

**Choice based Credit System (CBCS)
Scheme and course structure for
M.Sc Food Technology 3rd semester effective from academic session 2015 and onwards**

Course Code	Course Name	Hours			Total Credits
		L	T	P	
FT14301CR	CEREAL, LEGUME AND OIL SEED TECHNOLOGY	4	0	0	4
FT14302CR	FRUIT AND VEGETABLE TECHNOLOGY	4	0	0	4
FT14303CR	PROCESSING OF FOODS OF PLANT ORIGIN (PRACTICAL)	0	0	8	4
FT14304EA	NEUTRACEUTICALS AND FUNCTIONAL FOODS	3	2	0	4
FT14305EA	FLAVOUR TECHNOLOGY	3	2	0	4
FT14306EA	NOVEL TECHNIQUES OF FOOD PROCESSING	3	2	0	4
FT14307EA	POSTHARVEST MANAGEMENT OF TREE NUTS	2	2	2	4
FT14308EO	ELEMENTARY ANIMAL PRODUCTS TECHNOLOGY	0	4	4	4
Credits=28 Hours=45					

Course Code: FT14301CR

Course Name: CEREAL, LEGUME AND OIL SEED TECHNOLOGY (4+0+0)

Unit – I (Wheat Chemistry and Technology)

- Current status and future scenario of world wheat production and uses.
- Structure and chemical composition of wheat grain and its relation to processing qualities.
- Criteria of wheat quality ó physical and chemical. Molecular basis of wheat grain hardness/softness.
- Wheat milling ó principle, conditioning and milling systems. Flour streams, extraction rates and their composition.
- Structure and functionality of wheat proteins, carbohydrates and lipids in bread making.
- Enzymes of wheat and their technological significance.
- Vital wheat gluten ó manufacturing techniques, uses and functionality.
- Dough rheology and dough testing apparatus such as recording dough mixers, load extension meter.
- Bread making processes, development in bread making methods, functions of ingredients/ additives such as fat, emulsifiers, oxidants, reducing agents, conditioners. Bread faults and remedies.
- Technology of biscuit, cake, cookies and cracker manufacture.
- Durum wheat ó chemistry, quality and technology of pasta products.

Unit – II (Rice Chemistry and Technology)

- Rice grain structure and chemical composition.
- Milling of rice ó types of rice mill: huller mill, sheller-cum-huller mill, sheller-cum-cone polisher mill, small capacity rice mill. Modern rice milling. Factors affecting rice yield during milling. By-products of rice milling and their utilization.
- Cooking quality of rice.
- Parboiling of rice ó traditional method and their drawbacks. CFTRI process of parboiling. Properties of parboiled rice. Changes during parboiling. Advantages and disadvantages of parboiling.
- Rice convenience foods ó precooked rice, canned rice, expanded rice, rice based infant food formulas, rice puddings and breads, rice cakes, rice noodles and fermented foods.

Unit – III (Minor Cereal Grains)

- Composition and structure of corn.
- Wet and dry milling of corn. Corn products and their uses.
- Composition and structure of barley and oat. Milling of oat and barley. Classification of malt products, nutritive value and food applications of malt.
- Chemical, technological and nutritional aspects of sorghum and millets.

Unit IV (Oil seed and Legume processing)

- Types of oil seeds and their chemical composition.
- Oil extraction ó Mechanical and solvent extraction.
- Refining of crude oils.
- 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.
- Fermented and traditional products.

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.

Course Code: FT14302CR

Course Name: FRUIT AND VEGETABLE TECHNOLOGY (4+0+0)

UNIT-I

Fruit maturity and ripening indices.

Postharvest changes in fruits and vegetables.

Ethylene biosynthesis, mode of action, inhibition of ethylene synthesis

Composition & related quality factors for processing .

Handling of horticultural produce.

Precooling and transport of horticultural commodities.

UNIT-II

Cold chain management.

Storage: Definition & functions

Types of storage: low cost and high cost storage systems

Controlled atmospheric storage: Its construction and control of gases.

Hypobaric storage

Zero energy cool chamber: Its construction and advantages.

UNIT-III

Principles of preservation,

Preservation by heat, chemicals, sugar, salt, fermentation, drying, freezing

Chemistry of pectin, theories of gel formation

Role of enzymes in processing

Quality standards of fruits & vegetable products.

UNIT-IV

Canning: spoilage of canned products

Fruit & vegetable Juices: Preparation & preservation of juices syrups, cordials,

Squash, concentrate pickles, tomato products

Dehydration of fruits & vegetables

Freezing of fruits & vegetables

Jams, Jellies, Marmalades and preserves

Waste utilization

Reference:

1. Postharvest Technology of Fruit & Vegetables by A.K. Thompson.
2. Postharvest Technology of Fruits & Vegetables by verma & joshi 2000. Indus publications, New Delhi
3. An introduction to Postharvest Technology by RBH Wills. 2003
4. Preservation of fruits & Vegetables by Siddappa etal 1999. ICAR, New Delhi
5. Preservation of Fruits & Vegetables by Srivastava & Kumar, 1996. Intl. Book publishing Co. Lucknow
6. Handbook of Vegetables and Vegetable Processing by Y. H. Hui 2011. Wiley Blackwell
7. Handbook of Fruits and Fruit Processing by Y. H. Hui 2006. Wiley Blackwell

Course Code: FT14303CR

Course Name: PROCESSING OF FOODS OF PLANT ORIGIN (PRACTICAL) (0+0+4)

Part I (Cereals)

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.

Part II (Fruits and Vegetables)

1. Quality Evaluation of Fruits & Vegetables (TSS, Color, 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)
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.
11. Visit to a fruit and vegetable processing industry.

References:

1. Handbook of Analysis and Quality Control of Fruit and Vegetable Products S. Ranganna
2. Preservation of fruits & Vegetables by Siddappa et al 1999. ICAR, New Delhi
3. Pomeranz, Y. (1998). *Wheat: Chemistry and Technology*, Vol. I 3rd Ed., American Association of Cereal Chemists, St. Paul, MN, USA.
4. Juliano, B. O. (1985). *Rice Chemistry and Technology*, American Association of Cereal Chemists, St. Paul, MN, USA.
5. Stanley P.Cauvain & Lindas S. Young. Baked Products. Blackwill Publishing.
6. Stanley P.Cauvain & Lindas S. Young. The Chorleywood Bread Process. CRC Publications.
7. Bakery Technology & Engineering by Samueal A. Matz.
8. Manual of American Association of Cereal Chemists
9. Manual of AOAC, 1990

Course Code: FT14304EA

Course Name: NEUTRACEUTICALS AND FUNCTIONAL FOODS (3+1+0)

Unit – I

- Introduction - Definition, Classification of nutraceutical factors. Food and non food sources. Mechanism of action.
- Nutraceutical factors in specific foods.
- Introduction to diseases of developed world- diabetes, obesity, hypertension
- Dietary fibre ó Types, Effects of fibre deficient diets
- Physical and physiological properties of dietary fiber
- Hypocholesterolemic, hypolipidemic and hypoglycemic effects. Role in prevention of CHD and cancer.
- Beta- glucan- Chemical features and health benefits

Unit – II

- Probiotics- definition, criteria for selection of probiotic microorganisms.
- Common probiotic products, yoghurt, kefir and ice-cream.
- Health benefits of probiotics-immune modulation and cancer prevention
- Prebiotics ó Important prebiotic molecules and their beneficial effects.
- Concept of synbiotics.
- Fatty acid as functional food- Mono and poly-unsaturated fatty acids
- Omega 3 fatty acids- introduction, nomenclature & sources.
- Eicosanoid metabolism of fatty acids and its implications in human health
- Biological and functional effects. Omega 3 fatty acids and insulin resistance.
- Olive oil and its health benefits.

Unit – III

- Phytochemicals and Antioxidants ó Introduction, therapeutic properties of some common plants.
- Free radicals and oxidative stress
- Biosynthesis of common phytochemicals-Shikmic acid and mavalonic acid pathway
- Role of ascorbic acid, flavonoids, Tocopherols, Carotenoids, capsaicinoids, lycopeneb as disease prevention agents.
- Garlic-composition and its therapeutic effects
- Tea and its health benefits
- Soybean as a functional food.

Unit – IV (Tutorials)

- Proteins as functional foods
- Vitamins and minerals as functional ingredients
- Extraction of nutraceuticals
- Stability of nutraceuticals factors during processing and digestion
- Testing efficacy of functional foods
- Marketing of functional foods.
- Legislative aspects of functional foods.

References:

1. Functional Foods by Goldberg.
2. Handbook of Nutraceuticals and Functional Foods by Wildman.
3. Functional Foods: principles and technology by Mingruo Guo.

Annexure to Notification No.F(pres-PG Syllabus-CBCS)Acad/KU/15 dated 24-04-2015
Syllabus for M.Sc Food Technology 3rd to 4th semester

4. Chemical and Functional Properties of Food Components by Zdzislaw E. Sikorski.
5. Technology of Functional Cereal Products by Bruce R. Hamaker.
6. Functional Foods: Biochemical and Processing Aspects by John Shi, G. Mazza, Marc Le Maguer, CRC Press

Course Code: FT14305EA

Course Name: FLAVOR TECHNOLOGY (3+1+0)

Unit-1

- **Introduction:** Definition & classification of food flavors. Factors affecting food flavors.
- **Flavor compounds of foods:** Terpenoids, flavonoids, sulfur compounds and other volatile flavor compounds.
- **Taste substances & Nonspecific saporous sensations:** Sweet, bitter, sour, salty, astringency, pungency and cooling.
- **Flavor forms:** Water & oil soluble liquid flavors, emulsion based, dispersed & spray dried flavors.

Unit-11

- **Flavor of fruits:** apple, pears, quinces, stone fruits, berries & tropical fruits.
- **Flavor of vegetables:** Vanilla, garlic, onion & cruciferae.
- **Spice flavors:** Essential oils and oleoresins.
- **Flavor composition of fermented products:** Chocolate, tea, coffee, beer, wine & fermented dairy products.

Unit-111

- **Development of process or reaction flavor volatiles:** Thermally induced from fats & oils, proteins and maillard reaction.
- **Flavor precursors in food stuffs.**
- **Flavor nucleotides usages in foods.**
- **Off flavor development in foods:** Thermally produced, enzymatic reactions & microbial by-products.

Unit-1V

- **Flavor encapsulation & stabilization:** Principles, types & techniques of flavor encapsulation & their applications in food industry.
- **Sensory assessment of flavors.**
- **Analysis of odor-active compounds of foods/beverages (Charm-analysis).**
- **Electronic nose and direct analysis of food aromas with electronic nose.**
- **Instrumental techniques in flavor analysis**

References:

1. Food Flavor Technology. Andrew J. Taylor.
2. Food Flavors: Formation, Analysis, & packaging influences. E. T. Contis, C. T. Ho, C. J. Mussinan, T. H. Parliament, F. Shahidi & Spanier.
3. Encapsulation Technology for active food ingredients & food Products. Nicolass Jan Zuidam, Viktor A. Nedovic.
4. Food flavours. I. D. Morton & A. J. Macleod.
5. Food Chemistry. Owen R. Fennema.
6. Bitterness in foods and beverages. Russel L. Rouseff.
7. Chemistry of Foods & Beverages: Recent Developments. George Charalambous & Ira Katz. Phenolic, George Charalambous & George Inglet.
8. Food Additives. S. N. Mahindru.

Course Code: FT14306EA

Course Name: NOVEL TECHNIQUES OF FOOD PROCESSING (3+1+0)

Unit – I

Emerging Techniques in Food Processing: Application of technologies of high intensity light, pulse electric field, ohmic heating, micronization in food processing and preservation, Applications of Magnetic Field in Food Preservation, Irradiation Preservation of Foods, Encapsulation, Stabilization and Controlled Release of Food Ingredients and Bioactives.

Unit – II

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.

Use of Microwave Energy in Foods: Theory of microwave heating, dielectric properties of food materials, working principal of magnetron, microwave blanching, sterilization and finish drying.

Unit – III

High Pressure Processing of Foods: Concept of high pressure processing, quality changes, effects of pressure on microorganisms and its application in food processing.

Hurdle Technology: Types of preservation techniques and their principles, concept of hurdle technology and its application.

Unit – IV

Ultrasonic in Food Processing: Properties and generation of ultrasonic, ultrasonic imaging, application of ultrasonics as an analytical tool and processing techniques

Nanotechnology: Principles, mechanism and applications in foods

References:

1. New Methods of Food Preservation by G. W Gould, 2012; *Springer*
2. Introduction to Food Engineering by R. P Singh and Dennis R Heldman, 1983; *Academic press Elsevier*
3. Food processing technology: *Principles and practice* by P.J Fellows, 2009; *CRC Press*
4. Handbook of Food Preservation by M. Shafiur Rahman, 1999 ; *CRC Press*
5. Engineering Properties of Foods, Third Edition (Food Science and Technology) by M. A. Rao, Syed S.H. Rizvi, Ashim K. Datta ,2010 ; *CRC Press*
6. Food Physics: Physical properties- Measurement and applications by L.O.Figura and A.A.Teixeira 2007; *Springer*

Course Code: FT14307EA

Course Name: POST HARVEST MANAGEMENT OF TREE NUTS (2+1+1)

Unit I

- Horticulture maturity indices of tree nuts
- Factors affecting the quality of the tree nuts
- Storage of tree nuts: Respiratory metabolism, modified atmosphere storage and ethylene effects
- Packaging technology & packaging material
- Microbial food safety issues and Disorders of nuts and
- Quarantine issues in tree nuts

Unit II

- General principles of quality control, quality attributes grade and quality standards of in shell and shelled tree nuts
- Nutritional and Nutraceutical factors in tree nuts and their importance in human health.
- Aflatoxins in tree nuts and their health hazards
- Flavors and volatile components of tree nut
- Product development in; Pecans, Pine, Pistachios, Walnuts

Unit III (TUTORIALS)

- Browning in tree nuts and measures to prevent browning.

Harvesting & Post harvest handling operations, nutrient composition, health benefits of following tree nuts:

- Almonds
- Pistachios
- Pecans
- Hazelnuts
- Walnuts
- Chestnuts

Unit IV (Practicals)

- Product development from tree nuts
- Physical characteristics of tree nuts
- Proximate Composition of tree nuts
- Moisture content by gravimetric method
- Crude Protein Content by Kjeldhel method
- Crude Fat Content of different nuts by soxhlet method
- Ash content
- Iodine value of tree nuts oil
- Peroxide value of tree nut oils
- Saponification number of tree nut oils

References:

1. Tree nuts; Production, Processing, Products Vol.1 & 2 by J.G. Woodroof.
2. The bok of edible nuts by Frederic Rosengarten, Jr.
3. Tree nuts; Composition, phytochemicals and health effects edited by Cesarettin Alasalvar & Fereidoon Shahidi

Course Code: FT14308EO

Course Name: ELEMENTARY ANIMAL PRODUCTS TECHNOLOGY (0+2+2)

Unit-I

- Processing of market milk- standardization, toning of milk, homogenization.
- Storage, transportation and distribution of milk. Pasteurization and sterilization.
- Milk products- Processing of cream, butter, cheese, ice cream. Traditional dairy products

Unit-II

- Sources of meat, composition and nutritive value of meat.
- Structure of muscle. Microscopic structure of meat.
- Slaughtering of animals and poultry.
- Structure and contraction mechanism of muscle
- Biochemical alteration and rigor-mortis during Post-mortom.
- Eating quality of meat ó colour, flavor, tenderness, juciness and water holding capacity. Meat quality evaluation
- Preservation of meat by freezing, curing, pickling and smoking of meat.

Unit-III (Practicals)

- Quantative estimation of milk constituents such as moisture, %TS, fat.
- Determination of acidity and specific gravity of milk.
- Platform tests on given sample of milk.
- Standardization of milk.
- Detection of adulterants in milk- water, starch, urea.
- Preparation of common milk products like flavoured milk, yoghurt, cheese, butter, ice cream.

Unit-IV (Practicals)

- To study slaughtering and dressing of meat animals.
- Identification of meat of varying origion by subjective methods.
- Preperation and quality evaluation of meat and emulsions.
- Preperation and canning of tradational meat products.
- Sensory evaluation of cooked meat products.
- Determination of meat to bone ratio in Chicken
- Visit to local milk processing plant.

References:

1. Outlines of Dairy Technology by S. K. De
2. Chemistry and Testing of Dairy products by H.V. Atherton & J.A. Newlander
3. Milk and dairy Product Technology by Edger Spreer.
4. Dairy Chemistry by H.H. Sommer
5. Lawre. R. A. & Ledward, D. A. (2006). Lawres Meat Science 7th Ed. Woodhead Publishing Company, Cambridge, England.
6. Throntons Meat Hygiene.
7. Principles of Meat Science by Forest.
8. Developments in Meat Science by Lawrie.
Processed Meats by Pearsons.