

**Choice based Credit System (CBCS)
Scheme and course structure for
M.Sc. Food Technology 2nd semester effective from academic session 2015 and onwards**

Course Code	Course Name	Hours			Total Credits
		L	T	P	
FT15201CR	FOOD QUALITY ASSURANCE	3	0	2	4
FT15202CR	FOOD PACKAGING	3	0	2	4
FT15203CR	ADVANCED TECHNIQUES OF FOOD ANALYSIS	3	0	2	4
FT15204DCE	FOOD BIOTECHNOLOGY	4	0	0	4
FT15205DCE	FOOD ADDITIVES	2	0	0	2
FT15206DCE	PLANTATION CROPS AND SPICES	2	0	0	2
FT15207GE	INRTODUCTORY TECHNOLOGY LIPID	2	1		3
FT15208GE	POSTHARVEST DIESEASES OF FRUITS AND VEGETABLES	2	1	0	3
FT15209OE	FOOD SAFETY	1	1	0	2
Credits=28 Hours=31					

Course Code: FT15201CR

Course Name: FOOD QUALITY ASSURANCE (3+0+1)

Unit – I

- **Objectives, importance and functions of quality control.**
- **Methods of quality assessment-Subjective & objective methods.**
- **Sampling**-Types of samples, preparations & preservation of sample, sampling errors. Factors affecting sampling size.
- **Statistical quality control**-X & R charts, steps for developing control charts.
- **Properties of foods**– Colour, gloss, flavour, consistency, viscosity, texture & their relationship with quality.

Unit – II

- **National & international Food laws** – Food Safety and Standards Act 2006, Codex Alimentarius Commission, grades and standards. IPR and patents.
- **General hygiene and sanitation in food industry**– GMP, HACCP.
- **Food adulteration and food safety**– Physical, chemical & biological hazards in foods. Methods of evaluation of different food adulterants.
- **Establishment of food testing laboratory**– Infrastructure requirement, design and accreditation considerations.

Unit III

- **Sensory evaluation** - Definition, objectives.
- **Panel screening** - Selection methods, interaction and threshold.
- **Sensory evaluation methods / training**– Difference tests (Paired comparison, Duo Trio, Triangle), Rating (ranking, single sample, two sample, multiple sample, hedonic), sensitivity threshold test.
- **Quality evaluation of foods** – Fruits, vegetables, cereals, dairy products, meat, poultry, egg and processed food products.

Unit IV (Practical)

1. To examine the quality of fruits and vegetables- firmness, TSS and visual examinations.
2. To examine the quality of meat-color, texture, flavour, WHC, drip loss.
3. To examine the quality of milk-acidity, foaming, specific gravity, TS, SNF
4. To examine the quality of cereal products-color and texture of bread, cake and cookies.
5. Sensory methods for measuring food attributes- Difference tests and Rating tests.
6. Determination of adulterants in milk, ghee, edible oil, chillies, honey.
7. Determination of total solid, total dissolved solids, total suspended solids in waste water.
8. Determination of temporary and permanent hardness of water.
9. Assessment of nutritive value of foods.

References:

1. Sensory Evaluation Practices by Stone.
2. Principles of Sensory Evaluation of Foods by M.A. Amerine, R. M. Rangborn and E.B. Roessler.
3. Quality Control in Food Industry by Hershoerfer.

Syllabus for M.Sc Food Technology 1st to 4th semester

4. Quality Control in Food Industry by Kramer and Tuig.
5. Chemical and Biological Methods for Water Pollution Studies R.K.Trivedy & P. K. Goel.
6. Pearson Composition and Analysis of Foods by R .Kirk / R . Sawyer.
7. Physical Properties of Food by R.Jowitt & Fescher.
8. Analysis of Food Contaminants by J. Gilbert.
9. Food Quality Evaluation by Eram S Rao.

Course Code: FT15202CR

Course Name: FOOD PACKAGING (3+0+1)

Unit I

- Definition and functions of packaging.
- Deteriorative reaction in foodstuffs and factors affecting their kinetics.
- Shelf life studies of packaged food stuff. Shelf life testing of packaged foods.
- Migration of contaminants and its testing.
- Metals: Tinsplate containers, tinning process, Low tin steels, tin free steel (TFS).
- Can manufacturing, types of cans, seaming
- Aluminium containers
- Metal corrosion and lacquering.

Unit II

- Paper: pulping, fibrillation and beating, types of papers and their testing methods;
- Glass: composition, properties, types of closures, methods of bottle making;
- Plastics: chemistry and properties, polymerisation. Polymer processing.
- Barrier properties of packaging materials: Theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate (GTR) and its measurement, water vapour transmission rate (WVTR) and its measurement.
- Laminated plastic materials. Tetrapacks
- Biodegradable packaging, types advantages and disadvantages. Concept of green plastics.
- Edible films and coatings and their application.

Unit III

- New technologies in food packaging: active packaging, intelligent packaging; application and technologies.
- MAP- basic concepts and role of various gases. Gas packaging machine.
- Packaging requirements of fruits and vegetables
- Packaging of fresh and processed meat. Deterioration and colour chemistry of meat and meat products.
- Packaging of dairy products- milk powder, butter, cheese etc.
- Packaging of spices, cereals and cereal based products.
- Packaging of fats and oils and their products.
- Food packaging regulations and labelling. Temper evident packages.
- **Unit IV (Practical)**
- Identification of films
- Determination of WVTR of packages
- Determination of shelflife of packaged foods
- Porosity of tinsplate
- Shrink and vacuum packaging of different foods
- Industrial visits to demonstrate aseptic packaging, ffs machinery, filling operations, tests for determination of mechanical properties etc.

References:

1. Food Packaging Principles by Gordon Robertson. .
2. Handbook of Food Packaging by Paine and Paine.
3. Food Packaging- Science & Technology by Lee
4. Innovations in Food Packaging by Jung M. Han.
5. Principles of Food Packaging by Saccharow and Griffin.
6. Food Packaging by Takashi Kadoya
7. Food and Packaging Materials Interactions by Paul Acherman
8. Environmentally Compatible Food Packaging by Emo Chiellini
9. Innovations in Food Packaging by Jung H. Han,

Course Code: FT15203CR

Course Name: ADVANCED TECHNIQUES OF FOOD ANALYSIS (3+0+1)

Unit – I

- **Role of analyst**
- **Tri stimulus color system & hunter lab CDM,**
- **Flame photometry**– Concept of ground state, excited state, ionization energy. resonance line, inferences, components of flame emission spectrophotometer.
- **Principles and application of atomic absorption spectroscopy**– Components of atomic absorption spectroscopy, ICP.

Unit - II

- **X-ray analysis of foods**– Properties, production & detection, x- ray tubes, detectors, sources, application in food industry.
- **Mass spectroscopy**– Instrumentation and interpretation
- **Morphological and thermal Analysis**- SEM and DSC- Basic Principles, Instrumentation, and application in foods

Unit - III

- **Chromatography**– Principles of different chromatographic separations. HPLC, GC and coupling systems
- **Rheology measurement**– Farinograph, Amylograph, Rheometer, Texture analysis.
- **Nuclear magnetic resonance (NMR)** – Principle, Components, Interpretation of NMR spectra, application of NMR.
- **Immunoassays and Nucleic acid based techniques** : ELISA & PCR

Unit-IV (Practical)

1. Working of HPLC
2. Farinography of wheat samples
3. RVA of starch and wheat samples
4. Texture analysis of foods products using Texture Analyser
5. Phase transitions, enthalpy changes and oxidative stability of foods using DSC
6. Structural analysis of food samples using ATR-FTIR
7. Analysis of XRD- Data for estimation of % crystallinity in starch samples
8. Analysis of SEM pictures for studying morphology

References:

1. Food Analysis by Pomeranz.
2. Food Analysis by S. Suzanne Nielsen
3. Advances in Food Diagnostics by Leo M. L. Nollet and Y.H Hui
4. Methods of Analysis for Functional Foods and Nutraceuticals by W.Jaffrey
5. Instrumental Methods in Food Analysis by J.R. J Pare and J.M.R Belanger

Course Code: FT15204DCE

Course Name: FOOD BIOTECHNOLOGY (4+0+0)

Unit I:

- Introduction to Food Biotechnology.
- Food Biotechnology & World Feeding problems
- Nucleic Acids: Structure & function, concept of gene.
- Introduction to Genetic Engineering, Recombinant DNA technology, Gene Cloning, Vectors, Ti Plasmid, Transformation.
- SCP: Sources, Nutritional Value, substrate Requirement, Production. Single Cell oils & Composition.

Unit II

- G.M Foods: Advantages, safety Evaluation, Allergenicity, Public attitudes, G.M. Crops: Bt Corn, Bt Brinjal & Golden Rice.
- Antisense RNA & Gene Silencing: An approach To Food manipulation.
- Genetic Manipulation of fruit Ripening & fruit softening.
- Carotenoid biosynthesis & Modification of colour.
- Ethylene Biosynthesis.
- Use of Enzymes in Food Industry (Lipases, Amylase, Proteases, transglutamine, pectinase oxidases).
- Immobilized Enzymes: Methods & Benefits..

Unit III

- Bioclours: Technology of Production, sources (Microbial & plant) and applications.
- Flavours: Current approaches for bio production of flavours.
- Production & Harvesting of Baker's Yeast.
- Production and application of pullulans and alginates.
- Oil seed engineering: New approaches to increase oil yields.

Unit IV

- Bio preservatives: Classification and mode of action.
- Biosensors: basic components, principle and properties, classification, Merits and demerits, application in food industry.
- Waste utilization: production of fats, essential oils, pectin, starch, animal feed.
- Strategies for biotechnology of waste utilization.

References:

1. Joshi, V. K. and Sing., R.K. Food Biotechnology principles & Practises.
2. Buchanan, Jones, G. Biochemistry and molecular biology of plants. I.K. International Pvt. Ltd.
3. Adrian, S., Nigel W. S., Mark, R.F. Plant Biotechnology: The genetic manipulation of plants. Second Edition, Oxford University Press.

Course Code: FT15205DCE

Course Name: FOOD ADDITIVES (2+0+0)

UNIT -1

- Definition and classification of additives.
- Antioxidants: General function, classification and toxicological aspects.
- Antimicrobial, chemical & toxicological properties of common preservatives- Benzoic acid, Sulfur dioxide, Propionic acid, Sorbic acid
- Acidulants- General functions, Classification, General application in foods.

UNIT -11

- Common flavouring components & their botanical source
- Classification of flavours, bio-production of flavours.
- Natural and synthetic colorants used in foods
- Artificial sweeteners used in foods

References:

1. Food Biotechnology principles and practices by V.K. Joshi and R.S. Singh
2. Food Additive Toxicology by Joseph A. Maga and Anthony T. Tu
3. Food chemical safety; Volume 2: Additives by David H Watson
4. Food Additives by A. Larry Branen, P. Michael Davidson and Seppo Salminen

Course Code: FT15206DCE

Course Name: PLANTATION CROPS & SPICES (2+0+0)

UNIT –I

- **Plantation Crops:** Definition and role of plantation crops in national economy and export potential.
- **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.

UNIT II

- **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.

References

- Chakraverty et al. Handbook of Postharvest Technology. Marcel Ceker
- Purseglove, 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).
- S.K Chadha & P. Rethinam. Advances in Horticulture- Plantation and spice crops. Malhotra Publishing House, New Delhi (9th & 10th Ed.)

Course Code: FT15207GE

Course Name: INTRODUCTORY LIPID TECHNOLOGY (2+1+0)

UNIT 1

Introduction

- Nomenclature of saturated and unsaturated fatty acids
- Common sources of vegetable oils and their oil content
- Chemical characterization of fats and oils.
- Properties of common oils-Soybean, peanut, Corn, Sunflower, safflower, Canola, Olive, Coconut, palm oil.

UNIT II

Processing of oils

- Extraction and rendering- Physical and chemical refining
- Bleaching, Hydrogenation
- Interesterification, Winterization
- Dewaxing, Fractionation
- Exterfication, Blending, Deodorization

UNIT III

- Storage and protection of oils
- Plasticization and flaking
- Bulk oil shipments
- Common tests for quality control of oils

Books Recommended

Food Lipids: Chemistry nutrition and biotechnology by Casimer C. Akoh and David B Min

Fats and oils by Richard D-O' Brien

Food Chemistry by Fenimma

Bailey's industrial oil and fat products by Fereidoon Shahidi

Course Code: FT15208GE

Course Name: POSTHARVEST DISEASES OF FRUITS AND VEGETABLES
(2+1+0)

UNIT-I

- Postharvest disease initiation: The pathogens, origin of pathogens. Spore germination and Pathogen penetration into the host
- Main pathogens of harvested fruits & vegetables
- Mycotoxins: occurrence, types of mycotoxins, Methods of prevention of mycotoxins

UNIT-II

- Factors affecting disease development: preharvest factors, harvesting and handling, inoculum level.
- Attack mechanisms of the pathogen: Enzymatic activity, toxin production, detoxification of host defense compounds by pathogens.
- Physiological & Biochemical changes following infection
 - a) Changes in fruit respiration & ethylene evolution
 - b) Pectolytic activity & its source in infected tissue
 - c) Fruit softening & changes in pectic compounds
 - d) Changes in Biochemical constituents of infected tissue

UNIT-III (Tutorial)

- Host protection & defense mechanism
- Means for maintaining host resistance a) cold storage b) controlled & modified atmospheres c) growth regulators d) calcium application
- Chemical control
- Physical control
- Biological control

Reference:

1. Pathak V.N. 1970. Diseases of fruit crops & their control IBH publication New Delhi.
2. Barkai Golan; Postharvest diseases of fruits and vegetables: development and control. Elsevier science: first Indian reprint 2005.

Course Code: FT15209OE

Course Name: 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. Food Science by Norman N.Potter
3. Food Safety Handbook by Rouland H. Schmidt