

Course Code	Course Name	Credits			Total
		L	T	P	
FT23108CR	Food Analysis and Quality Control	4	0	0	4
FT23109CR	Fruit and Vegetable Technology	4	0	0	4
FT23110CR	Technology of Meat, Poultry & Fish Products	4	0	0	4
FT23111CR	Skill development in Fruits and Vegetables	0	0	2	2
FT23112DCE	Skill development in Meat Technology	0	0	2	2
FT23113DCE	Plantation Crops & Spices	2	0	0	2
FT23114DCE	Statistics and Computer Applications	2	0	0	2
FT23115DCE	Recent Developments in Food Science and Technology	2	0	0	2
FT23003GE	Encapsulation Technology in Food Systems	2	0	0	2
FT23004OE	Functional Foods for Human Health	2	0	0	2

FT23108CR

Semester II

Food Analysis and Quality Assurance (4+0+0)

Unit I

- Principle and interferences of Flame photometry.
- Atomic absorption spectroscopy – Principle, working, instrumentation and applications. ICP.
- X-ray analysis of foods– Properties, production & detection, x- ray tubes, detectors, sources, application in food industry.
- Mass spectroscopy– Instrumentation and interpretation.

Unit II

- Chromatography– Principles of different chromatographic separations. Instrumentation and working of HPLC & GC.
- Nuclear magnetic resonance (NMR) – Principle, Components, Interpretation of NMR spectra, application of NMR.
- Immunoassays and Nucleic acid-based techniques: ELISA & PCR.
- Tri stimulus color system & hunter color lab CDM

Unit III

- Objectives, importance and functions of quality control.
- Methods of quality assessment-Subjective & objective methods.
- Statistical quality control-X & R charts, steps for developing control charts.
- National & international Food laws– Food Safety and Standards Act 2006, Codex Alimentarius Commission, grades and standards. Labeling of foods.

Unit IV

- General hygiene and sanitation in food industry– GMP, HACCP, QMS
- Sensory evaluation and panel screening
- Sensory evaluation methods/training– Difference tests (Paired comparison, Duo Trio, Triangle), Rating (ranking, single sample, two-sample, multiple samples, hedonic), sensitivity threshold test.

- **Quality evaluation of foods** – Fruits, vegetables, cereals, dairy products, meat, poultry, egg and processed food products.

References:

1. Principles of Sensory Evaluation of Foods by M.A. Amerine, R. M. Rangborn and E.B. Roessler 2013, Elsevier.
2. Quality Control in Food Industry 1st Edition - January 1, 1968, Hershoerfer
3. Fundamentals of Quality Control for the Food Industry by [Amihud Kramer](#), [Bernard A. Twigg](#), 1962
4. Food Quality Evaluation by [Eram S. Rao](#), Variety Book Publishers' Distributors, 2013
5. Pomeranz, Y. and Meloan, C.E. (2000) Food Analysis: Theory and Practice. 3rd Edition, AN Aspen Publication, Silver Spring.
6. Nielsen, S. Suzanne, ed. Food analysis laboratory manual. New York, NY, USA:: Kluwer Academic/Plenum Publishers, 2003.
7. Paré, J. R. J., and J. M. R. Bélanger, eds. *Instrumental methods in food analysis*. Elsevier, 1997.

FT23109CR

Fruit and vegetable Technology (4+0+0)

UNIT-I

- Fruit maturity and ripening indices. Postharvest changes in fruits and vegetables.
- Post harvest losses in fruit and vegetable
- Non-destructive techniques for assessing the nutritional quality of Fruits and Vegetables.
- Ethylene biosynthesis, mode of action, ethylene management.
- Handling of fresh fruits and vegetables.

UNIT-II

- Cold chain management.
- Storage: Definition & functions. Types of storage: low cost and high cost storage systems
- Controlled atmospheric storage: structural design of storage room and gas control systems.
- Monitoring Volatiles during storage of fruits and vegetables.
- Physiology and biochemistry of fresh cut fruits.
- Coating of fresh horticulture produce

UNIT-III

- Principles and methods of preservation of fruits and vegetables.
- Preparation and preservation of Jam, Jellies, Marmalades. theories of gel formation.
- Fruit & vegetable alcoholic and non alcoholic beverages: Preparation & preservation of juice, cordial, Squash, crush, nectar, RTS.
- Canning: Principle and Process.

UNIT-IV

- Preserve, candied and crystallized fruits and vegetables.
- Tomato Processing- Juice, ketchup, puree, paste.
- Browning reactions and discoloration during processing.

- Enzymes used in fruit and vegetable industry.

Reference:

1. Postharvest Technology of Fruits and Vegetables, Harvesting, Handling and Storage, 2nd Edition by A.K. Thompson, 2003
2. Postharvest Technology of Fruits & Vegetables by Verma & Joshi 2000. Indus publications, New Delhi
3. Yahia, Elhadi M., and Armando Carrillo-Lopez, eds. Postharvest physiology and biochemistry of fruits and vegetables. Woodhead publishing, 2018.
4. An introduction to Postharvest Technology by RBH Wills. 2003
5. Preservation of fruits & Vegetables by Siddappa et al 1999. ICAR, New Delhi
6. Preservation of Fruits & Vegetables by Srivastava & Kumar, 1996. Intl. Book publishing Co. Lucknow
7. Handbook of Vegetables and Vegetable Processing by Y. H. Hui 2011. Wiley Blackwell
8. Handbook of Fruits and Fruit Processing by Y. H. Hui 2006. Wiley Blackwell

FT23110CR

Technology of Meat, Fish & Poultry (4+0+0)

UNIT-I

- Scope of meat industry with special reference to J&K
- Sources, composition and nutritive value of meat.
- Ante-mortem handling and inspection of meat animals.
- Slaughtering and processing equipment: Plant location and facilities; stunning methods; sticking/bleeding; dressing methods; offal inspection and processing.
- Structure and functions of muscle: Microstructure, contraction and relaxation mechanism, muscle metabolism.

UNIT-II

- Postmortem changes in muscle: Biochemical alterations, physical alterations-rigor mortis; shortening; unusual patterns of postmortem metabolism. Factors affecting post mortem changes in meat.
- Eating quality of meat: Colour, WHC, flavour, tenderness and texture. Meat quality evaluation.
- Meat tenderization and aging.
- Mechanical deboning
- Principles of various preservation techniques: Refrigeration, freezing, curing, smoking, canning, dehydration and irradiation of meat.
- Traditional meat products

UNIT-III

- Poultry slaughtering, carcass evaluation and cutting.
- By product utilization of poultry.
- Structure composition, nutritive value and functional properties of egg.

- Factors affecting egg quality
- Methods of preservation.

UNIT-IV

- Composition and structure of fish.
- Post mortem changes in fish
- Preservation of fish by freezing, glazing, canning, smoking, freezing, irradiation and dehydration.
- Surimi- Chemistry, preparation and microbiology.
- Technology of production of fish products- fish sausage, fish meal and fish oil.

References:

1. Lawre. R. A. & Ledward, D. A. (2006). Lawres Meat Science 7th Ed. Woodhead Publishing Company, Cambridge, England.
2. Thornton's meat hygiene by J. F. Gracey. Bailliere Tindall, 7th edn,1982
3. Aberle, Elton D., Forrest, John C., Gerrard, David E., Mills, Edward W.. Principles of Meat Science. United States: Kendall Hunt Publishing Company, 2020.
4. Lawrie, R. A.. Meat Science. United Kingdom: Elsevier Science, 2013..
5. Pearson, A.M., Gillett, T.A.. Processed Meats. Netherlands: Springer, 1996..
6. Hall, G. M.. Fish Processing Technology. United Kingdom: Springer US, 2012.
7. Fish Processing Technology by GopalkumarK,New Delhi [Indian Council of Agricultural Research](#) 2006.

FT23111CR

Skill development in Fruits and Vegetables (Practical) (0+0+2)

1. Quality evaluation of fruits and vegetables (color, TSS, acidity, texture etc)
2. Canning of fruits & vegetables.
3. Testing of can, cut out analysis.
4. Preparation and analysis of syrups and Brines.
5. Experimental dehydration of fruits and vegetables (Dehydration and rehydration ratio) using solar drier, vacuum assisted microwave drier, cabinet drier.
6. Preparation and preservation of juices.
7. Preparation and preservation of squashes and RTS.
8. Preparation and preservation of Jam, Jellies and marmalades.
9. Preparation and preservation of pickle and vinegar.
10. Preparation of tomato ketchup and sauce.

References:

1. Ranganna, S.. Hand Book of Analysis And Quality Control For Fruit And Vegetable Products. India: Tata McGraw-Hill Publishing Company Limited, 2005.
2. Preservation of fruits & Vegetables by Siddappa etal 1999. ICAR, New Delhi.
3. Manual of AOAC, 1990.

FT23112DCE

Skill development in Meat technology (Practical) (0+0+2)

1. To study slaughtering and dressing of meat animals.
2. Study of post-mortem changes.
3. Meat cutting and handling.
4. Preparation of various meat products such as: Meat pickle & cured meat
5. Preparation and evaluation of traditional meat products.
6. Slaughtering of poultry.
7. Determination of meat to bone ratio in Chicken.
8. To evaluate freshness of fish.
9. To determine meat to bone ratio of fish.
10. Dressing of fish and calculation of dressing percentage.
11. Preparation of fish products such as fish cutlets, pickle, curry, tandoori fish.
12. Experiments in dehydration, freezing, canning, smoking and pickling of fish and meat.
13. Preservation of eggs.

References:

1. Lawre. R. A. & Ledward, D. A. (2006). Lawres Meat Science 7th Ed. Woodhead Publishing Company, Cambridge, England.
2. Aberle, Elton D., Forrest, John C., Gerrard, David E., Mills, Edward W.. Principles of Meat Science. United States: Kendall Hunt Publishing Company, 2020
3. Lawrie, R. A.. Meat Science. United Kingdom: Elsevier Science, 2013
4. Pearson, A.M., Gillett, T.A.. Processed Meats. Netherlands: Springer, 1996..

FT23113DCE

PLANTATION CROPS & SPICES (2+0+0)

UNIT –I

- **Plantation Crops:** Definition and role of plantation crops in national economy and export potential.
- **Tea:** Composition and processing of tea. Tea products such as tea concentrate, decaffeinated tea and flavoured tea. *Kashmiri kehwa*.
- **Coffee:** Chemical composition, processing, roasting and brewing of coffee. Coffee products such as decaffeinated coffee and instant coffee.
- **Cocoa:** Chemical composition, processing of cocoa and cocoa beverages.

UNIT II

- **Spices:** Definition, classification and functions.
- Quality specifications for spices.
- **Major & minor spices of India:** Chemical composition, processing, uses and special attributes of different spices like saffron, chillies, cumin, coriander, turmeric, fennel, fenugreek, pepper, cinnamon, cloves, ginger, mint and cardamom.
- **Extractives of spices:** oleoresins and essential oils. Simple seasoning blends.

References

- Chakraverty, A.; Mujumdar, A. S.; Raghavan, G. S. V.; Ramaswamy, H., 2003. Handbook of postharvest technology: cereals, fruits, vegetables, teas, and spices. Marcel Dekker Inc. New-York/Basel
- Purselove, J. W. *et al* (1998). Spices ‘Vol. I and II. Logman publishers.
- Peter, K. V. (2004). Handbook of Herbs and Spices Vol. I and II. Woodhead Publishing Limited, Cambridge, England.
- Raghavan, S. (2007). Handbook of Spices, Seasonings and Flavourings. CRC Press (Taylor and Francis Group).

- Voilley, A. & Etivant, P. (2003). Flavour in Food. Woodhead Publishing Limited, Cambridge, England.
- Ho, C-T., Lin, J-K., & Shahidi, F. (2009). Tea and Tea products. CRC Press (Taylor and Francis Group).

FT23114DCE

Statistics and Computer Applications (2+0+0)

Unit I

- Sampling: Steps and techniques, size of sample. Sampling and non- sampling errors.
- Measures of dispersion: Quartile deviation, Mean Deviation, Standard deviation,
- Correlation and regression
- Testing of hypothesis: Chi- square, t-test and F- test
- Analysis of variance: Concept and assumptions, Computation of one way and two way analysis of Variance

Unit – II

- Introduction to statistical software
- R software
- SPSS and Mini-tab
- MS Excel

References

1. Gupta, S. C.. Fundamentals of Statistics. India: HIMALAYA Publishing House, 2013.
2. Mann, Prem S., Lacke, Christopher Jay. Introductory Statistics. United Kingdom: Wiley, 2010.
3. Gupta, S. P.. Statistical Methods. India: Sultan Chand & Sons, 2011.
4. Hays, William Lee. Statistics. United Kingdom: Harcourt Brace College Publishers, 1994.

FT23115DCE

Recent Developments in Food Science and Technology (2+0+0)

Unit I

- Micro and nano encapsulation techniques for retention and controlled release of bioactive compounds like Microfluidization, electrospinning, Spray drying, extrusion, Coacervation, freeze drying, wet milling and emulsification.
- Nanotechnology applications in food processing and packaging.
- Concept of nano sensors.
- Artificial intelligence in food science.

Unit II

- Alternate proteins for Meat, dairy and egg.
- Production and processing of cultured meat.
- 3D food printing and personalized nutrition.
- Food sustainability

References

1. Handbook of Food Preservation, Second Edition. India: Taylor & Francis, 2007.
2. Alternative Proteins: Safety and Food Security Considerations. United States: CRC Press, 2022.

FT23003GE

Encapsulation Technology in Food Systems (2+0+0)

UNIT 1

- Requirements for encapsulation systems
- Wall materials used for microencapsulation of bioactive compounds, flavors and probiotics
- Micro and nano encapsulation techniques of bioactive compounds, flavors and probiotics like Liposomes, Microfluidization, electrospinning, Spray drying, extrusion, Coacervation, freeze drying, wet milling and emulsification.
- Release kinetics of bioactive compounds

UNIT II

- An industry perspective on the advantages and disadvantages of different bioactive delivery systems
- An industry perspective on the advantages and disadvantages of different flavor delivery systems
- [Properties and applications of different probiotic delivery systems](#)

References

1. Garti, N., McClements, D.J., 2012. *Encapsulation Technologies and Delivery Systems for Food Ingredients and Nutraceuticals*. Elsevier Science.
2. Handbook of Food Preservation, Second Edition. India: Taylor & Francis, 2007

FT23004OE

Functional Foods for Human Health (2+0+0)

Unit – I

- Phytochemicals and Antioxidants – Introduction
- Free radicals and oxidative stress
- Biosynthesis of common phytochemicals-Shikmic acid and mavalonic acid pathway
- Chemistry, sources and health benefits - Flavonoids, Carotenoids, Ascorbic acid, Lycopene, Capsaicinoids

Unit – II

- Garlic-composition and its therapeutic effects.
- Tea and its health benefits.
- Soybean as a functional food.
- Health benefits of olives

References

1. Goldberg, I.. Functional Foods: Designer Foods, Pharmafoods, Nutraceuticals. United States: Springer US, 2012.
2. Handbook of Nutraceuticals and Functional Foods. United Kingdom: CRC Press, 2019.
3. Functional Foods: Biochemical and Processing Aspects by John Shi, G. Mazza, Marc Le Maguer, CRC Press,2006.
4. Lockwood, Brian. Nutraceuticals: A Guide for Healthcare Professionals. United Kingdom: Pharmaceutical Press, 2007.
5. Postharvest Physiology and Biochemistry of Fruits and Vegetables. United Kingdom: Elsevier Science, 2018.

M.Sc Food Technology
Choice Based Credit System

3rd Semester

Course Code	Course Name	Credits			Total
		L	T	P	
FT23116CR	Cereal, Pulses and Oil seed Technology	4	0	0	4
FT23117CR	Nutraceuticals and Toxicology	4	0	0	4
FT23118CR	Dairy Technology	4	0	0	4
FT23119CR	Skill development in Cereal and Cereal Products	0	0	2	2
FT23120DCE	Skill Development in Dairy Technology	0	0	2	2
FT23121DCE	Human Nutrition	2	0	0	2
FT23122DCE	Entrepreneurship & Project Development	2	0	0	2
FT23005GE	Food Safety	1	1	0	2
FT23006OE	Starch Chemistry & Technology	2	0	0	2

FT23116CR

Semester III

Cereal, Pulses and Oil seed Technology (4+0+0)

Unit I

- Structure, chemical composition and types of wheat grain and its relation to processing qualities, Enzymes of wheat and their technological significance.
- Wheat milling – principle, conditioning, and milling systems. Flour streams, extraction rates and their composition.
- Dough rheology and dough testing apparatus such as recording dough mixers, load extension meter.
- Bread making processes. Soft and hard wheat products: types, chemistry, and functionality of ingredients.

Unit II

- Rice grain structure and chemistry
- Milling of rice – types of rice mill. Factors affecting rice yield during milling. By-products of rice milling and their utilization. Cooking quality of rice.
- Parboiling rice – traditional method and their drawbacks. CFTRI process of parboiling. Properties of parboiled rice. Changes during parboiling. Advantages and disadvantages of parboiling.
- Rice convenience foods – precooked rice, canned rice, expanded rice, rice based infant food formulas, rice puddings and breads, rice cakes, rice noodles and fermented foods.

Unit III

- Corn: Composition and structure, wet and dry milling of corn, Corn products.
- Oats: Composition, structure, milling and nutritional significance of oats. Oat products
- Barley: Composition, structure and milling of barley. Malting of barley.
- Millets: Nutritional significance and processing potential of some common millets such as Foxtail, Proso, Kodo, & pearl millet.

Unit IV

- Types of oil seeds and their chemical composition.

- Oil extraction – Mechanical and solvent extraction and refining.
- Processing of oil seeds for protein concentrates and isolates.
- Margarine manufacturing processing and its uses.
- Structure and composition of pulses, their importance in Indian diet. Dhal milling and processing of pulses.

References:

1. Pomeranz, Y. (1998). *Wheat: Chemistry and Technology*, Vol. I 3rd Ed., American Association of Cereal Chemists, St. Paul, MN, USA.
2. Juliano, B. O. (1985). *Rice Chemistry and Technology*, American Association of Cereal Chemists, St. Paul, MN, USA.
3. Samuel, A.M. (1996). *The Chemistry and Technology of Cereal as Food and Feed*. CBS Publishers & Distribution, New Delhi.
4. Dandy, D. A. V & Dobraszczyk, B. J. (2001) *Cereal and Cereal Products: Chemistry and Technology*, Aspen Publishers.
5. Kent, N. L. & Evers, A. D. (1994) *Kent's Technology of cereals* 4th Ed. Elsevier science Ltd. Oxford, U. K.

FT23117CR

Nutraceuticals and Toxicology(4+0+0)

Unit – I

- Introduction - Definition, Classification of nutraceutical factors- Food and non food sources, mechanism of action, nutraceutical factors in specific foods and chemical nature.
- Dietary fibre – Types, Physical and physiological properties of dietary fiber Hypocholesterolemic, hypolipidemic and hypoglycemic effects. Role in prevention of CHD and cancer.
- Probiotics & Prebiotics – Specific and non specific physiological effects of probiotics. Different types of prebiotics and their chemical nature. Concept of synbiotics.
- Oxidative stress- Free radicals and Reactive Oxygen Species and types.
- Antioxidants – role and types.

Unit – II

- Fatty acid as functional food- Nomenclature of Mono and poly-unsaturated fatty acids.
- Eicosanoid metabolism of fatty acids and its implications in human health
- Omega 3 fatty acids- insulin resistance and Lipoprotein Metabolism
- Biosynthesis of common phytochemicals- Shikmic acid and mavalonic acid pathway.
- Bio synthesis of phenylpropanoids.

Unit – III

- Basic concepts of toxicology- dose response relationship - frequency response.
- Phases of Toxicological Effects- Exposure Phase, Toxicokinetic Phase, Toxicodynamic Phase
- Toxicity testing- Toxicological testing methods
- Manifestation of organ toxicity.
- Biotransformation reactions- Phase I and Phase II reactions

Unit -IV

- Animal Toxins: mode of action & clinical symptoms- Scombroid Poisoning, Saxitoxin, Pyropheophorbide-A, Tetrodotoxin, Ciguatoxin

- Toxicants and antinutrients in Plants foods.
- Toxins produced during processing.
- Pesticides and drug residues
- Heavy Metals – Mercury, Lead, Cadmium, Arsenic, selenium.

References

1. Goldberg, I.. Functional Foods: Designer Foods, Pharmafoods, Nutraceuticals. United States: Springer US, 2012.
2. Handbook of Nutraceuticals and Functional Foods. United Statesby Wildman: Taylor & Francis, 2016.
3. Functional Foods: Biochemical and Processing Aspects byJohn Shi, G. Mazza, Marc Le Maguer, CRC Press 2006.
4. Lockwood, Brian. Nutraceuticals: A Guide for Healthcare Professionals. United Kingdom: Pharmaceutical Press, 2007.
5. Postharvest Physiology and Biochemistry of Fruits and Vegetables.Postharvest Physiology and Biochemistry of Fruits and Vegetablesby Elhadi M. Yahia. United Kingdom: Elsevier Science, 2018.
6. Deshpande, S.S.. Handbook of Food Toxicology. United States: Taylor & Francis, 2002.
7. Maga.Food Additive Toxicology. Hong Kong: Taylor & Francis, 1995.
8. Food Toxicologyby Carl K.Winter. United States: CRC Press, 2000.
9. Omaye, Stanley T.. Food and Nutritional Toxicology. United States: CRC Press, 2004.

FT23118CR

Dairy Technology (4+0+0)

Unit – I

- Scope of dairy industry in India. Importance & sources of milk.
- Composition of milk, Factors affecting composition of milk.
- Structure and Chemistry of Milk-Milk fat, proteins, enzymes, lactose

Unit – II

- Storage, transportation and distribution of milk.
- Processing of market milk- standardization, toning of milk, homogenization. Pasteurization and sterilization.
- Milk products - Processing of cream, butter, butter oil, condensed milk, evaporated milk, whole and skimmed milk.
- Acidified milk products: Yogurt, Kefir, butter milk, sour milk.
- Effect of processing on milk components and nutritive value.

Unit – III

- Cheese: Classification and technology of cheese manufacturing. Packaging of cheese.
- Production of Ice creams & its quality control.
- Instantization of milk. Milk powder

Unit – IV

- Traditional dairy products of India: Paneer, Srikhand, Rabri, Kulfi, chhana, Lassi.
- Bioactive peptides derived from milk proteins.
- In plant cleaning system.
- Quality standards of milk and milk products.

References:

1. Technology of Dairy Products. Germanyby Early. R. : Springer, 1998.
2. De, Sukumar. Outlines of Dairy Technology. India: Oxford University Press, 1991.
3. Chemistry and Testing of Dairy Products by Athestem.

FT23119CR

Skill Development in Cereal and Cereal Products (Practical)(0+0+2)

1. Physico-chemical testing of wheat and rice.
2. Experimental milling of wheat and rice. Assessment of per cent of head rice, broken, immature kernels and degree of polish in rice.
3. Determination of quality characteristics of flours.
4. Experimental parboiling and evaluation of quality of parboiled rice.
5. Evaluation of cooking quality of rice.
6. Rheological properties of dough using Farinograph/ Extensograph/Mixograph.
7. Pasting properties of starches using Visco-amylograph/RVA.
8. Experimental baking of bread, cake and biscuit and their evaluation,
9. Experimental extrusion cooking and quality evaluation of extrudates.
10. Solvent extraction of oil seeds.
11. Quality evaluation of oils.
12. Visit to wheat and rice processing plants.
13. Determination of yeast activity
14. Preparation of protein isolates from legumes and evaluation of cooking quality of legumes.

References:

1. Cauvain, Stanley P., Young, Linda S.. Baked Products: Science, Technology and Practice. Germany: Wiley, 2008.
2. Bakery Technology & Engineering by Samueal A. Matz.
3. Manual of American Association of Cereal Chemists

FT23120DCE

Skill Development in Dairy Technology (Practical) (0+0+2)

- Quantitative estimation of milk constituents such as moisture, total solids, fat.
- Determination of acidity of milk.
- Determination of specific gravity of milk.
- Platform tests on given samples of milk.
- Determination of adulterants in milk, ghee, butter, ice cream etc.
- Detection of preservatives in milk.
- COB test.
- Visit to local milk processing plant.
- Preparation of common milk products
 - Flavoured milks.
 - Yoghurt.
 - Butter.
 - Ice-cream.

References:

1. De, Sukumar. Outlines of Dairy Technology. India: Oxford University Press, 1991
2. Chemistry and Testing of Dairy products by H.V. Atherton & J.A. Newlander
3. Spreer, Edgar. Milk and Dairy Product Technology. United Kingdom: CRC Press, 2017.
4. Dairy Chemistry by H.H. Sommer.

FT23121DCE

Human Nutrition (2+0+0)

Unit I

- Introduction to Human Nutrition: Food, Nutrition & Health.
- Nutrient requirements & recommendation
- Digestion & Absorption of Nutrients
- Methods of cooking.
- Enhancing nutritional quality of the Diet.
- Lifecycle nutrition
- Principles of meal planning
- Food-based dietary guidelines
- Nutrition for Adults, pregnancy, lactation, infancy, preschools, adolescents & elderly.

Unit II

- Clinical & therapeutic diets
- Diet in lifestyle disorders:- diabetes, CVD, Cancer.
- Diet in fever, burns & surgery
- Nutritional care in weights manager.
- Special Nutrition.
- Food borne diseases (Introduction).
- Exercise & Sports Nutrition.
- Nutrition & infection

References:

1. Davidson, Sirstanley, Passmore, R. J. F. Brock, A. S. Trustwell, (1975). Human Nutrition and Dietetics 6th Edition, The English language book society and Churchill Living stone.
2. Swaminathan, (1985). Advanced Text Book on Foods & Nutrition 2nd Edition, Bangalore Printing & Publishing Co. Ltd.
3. Mudambi Sumati R. & Rajagopal, M. V. (1995). Fundamentals of Food & Nutrition, 3rd Edition, New Age International (P) Limited, Publishers.
4. J. Mann, A. S. Trustwell, (2017). Essentials of Human Nutrition 5th Edition Oxford University Press.

FT23122DCE

Entrepreneurship and Project Development (2+0+0)

Unit I:

- Entrepreneurship–Concept and development. Characteristics and personal attributes of successful entrepreneurship.
- Entrepreneurial motivation. Functions and role of entrepreneurs. Problems faced by entrepreneurs and their remedies.
- Identification of project, generation and screening of project ideas. Classification of projects.
- Forms of ownership–Sole proprietorship, partnership, company and cooperative society.

UNIT II:

- Steps for starting a small business, procedure and formalities for registration. Incentives and subsidies . Market and demand analysis–Demand forecasting
- Technical, management and economical analysis of projects
- Estimation of project cost–Objectives, components and basic of estimates. Working capital requirement and its estimates
- Sources of Finance–Short term and long terms sources. Techniques of financial analysis–Cash flow Estimates, Break-even analysis, payback period, average rate of return, Net Present Value and Internal rate of Return.

FT23005GE

FOOD SAFETY (1+1+0)

Unit – I

- Definition of food safety and importance of safe food
- Hazards and types of hazards
- Physical and Chemical hazards- Sources harmful effects and management
- Naturally occurring toxicants in foods, Process induced food toxicants, Safety aspects of food additives
- Biological hazards, food borne illnesses
- Toxicants of fungal and bacterial origin
- Food adulteration, common food adulterants; Methods to detect food adulteration
- Food safety and Quality management system; HACCP

Unit – II (Tutorial)

- Food Safety and Standards Act 2006 and regulation 2011.
- Registration and Licensing
- Packaging and labeling
- Nutrition and Health Claims
- Zoonotic diseases. Eg Bird flu, Swine flu
- Genetically modified food- safety aspects

References:

1. Food Safety & standards Act 2006, Commercial law Publishers (India) Pvt. Ltd
2. Potter, Norman N., Hotchkiss, Joseph H.. Food Science: Fifth Edition. United States: Springer US, 2012.
3. Schmidt, Ronald H., Rodrick, Gary E.. Food Safety Handbook. Germany: Wiley, 2005.

FT23006OE

Starch Chemistry & Technology (2+0+0)

Unit I

- Starch: Introduction, sources, classification.
- Structure of starch: Granular structure and molecular structure.
- Physio-chemical properties of starch: Swelling, solubility index, gelatinization and retrogradation of starch.
- Use of starch in food, pharmaceutical and textile industries.

Unit II

- Production of starch: Production of starch from plant sources using
- Wet and Dry milling of starch.
- Resistant starch.
- Modification of starch: Physical, Chemical and Biological modification of starch.

References:

1. Pomeranz, Y. (1998). *Wheat: Chemistry and Technology*, Vol. I 3rd Ed., American Association of Cereal Chemists, St. Paul, MN, USA.
2. Juliano, B. O. (1985). *Rice Chemistry and Technology*, American Association of Cereal Chemists, St. Paul, MN, USA.
3. Samuel, A.M. (1996). *The Chemistry and Technology of Cereal as Food and Feed*. CBS Publishers & Distribution, New Delhi.
4. Dandy, D. A. V & Dobraszczyk, B. J. (2001) *Cereal and Cereal Products: Chemistry and Technology*, Aspen Publishers.
5. Kent, N. L. & Evers, A. D. (1994) *Kent's Technology of cereals* 4th Ed. Elsevier science Ltd. Oxford, U. K.

M.Sc Food Technology
Choice Based Credit System

4th Semester

Course Code	Course Name	Credits			Total
		L	T	P	
FT23123CR	Project Work	0	0	14	14
FT23124DCE	Credit Seminar	2	0	0	2
FT23125DCE	Industrial Visit	0	0	6	6
FT23007GE	Bakery Science	1	1	0	2
FT23008OE	Post Harvest Physiology of Fruits & Vegetables	2	0	0	2

Semester IV

FT23123CR

Project Work (0+0+14)

FT23124DCE

Credit Seminar (2+0+0)

FT23125DCE

Industrial visit (0+0+6)

FT23007GE

Bakery Science (1+1+0)

Unit I:

- Structure and morphology of grain; Classification of wheat
- Milling, aims and principle of milling, steps of milling, milling machinery
- Raw materials used in bakery and their role in the product: Flour, yeast, fat, sugar, baking powder, egg, salt etc.
- Dough rheology and its measurement
- Basics of bread making: Basic bread recipe, flour characteristics and improvement, steps in bread making process, Charley-wood bread making process.
- Manufacturing cookies, biscuits and cakes, icings and toppings

Unit II: (Tutorials)

- History of bakery and confectionary
- Wheat proteins- chemistry, properties and their role in baked products
- Enzymes used in baking industry
- Bread faults and their remedies
- Breads enriched with health promoting components- high fiber breads, omega-3-fatty acid enriched breads, composite breads.

References:

1. Wheat chemistry and technology, Volume-I by Y. Pomeranz.
2. Cereals and cereal products by D. A. V. Dendy and B. J. Dobraszczyk.
3. Cereal processing technology by G. Owens.
4. Baking science and technology: fundamentals and ingredients by E. J. Pyler and L. A. Gorton.
5. Bread Science: The Chemistry and Craft of Making Bread by Emily Buehler.

FT23008OE

Post Harvest Physiology of Fruits & Vegetables (2+0+0)

Unit I

- Cell and its structure with special reference to plant cell.
- Introduction to post harvest physiology of fruits and vegetables.
- Classification of fruits based on post harvest considerations.
- Fruit maturity and ripening; Maturity indices.
- Ethylene biosynthesis, regulation and mode of action. Factors affecting ethylene production.
- Water loss during fruit storage, factors affecting water loss, control of water loss.

Unit II

- Cell wall associated enzymes: polygalactouranase, Rhamnogalactouranase, pectin methyl esterase, Beta- galactosidase etc. Their role in textural change
- Polyphenol oxidases, lipoxygenase.
- Post harvest disorders in fruits and vegetables; mealiness, chilling injury etc.
- Role of minerals in post harvest storage life of fruits and vegetables with special reference to Ca, Mg, Zn, Mo & Co.
- Storage atmospheres - CA Storage, MA Storage, Hypobaric Storage.
- Management of post harvest processes and its importance to reduce post harvest losses: temperature management, atmospheric control and genetic control.

References:

1. Michael knee. *Fruit Quality and its Biological Basis*; (CRC press).
2. M. Black & J.D Bewely. *Seed Technology and its Biological Basis*. (CRC press).
3. L.N David, M.C Michael. *Leningers Principle of Biochemistry*. (FreeMan and company, New York).
4. P. Trevor, L.R.B Phillips. *Enzymes in Biochemistry and Biotechnology*. (Harwood 2007).
5. Bench ALR & Sanchez RA. 2004. *Handbook of Seed Physiology*. (Food Product Press).
6. Wills R.B.H, W.B. McGlasson, Graham.D, Lee T.H and Hall E.G; *An Introduction to the Physiology and Handling of Fruits and Vegetables*.(CBS publishers)

M.Sc Food Technology
Choice Based Credit System

1st Semester

Course Code	Course Name	Credits			Total
		L	T	P	
FT23101CR	Food Microbiology and Biotechnology	4	0	0	4
FT23102CR	Food Chemistry	4	0	0	4
FT23103CR	Food Processing Technology	4	0	0	4
FT23104CR	Food Packaging	3	0	1	4
FT23105DCE	Food Engineering	3	0	1	4
FT23106DCE	Experiments in Food Chemistry	0	0	2	2
FT23107DCE	Experiments in Microbiology	0	0	2	2
FT23001GE	Lipid Technology	2	0	0	2
FT23002OE	Elementary Food Processing	2	0	0	2

Semester I

FT23101CR

Food Microbiology and Biotechnology (4+0+0)

Unit I

- Brief history of Food Microbiology. Microbial Growth Curve.
- Factors affecting microbial growth: intrinsic and extrinsic factors.
- Types of microbes associated with foods & their characteristics: Bacteria, yeast, Fungi.
- Biochemical changes caused by microorganisms: Degradation of different food components.

Unit II

- Microorganisms associated with spoilage of milk, cereal, meat, fruit and vegetables & their products. Spoilage of canned products.
- Detection of Food spoilage using biosensors.
- Food borne diseases: Listeriosis, Salmonellosis, Shigellosis, Yersiniosis, Diseases caused by *Clostridium perfringens*, *Bacillus cereus*, *Escherichia coli*.
- Food intoxication: Staphylococcal intoxication, Botulism,
- Toxicants from molds: Aflatoxins, ochratoxins, patulin, Luteoskyrin, Pencillic acid.

Unit III

- Introduction to Genetic Engineering, Recombinant DNA Technology, Vectors, Ti Plasmid
- SCP: Sources, substrate requirement, Production,
- GM crops: Bt Corn, Bt Brinjal & Golden Rice.
- Antisense RNA & Gene silencing
- Genetic manipulation of industrially important yeast and Lactic Acid Bacteria.

Unit IV

- Fermentation- types of fermentation, Fermenters
- Waste utilization in industrial microbiology
- Biocolor: Technology of production, sources (Microbial & plant) and applications

- Bio-preservatives – types and applications
- Enzyme immobilization- methods and advantages. Industrial application of enzymes.

References:

1. Frazier, W.C. (2014). Food Microbiology. McGraw Hill Education (India) Private Ltd.
2. Jay, J. (2012). Modern Food Microbiology. Springer Science & Business Media.
3. George J. Banwart. (2012). Basic Food Microbiology. Springer Science & Business Media, 2012
4. Pommerville, J.C. Alcoms. (2021). Fundamentals of microbiology. Jones & Bartlett Learning
5. Stainier. (1979). Introduction to Microbiology. Prentice-Hall
6. Ray, B., & Bhunia, A. (2013). Fundamentals of Food microbiology. CRC Press, 2013
7. Pelczar, Smith & Chan. (2009). Microbiology. Tata McGraw-Hill Education
8. Joshi, V. K. and Sing., R.K. (2012). Food Biotechnology principles & Practices. I. K. International Publishing House Pvt. Ltd., New Delhi, Bangalore, India
9. Byong H. Lee. (2015). Fundamentals of Food Biotechnology. JohnWiley & Sons, Ltd
10. Buchanan, Jones, G. (2007). Biochemistry and molecular biology of plants. I.K. International Pvt. Ltd.
11. Adrian, S., Nigel W. S., Mark, R.F. (2008). Plant Biotechnology: The genetic manipulation of plants. Second Edition, Oxford University Press.

FT23102CR

Food Chemistry (4+0+0)

UNIT I

- Water- solute interactions.
- Carbohydrates- Classification, Structure and functional properties of mono, oligo & polysaccharides.
- Non- Enzymatic browning (NEB): Chemistry and factors affecting NEB.
- Polysaccharide solubility, viscosity and stability.
- Starch structure. Gelatinization and pasting properties.
- Industrially important polysaccharides like cellulose, pectic substances, Guar gum, locust bean gum, Xanthan gum, Carrageenans, & beta- glucan.

UNIT II

- Amino acid- Classification, structure and properties.
- Proteins: Classification, structure and forces involved in stability of protein structure.
- Protein denaturation, thermodynamics of denaturation and denaturing agents.
- Functional properties including hydration, solubility and interfacial properties.
- Nutritional properties of proteins: protein quality, digestibility, evaluation of protein nutritive value.

UNIT III

- Lipids: Classification, and nomenclature of saturated and unsaturated fatty acids.
- Physical properties of triacylglycerols - rheological, density, thermal and optical properties. Physicochemical transition of lipids – supercooling, nucleation, crystal growth, post crystallization events. Polymorphism in lipids.
- Isolation, purification and modification of lipids.
- Mechanism of oxidative rancidity and role of Prooxidants and antioxidants in lipid oxidation.
- Food lipids and health: Trans- fatty acids, omega fatty acids

UNIT IV

- Food Additives: Definition, classification and safety aspects.
- Commonly used food additives like antioxidants, antimicrobials, colorants and artificial sweeteners
- Food Flavors: Molecular mechanism of flavor perception. Taste substances and nonspecific saporous sensations: Sweet, bitter, sour, salty, astringency, Kokumi, pungency, and cooling.
- Flavoring substances associated with fruits and vegetables, milk, spices and processed products.
- Encapsulation, retention and controlled release of flavor and aroma compounds.

References:

1. Owen R. Fennema. (2007). Food Chemistry. CRC Press
2. Meyer. (1960). Food Chemistry. Reinhold Publishing Corporation.
3. Wong. (2018). Mechanism & Theory in Food Chemistry. Springer International Publishing
4. Belitz, H. D. (2009). Food Chemistry. Springer Science & Business Media
5. John M. deMan. (2018). Principles of Food Chemistry. Springer International Publishing
6. Joshi, V. K. and Sing., R.K. (2012). Food Biotechnology principles & Practices. I. K. International Publishing House Pvt. Ltd., New Delhi, Bangalore, India
7. Andrew J Taylor. (2010). Food Flavor Technology. Wiley Blackwell Publishing Ltd
8. Branen, A.L., Davidson, P.M., and Salminen, S. (2001). Food Additives. CRC Press

FT23103CR

Food Processing Technology (4+0+0)

UNIT I

- Principles of Food Preservation
- Food Dehydration: Drying curves, factors affecting food dehydration, effect of dehydration on food quality. Types of driers.
- Evaporation: Single and multiple effect evaporators, Types of evaporators.
- Significance of water activity in shelf stability of foods. Intermediate moisture foods.
- Thermal processing: blanching, pasteurization, sterilization. Aseptic processing.

UNIT II

- Food Irradiation– Principle, mechanism and applications in foods. Safety concerns.
- Refrigeration and freezing: Principle of refrigeration, freezing curve. Types of freezers, Freezing and chilling injuries.
- Membrane processing–types of membranes, equipments, applications in foods, Advantages.
- Minimally processed foods– Preservation and packaging of minimally processed foods.
- Chemical preservatives.

UNIT III

- High Pressure Processing of Foods: Concept of high pressure processing, effects of pressure on microorganisms and its application in food processing.
- Ultrasonic in Food Processing: Properties and generation of ultrasonic, Cavitation, Ultrasonics as a processing techniques.
- Cold plasma for Food Processing – Principle and generation of cold plasma. Application of cold plasma Technology.
- Pulse electric field - Principle, PEF system, Mechanism of microbial inactivation, Factors effecting pulse electric field efficiency. Applications of PEF.

Unit IV

- Ohmic heating – principles and applications.
- Microwave processing–mechanism, equipment and applications.
- Supercritical Fluid Extraction: Properties of super critical fluids, Principle and applications in Food Processing.
- Micronization in food processing- techniques and benefits

References:

1. P. Fellows. (2022). Food Processing Technology. Woodhead Publishing
2. Desrosier. The Technology of Food Preservation. AVI Publishing Company, 1959
3. Potter, N.N. (2013). Food Science. Springer Science & Business Media
4. Introduction to Food Science and Technology by Stewart. Elsevier 2012
5. Handbook of Food Preservation by M. Shafiur Rahman. CRC Press 2020
6. Novel Food Processing Technologies by Gustavo V. Barbosa-Canovas, Maria S. Tapia, M. Pilar Cano. CRC Press 2004

FT23104CR

Food Packaging (3+0+1)

Unit I

- Definition and functions of packaging.
- Types of packaging used in foods-chemistry and applications.
- Properties of packaging materials - Barrier properties - gas transmission rate (GTR) and water vapour transmission rate (WVTR); Mechanical properties. Migration
- Metals: Tinplate containers, tinning process, Low tin steels, tin free steel (TFS). Can-manufacturing, types and lacquering.

Unit II

- Glass and paper packaging.
- Plastics: Polymer processing methods.
- Innovative technologies in food packaging: active packaging & intelligent packaging.
- Biodegradable and Edible packaging. Concept of green plastics and nanosensors.

Unit III

- Modified and controlled atmospheric packaging: Design and application.
- Shelf –life assessment and prediction methodologies.
- Packaging requirements- Dairy, cereal, meat, spices, fruit & vegetable.
- Food packaging- regulations and labeling.

Unit IV (Practical)

1. Identification of films
2. Determination of WVTR and OTR of packages
3. Determination of shelf life of packaged foods
4. Porosity of tinplate
5. Shrink and vacuum packaging of different foods.

References:

1. Food Packaging Principles by Gordon Robertson. CRC Press 2005

2. Handbook of Food Packaging by Paine and Paine. (2012). Springer Science & Business Media
3. Food Packaging- Science & Technology by Lee. (2008). Taylor & Francis
4. Innovations in Food Packaging by Jung M. Han. (2014). Academic Press
5. Principles of Food Packaging by Saccharow and Griffin. AVI Publishing Company, 1980
6. Innovations in Food Packaging by Jung H. Han. Elsevier, 2005

FT23105DCE

Food Engineering (3+0+1)

Unit I

- Material and energy balance: Basic principles, total mass and energy balance, numerical problems based on dilution, concentration, dehydration, and energy balance.
- Modes of heat transfer- conduction, convection and radiation.
- Thermal process calculations- D value, Z value, F value for canned foods.
- Heat Exchangers: Design, types and applications.

Unit II

- Types of evaporators- Design of Single effect and multiple effect evaporators.
- Refrigeration– Principle, refrigeration cycle, Thermodynamics of refrigeration
- Psychrometric charts and their application.
- Rheological studies: Viscosity, Newtonian and non-Newtonian fluids, Storage and loss Modulus and its applications in foods. Concept of Farinograph, Amylograph, Rheometer, and texture analyzer.

Unit III

- Size reduction – Elastic stress limit, yield point, Kicks law, Rittengers law, Bonds law.
- Equipment for fibrous, dry and liquid foods.
- Mixing – Theory of solids mixing, theory of liquids mixing, equipment for low, medium and high viscosity foods.
- Separation Processes: Sedimentation, Filtration, Centrifugal Separation.

Unit IV

- To study drying rate characteristics of different food materials.
- Determination of freezing curve and freezing time of selected food material.
- Demonstration of steam distillation.
- To study particle size by using sieve analysis.

References:

1. Introduction to Food Engineering by R.P. Singh and D.R. Heldman. Academic Press, 2013
2. Fundamentals of Food Process Engineering by R.T. Toledo. Springer Science & Business Media, 2007
3. Industrial Engineering and Management by O. P. Khanna. Dhanpat Rai, 1980
4. Food Processing Technology by P. Fellows. (2022). Woodhead Publishing

FT23106DCE

Experiments in Food Chemistry (Practical) (0+0+2)

1. Preparation and standardization of solution.
2. Proximate analysis of foods.
3. Qualitative tests for Carbohydrates
4. Protein separation and characterization using SDS-PAGE electrophoresis
5. Smoke, Flash and Fire points of oils and fats
6. Determination of free fatty acids
7. Peroxide value and TBA for measuring lipid oxidation
8. Estimation of Total phenolic content
9. Pasting properties of starches using RVA.
10. Sensory methods for measuring food attributes- Difference tests and Rating tests.
11. Determination of adulterants in milk, ghee, edible oil, chillies, honey.

References

1. Handbook of Analysis and Quality Control for Fruit and Vegetable products by Ranganna. Tata McGraw-Hill, 1986
2. Food Analysis by S. Suzanne Nielsen. (2017). Springer Science & Business Media
3. Chemical Analysis of Foods and Food Products by Jacobs, Morris B. (1939). New York,; D. Van Nostrand company, inc.
4. Physical Properties of Food by R.Jowitt & Fescher. (1983)
5. Sensory Evaluation Practices by Stone. (2012). Elsevier Science

FT23107DCE

Experiments in Microbiology (Practical) (0+0+2)

1. Microscopy.
2. Techniques of inoculation.
3. Staining techniques-gram staining, Positive staining, Negative staining.
4. Enumeration of micro-organisms– TPC, Yeast and mould count, ANPC.
5. PCR
6. Production of biocolors
7. Identification of bacteria on the basis of:
 - a. Cultural characteristics
 - b. Morphological characteristics
 - c. Biochemical characteristics -Indole Test/ MVIC test, Starch-hydrolysis, Oxidase Test, TSI test, Coagulase test, Catalase test

References

1. Textbook of Practical Microbiology by Subhash Chandra Parija. Elsevier 2016
2. Laboratory Manual in Microbiology by Gunasekaran. (2007). New Age International (P) Limited
3. Bergey's Manual of Systematic Bacteriology. (2012). Springer New York.

FT23001GE

INTRODUCTORY LIPID TECHNOLOGY (2+0+0)

UNIT 1

- Lipids-classification and sources
- Nomenclature of saturated and unsaturated fatty acids
- Physicochemical properties of Lipids.
- Extraction and rendering of lipids- Physical and chemical refining
- Hydrogenation, interesterfication and Winterization of oils

UNIT II

- Chemistry of frying of oils- physical and chemical changes. Decomposition products
- Mechanism of Lipid oxidation
- Factors affecting lipid oxidation
- Role of prooxidants and antioxidants
- Fat replacements

References

1. Food Lipids: Chemistry, nutrition and biotechnology by Casimer C. Akoh and David B. Min (2017). CRC Press
2. Fats and oils by Richard D-O' Brien. (2008). CRC Press
3. Food Chemistry, Third Edition. Hong Kong: Taylor & Francis, 1996.
4. Bailey's Industrial Oil and Fat Products, 7 Volume Set. United Kingdom: Wiley, 2020.

FT23002OE

ELEMENTARY FOOD PROCESSING (2+0+0)

Unit – I

- Status of Indian food industry– Exports scenario of fruits, vegetables, spices, and their processed products; Driving forces for food industry and constraints
- Causes of food spoilage.
- Thermal Processing – Canning, Sterilization, Pasteurization, Aseptic processing.
- Preservation by low temperature- Refrigeration and Freezing

Unit–II

- Concept of water activity; Intermediate moisture foods.
- Fermentation– Types, nutritional importance of fermented foods.
- Hurdle Technology
- Controlled atmospheric storage – Principle, design considerations, effects of CA storage on food quality.

References:

1. Fellows, P.J. Food Processing Technology: Principles and Practice. United Kingdom: Elsevier Science, 2009.
2. Desrosier, J. N.. Technology of Food Preservation. India: CAB Publishers., 1998.
3. Potter, Norman N. Food Science. United States: Avi Publishing Company, 1973.
4. Stewart, George. Introduction to Food Science and Technology. United States: Elsevier Science, 2012.