, Toxicants formed during food processing polycyclic aromatic hydrocarbons, nitrosamines, veterinary drug residues and melamine contaminations, Pesticide residues in food

(Practical 0.5)

S.No.	Practicals
1	Analysis of edible common salt for moisture content and total chlorides
2	Identification of natural colors, Isolation and estimation of

	synthetic food colors
3	Estimation of contaminants, chemical residues and aflatoxins, pesticides and heavy metals contaminants in foods
4	Estimation of pesticide residues in food/water

Recommended text books:

1. Branen, A. L., Davidson, P. M. and Salminen, S. (2002). *Food Additives*: Marcel Dekker, New York.

Reference Books

2. Wood, R., Foster, L., Damant, A. and Pauline, K. (2004). *Analytical Methods for Food Additives*: Boca Raton, New York.
3. Watson, D. H. (2014). *Food Chemical Safety*: Additives: WP, New Delhi.
4. Steinhart, E., Doyle, M. E. and Cochrane, B. A. (1995). *Food Microbiology and Toxicology*: Marcel Dekker, New York.

TECHNOLOGY OF FROZEN FOODS

4(3T+1P)

Courses Outcome-The objective of this course is to (1) Gain knowledge on quality and safety of different frozen foods. (2) Acquire knowledge on different properties and microbiology of frozen foods.

UNIT-I (Freezing of Foods)
(Theory 1)
Food freezing :importance and potentialities, nutritive values of frozen foods, Microbiology of frozen foods , Freezing methods and equipment, sharp freezers the Quick freezing systems –Freezing cabinets and walk in freezers, Frozen food locker plants, Glass transitions in frozen foods and biomaterials, Thermo-physical properties of frozen foods, Freezing loads and Freezing time calculation, Innovations in freezing process.
(Practical 0.5)

S.No.	Practicals	Credit
1	Determination of effective freezing time, cooling and half cooling time	0.4
2	Quality evaluation of frozen foods, mechanism and driving force for freezer burn, adequacy of thawing	0.2
3	Standardization of procedure for preparation of frozen peas and corn	0.2
4	Frozen food packaging and shelf –life evaluation	0.2

UNIT-II (Overview of Cold Chain)
(Theory 1)
Cold Chain: Cold store design and maintenance, Packaging and machineries, Transportation, Retail display equipments and management, Household refrigerators and freezers, Monitoring and control of the cold chain, Cold storage and thawing of foods – Adaptability of vegetables to freezing, preparation and freezing of meat, poultry and fish, freezing of Dairy products, precooked frozen foods, storage of frozen food.
(Practical 0.5)

S.No.	Practicals	Credit
1	Tests of adequacy of blanching of raw material before freezing	0.2
2	Mineral impurities in frozen vegetables	0.1

3	Color grading of fresh and frozen fruit juices	0.1
4	Packaging of frozen food	0.1

UNIT-III (Quality & Safety of Frozen Foods)
(Theory 1)
Quality and Safety of Frozen Foods: Importance of quality control and standards in the frozen food industries, Quality and safety of frozen meat and meat products, frozen fish, Shellfish, and related products, frozen vegetables, frozen fruits, frozen dairy products, frozen ready meals, frozen bakery products, frozen eggs and egg products, Sensory analysis of frozen foods, Monitoring and Measuring Techniques for Quality and Safety, Chemical Measurements, Food borne illnesses and detection of pathogenic microorganisms, Shelf-life prediction of frozen foods.
Packaging of Frozen Foods**:**Introduction to frozen food packaging, Plastic packaging of frozen foods, Paper and card packaging of frozen foods, Packaging of frozen foods with other materials, Packaging machinery.

Recommended text books:

1. Sun, Da-Wen (2012). *Handbook of Frozen Food Processing and Packaging*: Taylor & Francis, United State of America.

Reference Books

2. Kennedy, C. J. (2000). *Managing Frozen Foods*: CRC Press, New York.
3. Potter, S. (2006). *Food Science*: Sage, New Delhi.

NOVEL FOOD PACKAGING
4(3T+1P)
Courses Outcome- The objective of this course is to (1) Grasp advance knowledge on the properties and production of various packaging materials and effect of various indicators used in supply chain management to indicate the food quality 2. Understand various types of scavengers and emitters for improving the food shelf life.
UNIT-I (Active and intelligent packaging techniques)
(Theory 1)
Active and intelligent packaging techniques, oxygen, ethylene and other scavengers: Oxygen scavenging technology, selection of right type of oxygen scavengers, ethylene scavenging technology, carbon dioxide and other scavengers, antimicrobial food packaging, antimicrobial packaging system, effectiveness of antimicrobial packaging.
Advantages of non-migratory bioactive polymers, Inherently bioactive synthetic polymers: types and application, Polymers with immobilized bioactive compounds, definingand classifying time temperature indicators (TTIs), requirements for TTIs, development of TTIs, maximizing the effectiveness of TTIs to monitor shelf-life during distribution, use of freshness indicator in packaging: Compounds indicating the quality of packaged food products, pathogen indicators, moisture regulation: Silica gel, clay, molecular sieve, humectants, irreversible adsorption.
UNIT-II (Modified atmosphere packaging)
(Theory 1)
Developments in modified atmosphere packaging (MAP): Novel MAP applications for fresh-prepared produce, novel MAP gases, testing novel MAP applications, Applying high O_2 MAP. Combining MAP with other preservation techniques, packaging-flavour interactions: Factors affecting flavour absorption, role of the food matrix, role of differing packaging materials.
(Practical 0.5)

S.No.	Practicals
1	Testing of properties of different packaging materials (paper, plastic, glass and metal)
2	Study of symbols and labels used on food packages
3	Vacuum packaging, form-fill- seal packaging

4	Determination of changes in packaged foods

UNIT-III (Modern packaging systems)
(Theory 1)
Modern packaging systems: Green plastics for food packaging, problem of plastic packaging waste, range of biopolymers, developing novel biodegradable materials, Integrating intelligent packaging**:** role of packaging in the supply chain, creating integrated packaging, storage and distribution: alarm systems and time temperature indicators, traceability: radio frequency identification, recycling packaging materials: recyclability of packaging plastics, improving the recyclability of plastics packaging, Testing the safety and quality of recycled material, using recycled plastics in packaging, methods for testing consumer responses to new packaging concepts.
(Practical 0.5)

S.No.	Practicals
1	Packaging of foods under different conditions
2	Preparation and application of edible coatings
3	Comparative evaluation of different packages for fragile foods
4	Estimation of shelf life of food under different packaging materials

Recommended text books:

1. Jung, H. H. (2014). *Innovations in Food Packaging*: Oxford, London.

Reference Books

2. Ahvenainen. R. (2003). *Novel Food Packaging Techniques*:CRC Publications.
3. Robertson, G. L. (2010). *Food Packaging and Shelf Life*: CRC Publications, New York.
4. Robertson, G. L. (2006). *Food Packaging: Principles and Practice* (2 ed.): CRC Publications, Boca Raton.

THIRDSEMESTER

Course Name: Advanced milk and milk products technology
TOTAL=4(3T+1P)
Courses Outcome- The objective of this course is to (1) Understand the processes related to storage, processing and distribution of milk and milk Products. 2. Perceive the different properties of milk and milk products.

UNIT-I (Technology of Market Milk & fat rich dairy products) (1- 0)
Theory (1.0 credits)
Technology of Market Milk:Dairy Industry in India: present status and scope; Milk: definition, composition and nutritive value; grading of milk; factors affecting composition of milk; physico-chemical properties of milk; FSSAI standards and legislations for market milk. Liquid milk processing: filtration/clarification; bactofugation; standardization; homogenization; pasteurization (LTLT, HTST); sterilization; UHT processing; aseptic packaging; storage and distribution. Technology of special milks: Technology of sterilized/ flavored milk, acidophilus milk, bulgarian milk, kumis, kefir; reconstituted & recombined milk, toned, double toned milk. Technology of fat rich dairy products: Cream: definition and legal standards, consumer cream products, standardization & production of cream, processing of cream (neutralization & pasteurization), butter: definition, butter-making process, overrun, yield, theories of churning, quality of butter, fat losses in cream & butter, defects in cream & butter. Ice-cream: definition, classification and composition of ice-cream, technological aspects of ice cream preparation, packaging, hardening, storage and shipping of ice cream.
UNIT-II (Technology of condensed and dried milk, yoghurt and cheese) (1-0.5)
Theory (1.0 credits)
Technology of condensed and dried milk: Definition and legal standards for evaporated and condensed milks, methods of manufacture and physico-chemical properties of evaporated and condensed milk, concept of heat

stability & its control, defects in condensed and evaporated milks, Quality of raw milk for dried milks, definition and legal standards for dried milks, milk drying system (film, roller, drum, spray, foam spray drying), method of manufacture of dried milks (WMP & SMP), defects in dried milk,Technology of yoghurt and cheese: Yoghurt - Definition and technology of yoghurt manufacturing, technology of different varieties of cheese manufacturing (cheddar &mozarella), changes during ripening of cheese, yield of cheese; manufacture of processed cheese, defects in cheese, accelerated ripening of cheese.

Practical: (0.5 credit)

S. No.	Practical
1	Determination of SNF (Solids Not Fat), specific gravity, total solids of milk.
2	Determination of moisture & fat content of milk powder
3	Study of familiarization with various parts and working of cream separator

UNIT-III (Technology of indigenous dairy products) (1-0.5)

Theory (1.0 credits)

Technology of indigenous dairy products: Introduction to traditional dairy products, khoa, channa, paneer, dahi, shrikhand, ghee, khoa and channa based sweets, miscellaneous traditional dairy foods, Dairy industry by-products and sanitation: By-products: introduction, definition, composition, Importance and food applications,whey protein concentrates&isolates,Dairy plant sanitation: hygiene in dairy industry, different types of cleansing/sanitizing agents and their applications, cleaning systems in dairy industry.

Practical: (0.5 credit)

S. No.	Practical
1	Preparation of ice cream
2	Determination of fat by garber method
3	Detection of adulterants in milk like water, urea, neutralizers, preservatives sucrose storch

Recommended text Books*:*

1. Winton, A. L. and Winton, K. B. (2000). *Milk and Milk Products*: Agrobios, India.
2. Kutty, C. I. and Khamer, S. (2004). *Milk Production and Processing*: Daya, Delhi.

Reference books:

1. Fox, P. F. and McSweeney, P. L. H. (1998). *Dairy Chemistry and Biochemistry*: Kluwer Academic, New York.

Course Name: Nutraceuticals and Functional Foods

Courses Outcome- The objective of this course is to (1) Acquire knowledge on various bio molecules showing health benefits. (2) Identify various aspects about safety, quality and toxicology of food products including, nutraceutical and functional foods.

UNIT-I (Basics of Nutraceuticals and functional foods) (2-0)

Theory (2.0 credits)

Nutraceuticals and functional foods: definition, types and scope, need, food applications and their health benefits, Nutraceutical compounds and their classification, Nutraceuticals for specific situations such as cancer, heart disease, stress, osteoarthritis, hypertension etc.

Photochemical and their usefulness: Antioxidants and Flavonoids, Omega-3 Fatty Acids, Carotenoids, Dietary fibres, Phytoestrogens,Glucosinolates,Organosulphur Compounds etc. their effectiveness in specific disease conditions; other functional ingredients in foods such as peptides, fatty acids, Cereal products as functional foods – oats, wheat bran, rice bran etc, Functional vegetable products, oil seeds, sea foods and sea weeds, antimicrobial compounds, Coffee, tea and other beverages as functional foods/drinks and their protective effect, Effects of processing, storage and interactions of various environmental factors on the potentials of such foods, health benefits.

UNIT-II (Phyto-chemicals and development of functional foods) (1-0)

Theory (1.0 credits)

Extraction of Phyto-chemicals and development of functional foods: Extraction methods for maximum recovery, Stability studies, Developing functional foods, Use of bioactive compound in appropriate form with protective

substances and activators, Effect of environmental conditions in food matrix on activity of bioactive compound, Effects of processing conditions and storage, Development of biomarkersto indicate efficacy of functional ingredients, delivery of immune-modulators/vaccines in functional foods.

UNIT-III (Prebiotics and Probiotics) (1-0)

Theory (1.0 credits)

Prebiotics and Probiotics: Usefulness of Probiotics & Prebiotics in gastrointestinal health and other benefits, Examples of useful microbes and their benefits, Prebiotic ingredients in foods, types of prebiotics and their effects on gut microbes, Probiotic foods and their functional role, Marketing and regulatory issues for functional foods and nutraceuticals.

Recommended* text Books*:

Recommended* text Books*:

1. Mine, Y and Fereidoon, S. (2006). *Nutraceutical Proteins and Peptides in Health and Disease*: TF, Bocaraton.
2. Bagchi, D. (2008). *Nutraceutical and Functional Food Regulations in United States and Around the World*: Elsevier, London.

Reference books

1. Shi, J. (2007). *Functional Food Ingredients and Nutraceuticals*:Processing Technologies: CRC Press, London.
2. Guo, M. (2009). *Functional Food*: Principles and Technology: WP, New Delhi.

Course Name: Food Rheology and Texture

Courses Outcome- The objective of this course is to (1) Understanding various rheological and textural properties of solid and liquid foods. (2) Grasp knowledge regarding various instruments used in determination of food rheology.

UNIT-I (Food rheology) (1-0)

Theory (1.0 credits)

Food rheology concept, scope of food rheology, texture of foods – type of stress, types of strain, types of viscosity, modulus (young, shear, bulk), poisson's ratio, definition and importance of texture, texture-related concepts. Determination of rheological properties and measuring methods: destructive and non-destructive measurements, creep recovery and stress relaxation, dynamic mechanical tests, Modeling food texture: introduction, factor affecting texture, models to predict texture.

UNIT-II (Rheological properties of fluid food) (1-0.5)

Theory (1.0 credits)

Rheological properties of fluid food: viscosity, factors affecting viscosity, flow of material- Newton's law of viscosity, viscous fluids (Newtonian fluids, non-Newtonian fluids), plastic fluids (Bingham plastic, non-Bingham plastic fluids), fluid behavior in steady- shear flow: time dependent and time independent material function, viscosity measurement- capillary flow viscometers, orifice type viscometers, falling ball viscometers, rotational viscometers- concentric cylinder (coaxial rotational) viscometers, cone and plate viscometers, parallel plate viscometers, single-spindle viscometers (brookfield viscometer).

Practical: (0.5)

S. No.	Practical
1	Determination of viscosity of liquid foods, guminess, chewiness, springiness
2	Determination of hardness of various fruits, vegetables and processed foods using texture profile analysis.

UNIT-III (Rheological properties of solid food) (1-0.5)

Theory (1.0 credits)

Rheological properties of solid food: deformation of material, viscoelastic behavior, Failure and glass transition in solid foods: failure in solid foods, glass transition of solids foods (measurement, factors affecting, importance), Texture of foods: compression, snapping-bending, cutting shear, puncture, penetration, texture profile analysis, dough testing instruments- farinograph and mixograph, extensograph and alveograph, amylograph.

Practical: (0.5)

S. No.	Practical
1	Determination of force-distance relationship.
2	Sensory evaluation/ subjective measurement and correlation between subjective and objective measurements of foods.

Recommendedtext Books*:*

1. Rao, M. A., Rizvi, S. S. H. and Datta A. K. 2005. *Engineering Properties of Foods*: CRC Press.
2. Heldman, D. R. (2007). *Food Process Engineering*:AVI Publications.

Reference books:

1. Faridi, H. and Faubion, J. M. (1997). *Dough Rheology and Baked Products*: CBS Publications, New Delhi.

2. Rao, M. A. (2007). *Rheology of Fluid and Semisolid Foods: Principles and Applications* (2 ed.): Springer, USA.

Course Name: Advanced Meat, Fish, Poultry and Egg Technology

Courses Outcome- The objective of this course is to (1) Understand the technology for raw material characteristics, handling, processing, and preservation. (2) Grasp by-product utilization of meat, poultry, fish and egg products**.**

UNIT-I (Introduction about Meat Technology) (1.5-0)

Theory (1.5 credits)

Production, Processing and consumption trends, Prospects of meat industry, Meat spoilage, Endogenous and exogenous infections, Hygiene and sanitation, Meat composition from different sources, Post-mortem muscle chemistry and composition, Intramuscular fat, Rigor mortis, The conversion of muscle into meat: Animals' stunning methods, ante-mortem and post-mortem examination, Design of handling facilities: Slaughtering and dressing, Consequences of circulatory failure, Proteolytic and other chemical changes, Operational factors affecting meat quality, Effects of processing on meat tenderization, Chilling, freezing and preservation, prepared meat products, intermediate moisture and dried meat products, The eating quality of meat: color, flavors and retention, water holding capacity, juiciness, texture and taste, meat eating and health, Inedible by-products

UNIT-II (Quality characteristics of poultry products) (1.5-0)

Theory (1.5.0 credits)

Quality characteristics of poultry products, Lay-out and design of poultry processing plants, Plant sanitation, Poultry meat processing operations and equipment for de-feathering, bleeding, scalding etc., Poultry meat products, Refrigerated storage of poultry meat, by-products

Egg structure, structural abnormalities, functions of egg in food system, egg products, whole egg powder, egg yolk products, by-products, their packaging and storage, eating quality of eggs, Inspection and grading, preservation and safe handling

UNIT-III (Commercially important marine products) (1-0)

Theory (1.0 credits)

Commercially important marine products from India, Product export and its sustenance, Processing operations, Basic biochemistry, Preservation of postharvest fish freshness, Transportation in refrigerated vehicles, Deodorization of transport systems, Design of refrigerated and insulated trucks, Grading and preservation of shell fish, pickling and preparation of fish protein concentrate, fish oil and other by-products

Recommendedtext Books*:*

1. Lawrie, R. A. (1998). *Lawrie's Meat Science* (6 ed.): Woodhead Publications, Cambridge.
2. Alan, H. V. and Jane, P. S. (1995). *Meat and Meat Products: Technology, Chemistry and Microbiology*: Champan& Hill, London.

Reference books:

1. Carmen, R. O. and George, J. M. (1997). *Poultry Meat and Egg Production*: CBS Publications, New Delhi.
2. Winton, A. L. and Barberwinton, K. (1999). *Fish and Fish Products*: Agrobios, Bikaner.
3. Winton, A. L. and Winton, K. B. (1993). *The Structure and Composition of Animal Product*: Agro Botanical, Bikaner.

Course Name: Research Methodology

Courses Outcome-The objective of this course is to (1) Understand the methods and role of scientific approach to research. (2) Understand the various experimental designs, methods of sampling their analysis and data collection.

UNIT – I (Introduction & Types of research) (1.5-0)

Theory (1.5 Credits)

Research methodology: Introduction & meaning of research, Objectives of research, motivation in research. Types of research & research approaches. Research methods vs. methodology, Criteria for good research.

Research problem: Statement of research problem, Statement of purpose and objectives of research problem, Necessity of defining the problem.

UNIT – II (Research design) (1.5-0)

Theory (1.5 Credits)

Research design: Meaning of research design, Need for research design, Features for good design, Different research designs, Basic principles of research design.

Measurement & scaling techniques: Measurement in research- Measurement scales, sources of error in measurement, Technique of developing measurement tools, Meaning of scaling, its classification, important scaling techniques.

UNIT – III (Methods of data collection) (1-0)

Theory (1 Credits)

Methods of data collection: collection of primary data, collection data through questionnaires& schedules, Difference between questionnaires & schedules.

Report Writing

Recommended Text Books:

1. Kothari CR (2004). Research Methodology: Methods and Techniques, New Age International.
2. Bhattacharya DK (2009). Research Methodology, Excel Books.

Reference Text

1. Annals of Food Science & Technology
2. Journal of Nutrition
3. Journal of Food Science & Technology