

**INTEGRAL UNIVERSITY**  
**LUCKNOW**

**SYLLABUS**

of

**B.TECH.**  
**FOOD-TECHNOLOGY**

2015-16

**B. TECH. FOOD TECHNOLOGY  
SEMESTER VII**

S.No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total
						Sessional			Exam.	
			Theory	L	T	P	CT	TA	Total	
1.	FT-701	Food Laws, Standard & Regulations	03	01	00	30	20	50	100	150
2.	FT-702	Flavour Technology	03	01	00	30	20	50	100	150
3.	FT-703	Nutraceuticals and Functional Foods	03	01	00	30	20	50	100	150
4.	FT-704	Food Industry Waste and Byproduct Management	03	01	00	30	20	50	100	150
5.	FT-705	<u>Electives-I</u>	03	01	00	30	20	50	100	150
		E1: Food Product Development & Sensory Evaluation E2: Plant Cell and Tissue Culture								
6.	FT-706	<u>Electives-II</u>	03	01	00	30	20	50	100	150
		E1: IPR in Food Sector E2: Post Harvest Management of Fruits and Vegetables								
8.	FT-751	Industrial Training	-	-	-	-	50	50	100	150
10.	GP-701	General Proficiency	-	-	-	-	-	50	-	50
<b>Total</b>			<b>18</b>	<b>06</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>400</b>	<b>700</b>	<b>1100</b>

**B.TECH**  
**FOOD TECHNOLOGY**  
**SEMESTER-VII**

# FOOD LAWS, STANDARDS AND REGULATIONS

FT – 701

w.e.f. Session 2014-15

**L T P**

**3 1 0**

## **UNIT -I**

**[8]**

Introduction, concept of food safety and standards (FSSAI), food safety strategies. Food hazards and contaminations - biological (bacteria, viruses and parasites), chemical (toxic constituents / hazardous materials) pesticides residues / environmental pollution / chemicals) and physical factors. Preventive food safety systems - monitoring of safety, wholesomeness and nutritional quality of food. Prevention and control of microbiological and chemical hazards. Food safety aspects of novel methods of food processing such as PEF, high pressure processing, thermal and non thermal processing, irradiation of foods.

## **UNIT-II**

**[8]**

Indian and Food Regulatory Regime (Existing and *old*), PFA Act and Rules, Food Safety and Quality Requirements, Additives, Contaminants and Pesticide Residue. Food Safety and Standards Act, 2006, Essential Commodities Act, 1955, Global Scenario, Codex Alimentarius, WHO/FAO Expert Bodies (JECFA/JEMRA/JMPR) WHO/FAO Expert Bodies (JECFA/ JEMRA/JMPR). Food safety inspection services (FSIS) and their utilization. Legal Metrology act, Weight and Measurement act, Introduction to Factory Act.

## **UNIT-III**

**[8]**

Introduction to OIE and IPPC, Other International Food Standards (e.g. European Commission, USFDA etc). WTO: Introduction to WTO Agreements: SPS and TBT Agreement, Export and Import Laws and Regulations, Export (Quality Control and Inspection) Act, 1963.

Customs Act and Import Control Regulations, Other Voluntary and mandatory product specific regulations, Other Voluntary National Food Standards: BIS Other product specific standards; AGMARK. Nutritional Labeling, Health claims.

#### **UNIT-IV**

**[8]**

Risk assessment studies: Risk management, risk characterization and communication.

#### **UNIT-V**

**[8]**

Voluntary Quality Standards and Certification

GMP, GHP, HACCP, GAP, Good Animal Husbandry Practices, Good Aquaculture Practices

ISO 9000, ISO 22000, ISO 14000, ISO 17025, PAS 22000, FSSC 22000, BRC, BRCIOP, IFS, SQF 1000, SQF 2000. Role of NABL, CFLS. Halal & Kosher Standard.

#### **Suggested Readings:**

1. Singal RS, Handbook of indices of food quality and authenticity; Woodhead Publ. Cambridge, UK.
2. Shapton DA, Principles and practices of safe processing of foods; Butterworth Publication, London.
3. Winton AL, Techniques of food analysis; Allied Science Publications New Delhi.
4. Pomeranze Y, Food analysis - Theory and Practice; CBS Publications, New Delhi.
5. Jacob MB, The chemical analysis of foods and food products; CBS Publ. New Delhi
6. FSSAI website: [www.fssai.gov.in](http://www.fssai.gov.in)

# FLAVOUR TECHNOLOGY

FT – 702

w.e.f. Session 2014-15

**L T P**

**3 1 0**

## **UNIT-I**

**[8]**

Definition and description of flavour, flavour profile and its principal chemical constituents. Sensation of flavour vs taste odor/smell and mouth feel influence of chemical constituents on flavour and their interaction with flavour characteristics.

## **UNIT-II**

**[8]**

Factors that affect the flavour and control of flavour in processed foods. Measurement of flavour, particularly for wine, tea, coffee, spices and condiments.

## **UNIT-III**

**[8]**

Flavour intensifier and their effects. Chemistry and technology (commercial preparations) of various flavour intensifiers.

Natural and synthetic flavouring substances and their chemical characteristics. Flavour components/constituents of fruit and vegetables, coffee, tea and cocoa bean, spices and condiments.

## **UNIT-IV**

**[8]**

Changes in flavouring components and characteristics during cooking/processing of various foods. Effects of storage, processing, transportation and environmental conditions on flavour components/constituents.

## UNIT-V

[8]

Processing (industrial/commercial) technologies/methods of flavouring compounds of plant foods and their utilization and applications.

Recent developments in flavour research, processing and technology.

### Suggested Readings:

1. Heath, HB (2005) Flavour chemistry and technology, CBS Publ., New Delhi.  
Fenaroli, G. Handbook of flavour ingredients, CRC Press. Bota Rica, New York  
Yamanishi, T. Recent advances in flavour researches, Dekker, New York.
2. Cromin DA (1992). Techniques of analysis of flavors : chemical methods including sample preparations, Elsevier Publ. London.
3. Schreier, P (1995). Analysis of volatile: methods and application Elsevier,

# NUTRACEUTICALS AND FUNCTIONAL FOODS

FT-703

w.e.f. Session 2014-15

**L T P**

**3 1 0**

## **UNIT-I**

**[8]**

Basics of nutraceutical and functional foods: defining nutraceuticals and functional foods. Introduction to Health food, Nature, type and scope of nutraceutical and functional foods. Nutraceutical and functional food applications and their health benefits. Nutraceutical compounds and their classification based on chemical and biochemical nature with suitable and relevant descriptions. Nutraceuticals for specific situations such as cancer, heart disease, stress, osteoarthritis, hypertension etc.

## **UNIT-II**

**[8]**

Proteins, carbohydrates and Fats as functional foods and nutraceuticals, Proteins as functional food ingredients i.e. whey proteins, soya proteins etc. Complex carbohydrates and Fibres as functional food ingredients. Antioxidants and other phytochemicals, (isoflavones, lycopenes), phytosterols and their role as nutraceuticals and functional foods. Oils with MUFA, n3 and n6 PUFA as nutraceuticals and functional foods.

## **UNIT-III**

**[8]**

Food as nutraceutical and functional foods, Probiotic foods and their functional role. Cereal products as functional foods - oats, wheat bran, rice bran etc. Functional fruits and vegetable products, oil seeds etc. Sea foods, Fat replacers, Beverages such as green tea, coffee, cocoa, fruit juices as functional foods and their protective effects. Herbs as functional foods, health promoting activity of common herbs.

## **UNIT-IV**

**[8]**

Stability and safety issues, Stability and bio-availability of functional ingredients in foods, Effects of processing, storage and interactions of various environmental factors on the potentials of such foods, interaction if drugs and nutraceutical. Safety, regulatory issues and marketing for functional foods and nutraceuticals.

## **UNIT-V**

**[8]**

Future of nutraceuticals and functional foods, Recent developments and advances in the areas of nutraceutical and functional foods and their role in nutrigenomics in health care.

### **Suggested Readings:**

1. Mazza,G , Functional foods - biochemical and processing aspects, Technomic Publ. Lancaster, USA.
2. Kirk, RS ,Pearson's composition and analysis of foods. Wesley Longman Inc. California, USA.
3. Association of official analytical chemists ,Official Methods of Analysis , USA.
4. Wildman, REC ,Handbook of Nutraceuticals and Functional Foods.
5. Paul Paquin ,Functional and Speciality Beverage Technology, Woodhead Publishing Ltd., Cambridge, UK

**FOOD INDUSTRY WASTE AND BYPRODUCT MANAGEMENT**  
**FT-704**

*w.e.f. Session 2014-15*

**L T P**

**3 1 0**

**Unit 1**

**[8]**

Introduction: Sources of waste and pollutants, Classification and characterization of Solid, Liquid and Gaseous wastes, such as wastes from fruit and vegetable and treatment of solid wastes from agro wastes. Basic considerations: Standards for emission or discharge of environmental pollutants from food processing Industries as per the updated provision of Environment (Protection) Act, 1986.

India -nature of different waste - Waste utilization from rice mill- Thermal and biotechnological use rice husk-cement preparation and different thermal application - utilization of rice bran-stabilization-defatted bran utilization.

**Unit 2**

**[8]**

Utilization of Fruit and Vegetable Wastes:

Types Of Waste And Waste Generation in Different Food Processing Industries: Concept, scope and importance of waste management and effluent treatment Temperature, pH, Oxygen Demands (BOD, COD), Measurement of levels of Pollution such as COD, BOD, TOD, fat, oil and grease content, metal content, forms of phosphorus and sulphur in waste waters, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues

Processes for waste utilization from fruit and vegetable industries - Distillation for production of alcohol - oil extraction from waste - waste management in sugar mills - citric acid production from fruit waste, extraction of active ingredients from fruit waste.

**Unit 3**

**[8]**

Fish, Meat and Poultry And Tuber Crops Waste Utilization :

Fish Industry by products and Waste utilization-meat and poultry waste recycling. Waste from tuber crops - effluent safe disposal- effluent treatment plant - waste recycling plant - feasibility report for food industries using food waste and by products.

#### **Unit 4**

**[8]**

By-Products Utilization of Wheat and Pulse Mill :

By products of wheat milling- germs and bran - by products of pulses milling - husk, germs and broken. Coconut processing - by-product utilization - fuel briquette.

#### **Unit 5**

**[8]**

Biodegradability : Concept of biodegradability, Criteria of Pollution, Physical Chemical and Biological properties, Soluble, suspended and volatile solids. Ammonia Nitrogen and Biological indicator. BOD Dilution test and mathematical model for BOD curve.

Typical Case Studies: Characterization and treatment of liquid wastes from Dairy, Slaughter house etc. Process of anaerobic bio-methanation, Conventional aerobic process, Aerated lagoon, Strategies for utilization of Biomass residues after fruit/food processing. Animal and community waste. Landfill and composting. Environmental protection act and specifications for effluent of different food industries, waste Utilization, Effluent treatment, Pre-treatment of waste : sedimentation, coagulation, flocculation and floatation, Secondary treatments: Biological oxidation-trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons, Tertiary treatments: Advanced waste water treatment process-sand, coal and activated carbon filters, phosphorus, sulphur, nitrogen and heavy metals removal.

#### **Suggested Readings:**

1. Green and Krammer, Food Processing Work Management ; CBS Publication
2. Mariett NG, Principles of Food Sanitation; CBS Publication

3. Lawrence K.Wang, Yung-Tse Hung Howard H.Lo, Waste Treatment in the Food Processing Industry; Constantine Yapijakis : CRC Taylor and Francis group, Boca Raton London, New York
4. Metcalf and Eddy, Waste Water Engineering Treatment Disposal and Reuse; Tata McGrawHill Book company NY
5. GN Pandey and GC Carney, Environmental Engineering; Tata McGraw Hill Pub Co Ltd. New Delhi.
6. J.H. Green Food Processing Waste Management
7. Environment (Protection) Act
8. AFST(I) & CFTRI Proceedings of the Symposium on Byproducts From food Industries: Utilization and Disposal

# **FOOD PRODUCTS DEVELOPMENT AND SENSORY EVALUATION**

**FT-705(E1)**

*w.e.f. Session 2014-15*

**L T P**

**3 1 0**

## **UNIT-I**

**[8]**

New Proprietary Food Products: Sources for R&D initiative, Definition, Classification, Characterization, Factors shaping new product development- Social concerns, health concerns, impact of technology and market place influence. Market Survey, Consumer survey to identify new products in terms of Line Extension Repositioning Existing Products New form/Reformulation. New packaging of existing products Innovative products, Creative Products. Tapping traditional foods and unconventional sources of foods. Minimizing post harvest losses. Identification of concept and product for development, Market research for the concept and selected product, Identification of products, selection of one product and its standardization improving success.

## **UNIT -II**

**[8]**

Bulk preparation of product, Packaging and Labelling of the product, Packaging design, graphics and labeling nutritional evaluation (estimation of relevant parameters), Shelf life testing of the product (testing for appropriate quality parameters- chemical, microbiological and nutrient content, acceptability studies), Product integrity and conformance to standard, Costing the product and determining the sales price, Advertising and test marketing the product, Report preparation.

## **UNIT-III**

**[8]**

Overview of sensory principles and practices: General consideration in sensory testing, flowcharts of sensory evaluation. Anatomy, physiology and function of various senses.

## UNIT-IV

[8]

Psychological methods Selection and screening of panel: Types of panel (Trained panel, discriminative and communicative panel). Methodology for sensory evaluation: Discriminative test - difference test: paired comparison, Duo-trio, triangle, ranking, Sensitivity Test, Descriptive test - category scaling, ratio scaling, flavor profile analysis, texture profile analysis, quantitative descriptive analysis.

## UNIT-V

[8]

Effective Tests: paired performance test, ranking test, rating scale: hedonic rating, food action scale rating. Maintaining suitable environmental conditions: laboratory setup and equipments

Sample preparation, Basic statistical concepts for sensory evaluation: Hypothesis testing and sensory inference, variation of T Test, Nonparametric and binomial based, Statistical methods, Chi-square test, analysis of variation, Correlation regression.

### Suggested Readings:

1. Lyon, D.H.; Francombe, M.A.; Hasdell, T.A.; Lawson, K. (eds) ,Guidelines for Sensory Analysis in Food Product Development and Quality Control, Chapman and Hall, London.
2. Amerine, M.A.; Pangborn, R.M.; Roessler, E.B.,Principles of Sensory Evaluation, Academic Press, New York.
3. Kapsalis, J.G,Objective, Methods in Food Quality Assessment, CRC Press, Florida.
4. Martens, M.; Dalen, G.A.; Russwurm, H. (eds), Flavour Science and Technology, John Wiley and Sons, Chichester.
5. Moskowitz, H.R.(eds), Food Texture: Instrumental and Sensory Measurement, Marcel Dekker Inc. , New York.

# PLANT CELL AND TISSUE CULTURE

FT-705(E2)

w.e.f. Session 2014-15

**L T P**

**3 1 0**

## **UNIT I**

**[8]**

History, basic concepts and general procedure: Cell Theory to totipotency; History of Plant Tissue culture including important work on tissue culture in India. Layout of a tissue culture laboratory, Aseptic procedures, growth of cultures under controlled conditions, steps in tissue culture, Basic terminology, Hardening or acclimatization, Aseptic areas, Dry heat methods, Wet heat, Ultra filtration , Chemicals, Antibiotics, UV

## **UNIT II**

**[8]**

Nutritional requirements in plant tissue culture: role of inorganic salts, vitamins, amino acids and amides, carbon source, water, osmotica, nutrient matrix, charcoal, hormones, H-Ions.

Plant Hormones, their occurrence and functions, mechanism of action, applications of hormones in plant tissue culture Manipulation of cytokinin and auxin ratio affects organogenesis

## **UNIT III**

**[8]**

Protoplast and cell culture: Technique of protoplast fusion, incompatibility barriers. The details of cell and protoplast culture, Callus cultures, Organ culture, Embryo culture, Meristem culture, Anther/ovule culture, Protoplast cultures, Somatic embryogenesis. Cryopreservation as a technique and its applications for storage of germplasm.

Somaclonal variants as a source of variability for agriculturally important characters. Chemical mutagens such as EMS or nitroso-guanidine employed to create variability, occurrence of somaclonal variations in crops including sugarcane, potato, tobacco, tomato and rice and for agronomically important characters such as disease resistance, stress and herbicide tolerance.

#### UNIT IV

[8]

Genetic fidelity of culture systems and common problems: Possible problems in tissue culture and their solutions: Culture contamination, explant death, no growth of explants, leggy shoots, unwanted callus, chlorotic leaves, poor or no rooting and other problems common to tissue cultures will be discussed

#### UNIT V

[8]

Applications of cell cultures in Food Science: Multiplication of highly valued plant material: rare, new, imported plant varieties. Production of Natural Food flavors, additives and preservatives, Production of amino acids (glutamate, feed additives), organic acids, nucleotides (IMP, GMP) using cell culture tools. Biosynthesis of high value flavors, colors, preservatives, nutritional supplements etc. Vanillin from *Vanilla species*; Steviosides from *Stevia*, Ginseng saponines from *Panax ginseng*; Shikonin from *Lithospermum*

#### Suggested Readings:

1. Bhojwani, S. S. and Rajdan, M. K. (1983). Plant Tissue Culture: Theory and Practice: Developments in Crop Sciences, Amsterdam, Elsevier
2. Vasil, I. K. and Thorpe, T. A. (1994) (eds). Plant Cell and Tissue Culture. Dordrecht, The Netherlands: Kluwer.
3. Smith, R. H. (2000). (ed). Plant Tissue Culture. Academic Press.
4. Dodds, J. H. and Roberts, L. W. (1996). Experiments in Plant Tissue Culture. Cambridge University Press, Cambridge

# **IPR IN FOOD SECTOR**

**FT-706(E1)**

*w.e.f. Session 2014-15*

**L T P**

**3 1 0**

## **UNIT-I**

**[8]**

Introduction - GATT - A historical perspective, objectives, fundamental principles, GATT rounds. WTO Historical background- Objectives, scope, function and structure, membership and withdrawal, dispute settlement.

## **UNIT-II**

**[8]**

Conventions and treaties (WTO, GATT, Paris convention, Madrid protocol, Berne convention, Budapest treaty, etc). Trade related aspects of Intellectual property rights (TRIPs) agreement - An overview, WIPO and its role.

## **UNIT-III**

**[8]**

Patents - Indian Patent law, meaning, scope, objectives, patentability criteria, patentable and non patentable inventions. Kinds of patent applications, procedure for obtaining patent. Patent specification (provisional, complete specification), drafting, patent claims. Patent opposition, enforcement and revocation, fee structure. Patent Cooperation Treaty, Sources of patent information, patent databases.

## **UNIT-IV**

**[8]**

Protection of biological material and biotechnology. IPR and Biodiversity. IPR and Plant Breeders Rights (UPOV and PPV and FR Acts). US and European patent system - comparison with Indian patent system. Copyrights - Introduction, how to obtain, scope, term, treaties, infringement. Trademarks- Introduction, how to obtain, scope, term, different types of marks (collective, certification, service).

## **UNIT-V**

**[8]**

Industrial designs - Definition, how to obtain, features, international design registration. Geographical indications, Trade secrets, Layout design of Integrated

circuits.IP- licensing and technology transfer- licensing agreements, issues in licensing, valuation of technology, data exclusivity.IP infringement issues and enforcement.

**Suggested Readings:**

1. Bhandari Surendra, World Trade Organization and Developing Countries, Deep and Deep Publications, New Delhi.
2. Kumar Ratnesh, World Trade Organization, Deep and Deep Publications, New Delhi.
3. Mittal D.P., Indian Patent Law [As Patent (Amendment) Act, 2005], Taxman's Allied Service (P) Ltd., New Delhi.
4. Ganguli Prabhddh, Gearing up for Patents: The Indian Scenario, University Press, Hyderabad.
5. Wadehra B.L., Law Relating to Patent Trademark Copyright Designs and Geographical Indications, Universal Law

# POST HARVEST MANAGEMENT OF FRUITS AND VEGETABLES

FT-706(E2)

w.e.f. Session 2014-15

**L T P**

**3 1 0**

## **UNIT I**

**[8]**

Harvesting vs. physiological maturity, Harvester indices, Post-harvest technology: Importance of post harvest management of food; Causes of post-harvest losses; General principles and method of preservation; Importance & scope of post harvest management of fruits and vegetables in Indian economy

## **UNIT II**

**[8]**

Morphology, structure and composition of fruits and vegetables; maturity indices and standards for selected fruits and vegetables; methods of maturity determinations, Physiological post harvest disorders - chilling injury and disease; prevention of post harvest diseases and infestation;

## **UNIT III**

**[8]**

Factors affecting post harvest losses; Standards and specifications for fresh fruits and vegetable. Harvesting and handling of important fruits and vegetables, Harvesting tools and their design aspects; primary processing for sorting and grading at farm and cluster level

## **UNIT IV**

**[8]**

Post-harvest physiological and biochemical changes in fruits and vegetables; ripening of climacteric and non-climacteric fruits; Storage practices: pre-cooling and cold storage, Zero energy cool chamber; Commodity pretreatments - chemicals, wax coating, prepackaging, VHT and irradiation.

## UNIT V

[8]

Handling and packaging of fruits and vegetables; Post Harvest handling system for fruits and vegetables of regional importance such as citrus, mango, banana, pomegranate, tomato, papaya and carrot etc., packaging house operations; principles of transport and commercial transport operations.

### **Suggested Readings:**

1. Kadar AA.1992. Post-harvest Technology of Horticultural Crops. 2nd Ed. University of California.
2. Lal G, Siddapa GS & Tandon GL.1986. Preservation of Fruits and Vegetables. ICAR.
3. Verma LR. & Joshi VK. 2000. Post Harvest Technology of Fruits and Vegetables. Indus Publ.
4. Eggmark standards by DMI, GoI.
5. Cold chain standards by NHB, GoI.

# **INDUSTRIAL TRAINING**

**FT-751**

*w.e.f. Session 2014-15*

The student(s) will be required to undertake training in the food industry after III B.Tech.VI semester for a specified period and submit its report after completion for evaluation and oral examination in the VII semester of his studies in Final B.Tech.