

*Annexure to Notification No.F(Pres-Syllabi.PG-CBCS)Acad/KU/14 dated 15-05-2014*

*Syllabus for M.Sc Food Technology 1<sup>st</sup> to 4<sup>th</sup> semester*

**Choice based Credit System (CBCS)**

**Scheme and course structure for**

**M.Sc Food Technology 2<sup>nd</sup> t semester effective from academic session 2014 and onwards**

Course Code	Course Name	Hours			Credits
		L	T	P	
FT14201CR	FOOD QUALITY ASSURANCE	4	0	0	4+0+0=4
FT14202CR	FOOD PACKAGING	4	0	0	4+0+0=4
FT14203CR	EXPERIMENTS IN QUALITY CONTROL & SENSORY EVALUATION OF FOODS	4	0	0	0+0+4=4
FT14204EA	FOOD ADDITIVES, PLANTATION CROPS & SPICES	4	0	0	4+0+0=4
FT14205EA	FOOD BIOTECHNOLOGY	0	0	8	4+0+0=4
FT14206EA	ADVANCED TECHNIQUES OF FOOD ANALYSIS	0	0	8	4+0+0=4
FT14207EA	POSTHARVEST DISEASES & STORAGE PESTS	3	2	0	3+1+0=4
FT14208EO	FOOD SAFETY	3	2	0	3+1+0=4

**FT14201CR**  
**FOOD QUALITY ASSURANCE**

**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.

**Unit – II**

- **Properties of foods**– Colour , gloss, flavour, consistency, viscosity, texture & their relationship with quality.
- **Quality evaluation of foods**– Fruits, vegetables, cereals, dairy products, meat, poultry, egg and processed food products.
- **Establishment of food testing laboratory**– Infrastructure requirement, design and accreditation considerations.

**Unit - III**

- **National & international Food laws**– AGMARK, PFA, FPO, 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.

**Unit IV**

- **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.
- **Instrumental analysis in quality control and food rheology**

**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 Hershoffer.
4. Quality Control in Food Industry by Kramer and Tuig.

**FT14202CR**  
**FOOD PACKAGING**

**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: Tinplate 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.
- Mechanical Properties of packaging materials- tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength; tear strength.
- 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.

**Unit III**

- Packaging equipment and machinery: canning, bottling & carton making machines.
- Filling operation. Filling of solid and liquid foods.
- Form and fill sealing machines, tetrapacks.
- Aseptic packaging systems; retortable pouches, contact packaging.
- New technologies in food packaging: active packaging, intelligent packaging; application and technologies.
- MAP- basic concepts and role of various gases. Gas packaging machine.
- Biodegradable packaging, types advantages and disadvantages. Concept of green plastics.
- Edible films and coatings and their application.

**Unit IV**

- 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.

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- Packaging of fats and oils and their products.
- Food packaging regulations and labelling. Temper evident packages.

**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. **Novel Techniques of Food Packaging**
5. Innovations in Food Packaging by Jung M. Han.
6. Principles of Food Packaging by Saccharow and Griffin.
7. Food Packaging by Takashi Kadoya
8. Food and Packaging Materials Interactions by Paul Acherman
9. Environmentally Compatible Food Packaging by Emo Chiellini
10. Innovations in Food Packaging by Jung H. Han.

**FT14203CR**

**EXPERIMENTS IN QUALITY CONTROL AND SENSORY EVALUATION  
OF FOODS (PRACTICAL)**

1. Determination of total solid, temporary and permanent hardness of water.
2. To examine the quality of fruits and vegetables, meat, poultry, milk, cereal and their products.
3. Identification and ranking of food product attributes.
4. Sensory and instrumental methods for measuring food attributes.
5. Application of modern techniques for evaluation of color, texture, viscosity and consistency.
6. Texture evaluation of fruits, vegetable, dough, baked, paste, dairy and meat products.
7. Analysis of products for FPO specifications.
8. Qualitative and quantitative determination of adulterants in milk, ghee, edible oil, legumes, saffron, sugar, black pepper, turmeric, chillies, coffee, honey, mustard seeds.
9. Determination of total solid, total dissolved solids, total suspended solids, BOD and COD in food industry waste water.
10. Determination of food preservatives – SO<sub>2</sub> & benzoic acid.
11. Assessment of nutritive value of foods.
12. Determination of NaCl concentration.

**References:-**

1. Chemical and Biological Methods for Water Pollution Studies R.K.Trivedy & P. K. Goel.
2. Pearson Composition and Analysis of Foods by R .Kirk / R . Sawyer.
3. Physical Properties of Food by R.Jowitt & Fescher.
4. Analysis of Food Contaminants by J. Gilbert.

## **FT14204EA**

### **FOOD ADDITIVES, PLANTATION CROPS & SPICES**

#### **UNIT -1**

- **Introduction:** Definition and need for food additives.
- **Additives used in foods:** Antioxidants, preservatives, coloring agents, non-nutritive sweeteners, stabilizers and thickeners, acids and buffer systems, fat replacers, leavening agents, flour improvers, humectants and anticaking agents, chelating agents, curing agents, clarifying agents.
- **Unintentional additives:** Radio-active fallout, agricultural contaminants, animal food additives.

#### **UNIT -2**

- **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 -3**

- **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- 4**

- **Vanilla:** Composition and processing of vanilla. Classification and extraction of vanilla flavorings. Uses of vanilla flavorings in different food products.
- **Coconut:** Chemical composition, post harvest handling and coconut products such as coconut oil, desiccated coconut, coconut water and coconut sap.
- **Cashewnut:** Chemical composition and processing of cashewnut. Cashewnut products such as cashewnut beverages and Kaju.

#### **References**

- Purseglove, J. W. *et al* (1998). Spices 'Vol. I and II. Logman publishers.
- S. N. Mahindru (2000). Food Additives. Tata McGraw-Hill Publishing Company Limited New Delhi.
- 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).

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- 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 (9<sup>th</sup> & 10<sup>th</sup> Ed.)

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**FT14205EA**

**FOOD BIOTECHNOLOGY**

**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:**

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



## **FT14206EA**

### **ADVANCED TECHNIQUES OF FOOD ANALYSIS**

#### **Unit – I**

- Role of analyst, various methods of sampling, analysis of results.
- **Refractometry**– Theory, instrumentation, specific & molar refraction, variables affecting refractive measurements, its applications, types of refractometers.
- **Principles and application of colorimetry**– Optical aspects (hue, value, chroma), tristimulus colour system, tintometers & hunter lab CDM.
- **Flame photometry**– Concept of ground state, excited state, ionization energy. resonance line, inferences , components of flame emission spectrophotometer.

#### **Unit - II**

- **Principles and application of atomic absorption spectroscopy**– Components of atomic absorption spectroscopy, ICP.
- **X-ray analysis of foods**– Properties, production & detection, x- ray tubes, detectors, x- ray fluorescence, sources, application in food industry.
- **Electrophoresis**–Applications, principles of separation of neutral molecules, separation of optical isomers and buffers.
- **Mass spectroscopy**– Components, Low voltage Mass Spectrometry, Quantitative analysis.

#### **Unit - III**

- **Chromatography**– Different types (HPLC, Paper Chromatography, TLC, GLC) their principles and applications.
- **Rheology measurement**– Farinograph, Amylograph, Viscosity measurement, Texture analysis.

#### **Unit IV**

- Enzymatic methods, DSC, SEM.
- Rapid methods of microbial analysis, immunoassays.
- **Nuclear magnetic resonance (NMR)** – Principle, Components, Interpretation of NMR spectra, application of NMR.

#### **References:**

1. Food Analysis by Pomeranz.
2. The Chemical Analysis of Food and Food Products by Jacobs.
3. Handbook of Analysis and Quality Control for Fruit and Vegetable products by Ranganna.

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**FT14207EA**

**POSTHARVEST DISEASES & STORAGE PESTS**

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 :a) preharvest factors, harvesting and handling, b) inoculum level
- Attack mechanisms of the pathogen a) 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

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

UNIT-IV

- Storage losses due to insects, mites, rodents, birds & moulds.
- Biology of major stored grain pests.
- Significance of temperature & moisture migration in the level of moulds & insect population.
- Biochemical Changes in stored commodities due to pest infestation.
- Principles of grain storage.
- Storage structures
- Source of infestation and methods of control
- Safe use of pesticides in stored commodities.
- Quarantine restriction in the movement of agriculture produce,

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- Case histories of exotic pests & their status.

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

Insects of stored grains by David Rees, CSIRO Publishing.

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**FT14208EO**

**FOOD SAFETY**

• **Unit – I**

- Definition of food safety and importance of safe food
- Hazards and types of hazards
- Physical hazards- their harmful effects and management
- Chemical hazards- Sources harmful effects and management
- Naturally occurring toxicants in foods
- Process induced food toxicants
- Environmental, industrial and packaging contaminants
- Safety aspects of food additives

**Unit – II**

- 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 – III**

- Food Safety and Standards Act 2006 and regulation 2011.
- Registration and Licensing
- Packaging and labeling
- Nutrition and Health Claims

**UNIT IV (Tutorials)**

- Zoonotic diseases. Eg Bird flu, Swine flu
- Genetically modified food- safety aspects