SYLLABUS
B.Tech. (Food Engg. and Technology)

Semester V

No.	Subject Code	Subjects	Hours/week (L + T)	Marks	Credits
1		Chemical Engineering Operations	2+1	50	3
2		Chemical Reaction Engineering	2+1	50	3
3	FDT 1016	Fermentation Technology	2+1	50	3
4	FDT 1017	Technology of Fruits, Vegetables and Tubers	2+1	50	3
5.	FDT 1018	Technology of Meat, Fish and Poultry	2+1	50	3
6	FDT 1019	Food Packaging	2+1	50	3
		TOTAL	**18**	**300**	**18**
7	FDP 1015	Food Chemistry Lab	8	100	4
8	FDP 1016	Microbiology Lab – II	4	50	2
9	FDP 1017	Biochemistry Lab – II	4	50	2
		Total	**8**	**100**	**4**
			26	**600**	**20**

Semester VI

No.	Subject Code	Subjects	Hours/week (L + T)	Marks	Credits
1	FDT 1021	Principles of Food Preservation	3+1	100	4
2	FDT 1022	Food Engineering	2+1	50	3
3	FDT 1023	Technology of Cereals, Legumes and Oilseeds	2+1	50	3
4	FDT 1024	Technology of Plantation Crops	2+1	50	3
5	FDT 1051	Elective-I : Nutraceuticals and functional foods	2+1	50	3
		TOTAL	**19**	**350**	**19**
6		Chemical Engineering Laboratory	4	50	2
7	FDP 1018	Analysis of Foods – I (Chemical)	8	100	4
8	FDP 1019	Food Processing – I	4	50	2
		Total	**16**	**200**	**8**
			35	**550**	**27**

In-Plant Training: 50 marks/2 credits

Semester VII

No.	Subject Code	Subjects	Hours/week (L + T)	Marks	Credits
1		Food Project Economics (common)	2+1	50	3
2		Industrial Psychology and Human Resource	2+1	50	3

		Management (common)			
3	FDT 1025	Technology of Milk and Dairy Products	2+1	50	3
4	FDT 1026	Food Biotechnology	2+1	50	3
5	FDT 1027	Food Process Engineering	2+1	50	3
6	FDT 1052	Elective- II: Principles of Food Analysis	2+1	50	3
		TOTAL	**18**	**300**	**18**
7	FDP 1020	Food Processing – II	8	100	4
8	FDP 1021	Analysis of Foods – II (Instrumental)	4	50	2
9	FDP 1022	Seminar	4	50	2
		Total	**16**	**200**	**8**
			34	**500**	**26**

Semester VIII

No.	Subject Code	Subjects	Hours/week (L + T)	Marks	Credits
1		Industrial Management	2+1	50	3
2		Value Education	2+1	50	3
3		Design and Analysis of Experiments	2+1	50	3
4	FDT 1028	Food safety, quality and regulations	2+1	50	3
5	FDT 1029	Current Topics in Food Science and Technology	2 +1	50	3
6	FDT 1053	Elective III : Waste Management in Food Processing	2+1	50	3
		TOTAL	**18**	**300**	**18**
7	FDP 1023	Food Processing – III	4	50	2
8	FDP 1024	Experimental Project	12	150	6
		Total	**16**	**200**	**8**
			34	**500**	**26**

Electives to be offered by Food Engineering and Technology Department and their prerequisite

S. No.	Elective	Prerequisite
1	Nutraceuticals and functional foods (Sem VI)	Nil
2	Principles of Food Analysis (Sem VII)	Nil
3	Waste Management in Food Processing (Sem VIII)	Nil

FDT 1016: Fermentation Technology (Sem V)

No.	Topic	Number of lectures (30)
1	Biochemistry of fermentation and energy metabolism. Isolation, purification and microbial strain improvement for increased production of the industrial products	04
2	Application of genetic control mechanisms in industrial fermentation processes. Principles of surface and solid-state fermentations; Fermentation media and sterilization	02
3	Design of different fermenters including enzyme reactors and photobioreactors. Scale-up of fermentation processes; Process control of fermentations	05
4	Fermentative production of alcoholic beverages, organic acids, vitamins, antibiotics, polysaccharides, amino acids, vinegar, dairy starter cultures and single cell protein. Traditional Indian fermented products based on dairy and soya	06
5	Enzyme kinetics and process optimization for product formation for industrially important micro-organisms and cell cultures. Enzyme fermentation and technology including immobilisation and stabilisation. Biotransformations and bioconversions with special reference to steroids.	08
6	Isolation, purification and down stream processing of intracellular and extracellular enzymes	05

Suggested reading:

1. Fermented Food Beverages in Nutrition, Gastineau CF, Darby WJ and Turner TB, 1979, Academic Press.
2. Advances in Biotechnology, Moo-Young M, 1981, Pergamon Press.
3. Fermentation Biotechnology: Principles, Processes and Products, Ward OP, 1989, Prentice-Hall.
4. Principles of Fermentation Technology, Stanbury PF, Whitaker A and Hall SJ, 1997, Elsevier.

FDT 1017: Technology of Fruits, Vegetables and Tubers (Sem V)

No.	Topic	Number of lectures (30)
1	Fruits and Vegetables: Post harvest handling, storage, control of ripening, etc. of Fruits	3
2	Post harvest handling, storage, control of ripening, etc. of vegetables	3
3	Fruits: Processing techniques, juices, concentrates, preserves and other traditional products.	8
4	Vegetables: Processing techniques, pickles, fermented pickles and	8

	other traditional products.	
5	Dehydrated and speciality products and by-products of fruits and vegetables	4
6	Honey, Sugars and saccharine products. Soft drinks, fermented pickles.	4

Suggested reading:

1. Post harvest biotechnology of vegetables, Salunkhe D.K.
2. Post harvest biotechnology of fruits, Salunkhe D.K.
3. Handbook of fruits science and tech. Salunkhe D.K. and Kadam S.S.
4. Handbook of vegetable science and tech. Salunkhe D.K. and Kadam S.S.
5. Processing vegetables: Sc. & Tech. Smith et al.

FDT 1018: Technology of Meat, Fish and Poultry (Sem V)

No.	Topic	Number of lectures (30)
01	Slaughtering technique of animal and slaughtering practices; Meat cuts and portions of meat. Post mortem changes in meat; Conversion of muscle to meat; Color of meat; Meat microbiology and safety Meat processing- Smoking and Curing; Prepared meat products including fermented meats. Frozen meat and meat storage; Packaging of meat products. Meat plant hygiene – GMP and HACCP. By-products from meat industries and their utilization; Meat industries in India	13
02	Classification of fresh water fish and marine fish; Commercial handling, storage and transport of raw fish. Average composition of fish; Freshness criteria and quality assessment of fish; Spoilage of fish. Methods of processing and preservation of fish- Canning, Freezing, Drying, Smoking and Curing. Fish products – fish meal, fish protein concentrate, fish liver oil, fish sauce and surimi; Fish processing industries in India.	13
03	Classification of poultry meat; Composition and nutritional value of poultry meat and eggs. Processing of poultry meat and eggs; Spoilage and control. By-product utilization; Poultry farms in India	04

Suggested reading:

1. Processed Meats, Pearson AM and Gillett TA, 3rd edition, 1999, An Aspen publication.
2. Development in Meat Science (Development series 3, Lawrie RA, 1981, Applied Sciences.
3. Egg and Poultry Meat Processing – Stadelman WJ, Olson VM, Shemwell GA and Pasch S, 1988, Ellis Horwood Ltd.
4. Fish as Food – Vol 1 & 2 – Borgstrom G, 1988, Academic Press.

5. Advances in Fish Processing technology, Sen DP, 2005, Allied Publishers Pvt. Ltd.

FDT 1019: Food Packaging (Sem V)

No.	Topic	Number of lectures (30)
1	Packaging as a method for conservation and protection of foods. Different packaging materials and their properties – including barrier properties, strength properties, optical properties etc. Glass, aluminium, tin, paper, boards, plastics, composites.	10
2	Packaging of various food commodities including fresh produce (fruits and vegetables), meat, fish, poultry and processed foods.	05
3	Evaluation of quality and safety of packaging materials – different testing procedures	05
4	Food and Packaging material interaction including migration, scalping of flavour etc. Package design, Solution of packaging material and design.	05
5	Selection of packaging material and design. Newer packaging technologies- CAP/MAP packaging, aseptic processing and packaging, irradiated packaging, retort pouch, microwaveable packaging	05

Suggested reading:

1. Packaging Media by Paine F.A. Publisher: Blackie and son Ltd., Bishop Briggs (1977)
2. Food Packaging and Preservation : theory and practice by Mathlouthi.,M. Publisher
3. Elsevier applied science publishers.London (1966)
4. Food and Packaging Interactions by Risch.S.H. Publisher American chemical society, Washington (1991).
5. Handbook of Food Packaging by F.A. Paine and H.Y. Paine Publisher: Blackie and son Ltd. London. (1983)
6. Food Packaging Technology (Vol.1 & 2) by G. Bureau and J.L.Multon, Publisher:VCH, New York (1996)
7. Packaging Materials and Containers by Paine, F.A.Publisher: Blackie and sons Ltd.., London, 1967.

FDP 1015: Food Chemistry Lab (Sem V)

No.	Topic	Total Practicals (30) (8h/week)
1	Estimation of sulphur dioxide (KMS)	01

2	Estimation of sodium benzoate	01
3	Estimation of sorbic acid and sorbate	02
4	Estimation of Propyl gallate	01
5	Estimation of sweeteners	01
6	Identification of hydrocolloids	02
7	Estimation of other food additives	03
8	Quantitative estimation related to food constituents	03
9	Iodine estimation	01
10	Estimation of chlorophyll and carotenoids	01
11	Quantitative estimation of anti-nutritional factors	03
12	Evaluating the effect of food processing on food constituents	03
13	Estimation of contaminants	03
14	Estimation of tin	01
15	Food adulteration	02
16	Sensory analysis of food samples	02

FDP 1016 : Microbiology Lab- II (Sem V)

No.	**Topic**	**Total Practicals (15) (4h/week)**
1	Isolation Of Microbes From Food Samples	02
2	Phenol coefficient of a disinfectant	02
3	Effect of physicochemical factors on growth of microorganisms	02
4	Nutritional requirements of microorganisms	02
5	Isolation and characterization of microbes based on morphological and physiological characteristics	03
6	Evaluation of microbial quality of food and water sample	02
7	Study of milk microbiology	02

FDP 1017 : Biochemistry Lab – II (Sem V)

No.	Topic	Total Practicals (15) (4h/week)
1	Introduction to enzymology	01
2	Study of amylases	01
3	Study of proteases	01
4	Study of lipases	01
5	Study of invertases	01
6	Study of lactases	01
7	Enzymes as indicators of thermal processing	01
8	Estimation of K_m and V_{max}	01
9	Estimation of trypsin inhibitor	01
10	Enzyme purification by ammonium sulphate	01
11	Enzyme purification by gel filtration	01
12	Estimation of Enzyme purity by PAGE	01
13	Estimation of ascorbic acid	01
14	Estimation of thiamine	01
15	Estimation of vitamin E	01

FDT 1021: Principles of Food Preservation (Sem VI)

No.	Topic	Number of lectures (60)
1	Thermal processing: Canning of food products - Canning of food products: Classifications of cans, Structure of cans, corrosion, Lacquering, Spoilage in canned foods. Thermal process time for canned foods	06
2	Newer techniques in thermal processing - Retort processing, UHT, Extrusion - hot and cold	06

3	Newer methods of non-thermal processing- Ohmic heating, Pulsed electric field, Dielectric heating, Infra-red microwave heating.	05
4	Water activity for food and its significance in food preservation. Psychometric charts;Dehydration and drying of foods; Different types of dryers, IMF foods. Osmotic dehydration	10
5	Freezing and cold storage including cryogenic freezing. Properties of frozen foods; Enthalpy change during freezing; Plank's equation for predicting rates of product freezing; Refrigeration load. IQF. Freeze concentration, dehydrofreezing, freeze drying,	13
6	Preservation by ionizing radiations, Ultrasonics, High pressure and Membrane Technology. Preservation by fermentation – Curing and Pickling; Smoking	10
7	Controlled and modified atmospheric storage. Chemical preservatives, biopreservatives , antimicrobials; hurdle technology.	10

Suggested reading:

1. The Technology of Food Preservation, Desrosier NW, 1977, The AVI Publishing Co. Inc.
2. Food Processing Technology: Principles and Practice, Fellows PJ, 2005, CBS Publishers.
3. Principles of Food Science, Fennema O.R.

FDT 1022: Food Engineering (Sem VI)

No.	**Topic**	**Number of lectures (30)**
1	Principles of mass and energy balance in food processing operations	02
2	Transport phenomena with respect to foods. Fluid dynamics, Newtonian and non Newtonian fluid, Bernoulli's Theorem, Rheological properties of foods	05
3	Principles of Heat transfer. Steady state and transient heat transfer. Estimation of Conductivity and other thermal properties of foods	05
4	Freezing and Thawing calculations	03
5	Basics of mass transfer	02
6	Process design aspects for liquid foods such as milk and juices. Concentration with thermal and membranes processes	03
7	Process and equipment design for food processing such as dehydration, cold and hot extrusion, retort.	10

Suggested reading:

1. The Fundamentals of Food Engineering, Charm SE, 1963, The Avi Publishing Co.
2. Engineering Properties of Foods, Rao MA and Rizvi SSH, 1986, Marcel Dekker Inc.
3. Fundamentals of Food Process Engineering, Toledo RT, 2000, Chapman and Hall.
4. Elements of Food Engineering, Watson EL and Harper JC, 1989, The Avi Publishing Co.
5. Food Process Engineering, Heldman DR and Singh RP, 1984, Chapman and Hall.

6. Food Engg. Fundamentals, J. Clair Batty, 1983, John Wiley & Sons.

FDT 1023: Technology of Cereals, Legumes and Oilseeds (Sem VI)

No.	Topic	Number of lectures
1	Varieties of grains, cereals and legumes grown and consumed in various countries. Post harvest handling and storage.	05
2	Processing operations such as milling, pearling, par boiling	05
3	Bakery technology	05
4	Wheat processing – flour mills, different fractions, modernizations and commercial aspects for Indian and global market. Chapati making, sheeting and other mechanization and preservation of chapatti	10
5	Malt and malt products	02
6	Extruded, puffed and fermented cereal based products, Indian traditional products	03

Suggested reading:

1. The chemistry and technology of cereals as food and feed, Matz S.A.,
2. Cereal Science and technology, Hoseney R.C.
3. Cereal Processing and Technology, Gavin Owens
4. Wheat – Chemistry and Technology, Pomeranz, Y

FDT 1024: Technology of Plantation Crops (Sem VI)

No.	Topic	Number of lectures
1	Varieties of spices and condiments grown and consumed in various countries. Post harvest handling and storage.	07
2	Processing and preservation of spices and condiments, oleoresins, flavour extract, solvent extraction, micro-encapsulation and applications in food products	07
3	Processing of tea. Varieties and processing, green tea, oolong tea, black tea, antioxidant properties	07
4	Processing of coffee and cocoa	07
5	Miscelleneous products including sugar from sugarcane, confectionery gums etc. from plants	02

Suggested Reading:

1. Spices – J.W. Purseglove, E.G. Brown and C.L.Green
2. Handbook of herbs and spices – K.V. Peter
3. Chocolate, cocoa and confectionery : Science and Technology – 3rd Edition 1989 Minifie

4. Industrial Chocolate Manufacture and Use, Edited by Stephen Beckett, 4th Edition Publisher Wiley Blackwell, ISBN: 978-1-4051-3949-6

Elective I- FDT 1051: Nutraceuticals and functional foods (Sem VI)

No.	Topics	Number of lectures (30)
1	Introduction to nutraceuticals: definitions, synonymous terms, basis of claims for a compound as a nutraceutical, regulatory issues for nutraceuticals including CODEX	05
2	Concept of angiogenesis and the role of nutraceuticals/functional foods; Nutraceuticals for cardiovascular diseases, cancer, diabetes, cholesterol management, obesity, joint pain, immune enhancement, age-related macular degeneration, endurance performance and mood disorders – compounds and their mechanisms of action, dosage levels, contraindications if any etc.	12
3	Manufacturing aspects of selected nutraceuticals such as lycopene, isoflavonoids, prebiotics and probiotics, glucosamine, phytosterols etc.; formulation of functional foods containing nutraceuticals – stability and analytical issues, labelling issues	08
4	Clinical testing of nutraceuticals and health foods; interactions of prescription drugs and nutraceuticals; adverse effects and toxicity of nutraceuticals; nutrigenomics – an introduction and its relation to nutraceuticals	09

Suggested Reading:

1. Geoffrey P. Webb. 2006. Dietary supplements and functional foods. Blackwell Publishing.
2. Losso, JN. 2007. Angi-angiogenic functional and medicinal foods. CRC Press.
3. Cupp, J and Tracy, TS.2003. Dietary supplements: Toxicology and Clinical Pharmacology. Humana Press.
4. Manson, P.2001. Dietary supplements (2nd Ed) Pharmaceutical Press.
5. Campbell, JE and Summers, JL. 2004. Dietary Supplement Labeling Compliance .
6. Shi, J.2007. Functional Food Ingredients and Nutraceuticals: Processing Technologies. Taylor & Francis Publ. CRC Press.
7. Goldberg, I 1994. Functional Foods: Designer Foods, Pharma foods, Nutraceuticals Chapman & Hall.
8. Robert E.C. 2006. Handbook of Nutraceuticals and Functional Foods. 2nd Ed.Wildman.
9. Brigelius-Flohé, J and Joost, HG. 2006. Nutritional Genomics: Impact on Health and Disease.Wiley-VCH
10. Neeser, JR and German, BJ. 2004. Bioprocesses and Biotechnology for Functional Foods and Nutraceuticals. Marcel Dekker.

11. Gibson, GR and William, CM. 2000. Functional foods - Concept to Product. Woodhead.

FDP 1018: Analysis of Foods- I (Chemical) (Sem VI)

No.	Topic	Total Practicals 30 (8h/week)
1	Analysis of tea and coffee	02
2	Analysis of liquid milk, condensed milk and skim milk powder	03
3	Analysis of honey and golden syrup	03
4	Analysis of wheat flour, starch and baking powder	03
5	Analysis of beer and wine	02
6	Analysis of jam, jelly and squash	03
7	Analysis of fish	02
8	Analysis of spices	02
9	Analysis of vinegar	02
10	Analysis of ghee and edible oil	03
11	Analysis of bread, cake and biscuit	03
12	Analysis of tin in canned foods	02

FDP1019: Food Processing – I (Sem VI)

No.	Topic	Total Practical (15) (4h/week)
1	Preparation of mango products (minimum three types)	02
2	Preparation of apple products (minimum three types)	02
3	Preparation of pineapple products (minimum three types)	02
4	Preparation of guava products (minimum three types)	01
5	Preparation of lime products (minimum three types)	02
6	Preparation of tomato products (minimum three types)	02
7	Preparation of coconut products (minimum three types)	02

8	Preparation of salad dressing, mayonnaise and peanut butter	01
9	Preparation of fried products	01

FDT 1025: Technology of Milk and Dairy Products (Sem VII)

No.	Topic	Number of lectures (30)
1	TQM in Food Industry. Technology of milk and dairy products. Pasteurisation sterilization, HTST and UHT processes.	04
2	Manufacture of condensed milk, milk powder, cheese, ice-cream, butter, ghee, malted products, evaporated and dried products, their evaluation and quality parameters, defects encountered during production, packaging and storage.	16
3	Substitutes for milk and milk products. Casein and caseinates, lactose, whey protein concentrates and isolates, milk coprecipitates, and other by-products.	05
4	Technology of baby foods, weaning foods, therapeutic foods. Fortification and enrichment.	02
5	Traditional dairy products, milk confections such as *yoghurt, dahi, khoa, burfi, kalakand, gulabjamun, rosogolla, srikhand, chhana, paneer, ghee, lassi* etc. Probiotic milk products.	03

Suggested reading:

1. Aneja *et al.* 2002. Technology of Indian Milk Products. Dairy India Publ. De S.1980. Outlines of Dairy Technology. Oxford Univ. Press.
2. Rathore,NS et al. 2008.Fundamentals of Dairy Technology- Theory & Practices. Himanshu Publ
3. Walstra et al. 2006. Dairy Science and Technology. 2nd Ed. Taylor & Francis.
4. Web BH. et al. 1987. Fundamental of Dairy Chemistry. 3rd Ed. AVI Publ.
5. Walstra et al. 1999. Dairy Technology. Marcel Dekker.

FDT 1026: Food Biotechnolgy (Sem VII)

No.	Topic	Number of lectures (30)
1	Application of Biotechnology in Food, Pharmaceutical and other industries	02
2	Basics of Molecular Biology- Chemistry and Biology of DNA, RNA and proteins. DNA replication, transcription and translation in prokaryots and eukaryots	08
3	Regulation of gene expression in prokaryots and eukaryots. Recombinant DNA technology (genetic engineering)	06
4	Basics of strain improvement techniques	03
5	Genetically modified food – plant and animal origin	03
6	Plant tissue culture; use of microalgae in biotechnology. Tissue culture (animal/insect cell) as a tool of biotechnology	04
7	Nutritional genomics	04

Suggested Reading:

1. Basic molecular and Cell Biology 3rd edition Ed. David Latchman. BMJ Publishing Group 1997. 1st Indian reprint 2006.
2. Gene cloning and DNA analysis. An Introduction 4th edition. T.A.Brown. Publishers Blackwell Sciences Ltd. UK 2001.
3. Introduction to plant biotechnology. H.S. Chawla 2nd edition. Publishers Oxford and IBH Publ. Co. Pvt. Ltd., New Delhi.
4. Cell and tissue culture; laboratory procedures in biotechnology. A. Doyle and J.B. Griffiths. John Wiley & Sons, Chichester, UK. 1998.

FDT 1027: Food Process Engineering (Sem VII)

No.	Topic	Number of lectures (30)
1	Important aspects of product and process development. Basic flow sheet development for food processing.	05
2	Thermal processing. Canning and retort processing – process design and equipment. Equipment design aspects of pasteurizer, homogenizer, sterilizers, evaporators and concentrators, dryers and their design parameters – tray dryer, spray dryer, fluidized bed dryer and solar dryer	10
3	Construction of cold storages and refrigerated vans; Types of freezers and their design parameters – plate contact freezer, air blast freezer, cryogenic freezer.	05
4	Other food processing such as Bakery machines and equipment; Sheeting, mixing and blending, Extrusion and other non thermal processing – process design and equipment	05
5	Food processing Plant layout, CGMP, material of construction, corrosion, waste utilization. Process control, optimization and preliminary project costing.	05

Suggested reading:

1. Fundamentals of Food Process Engineering, Toledo RT, 2000, Chapman and Hall.
2. Elements of Food Engineering, Watson EL and Harper JC, 1989, The Avi Publishing Co.
3. Food Process Engineering, Heldman DR and Singh RP, 1984, Chapman and Hall.
4. Engineering Economics, Dwivedi DN and Dwivedi A, 2005; Vikas Publishing House Pvt. Ltd.
5. Plant Layout and Material Handling, Apple JM, 1977, John Wiley & Sons.
6. Manufacturing Facilities, Design and Material Handling, Meyers FE and Stephens MP, 2000, Prentice Hall.

Elective II- FDT 1052 Subject: Principles of Food Analysis (Sem VII)

No.	Topics	Number of lectures (30)
1	Types of samples analysed, steps in analysis, choice of methods; sampling procedures, considerations and sample preparation; Evaluation of analytical data – accuracy and precision, sources of errors, specificity, sensitivity and detection limits, regression analysis, reporting results	05
2	Analysis of chemical constituents, their characterization and significance- moisture, ash, minerals, lipids, fat, proteins, fibre, titratable acidity, starch, reducing sugars	05
3	Spectroscopic analysis of foods – basic principles, UV, visible, fluorescence,IR, AAS, MS, NMR. Chromatographic analysis of foods – basic principles, HPLC, GC, GLC, principles and applications	10
4	Analysis of vitamins, pigments, flavours, extraneous matter, pesticides and mycotoxins. Microscopic analysis of foods Other methods- potentiometry, enzymatic, immunoassays, thermal analysis. Analysis of genetically modified foods.	10

Suggested readings:

1. AOAC International. 2003. Official methods of analysis of AOAC International. 17th Ed. Gaithersburg, MD, USA, Association of Analytical Communities
2. Kirk, RS and Sawyer, R. 1991. Pearson's Chemical Analysis of Foods. 9th Ed. Harlow, UK, Longman Scientific and Technical.
3. Leo ML.2004. Handbook of Food Analysis. 2nd Edition. Vol 1,2 and 3, Marcel Dekker.
4. Linden G. 1996. Analytical Techniques for Foods and Agricultural Products. VCH.
5. Nielsen, S.(Eds) 1994. Introduction to Chemical Analysis of Foods. Jones & Bartlett
6. Pomrenz Y & Meloan CE. 1996. Food Analysis - Theory and Practice. 3rd Ed. CBS.
7. Ranganna, S. 2001. Handbook of Analysis and Quality Control for Fruit and Vegetable Products, 2nd Ed, Tata-McGraw-Hill Publ

FDP 1020: Food Processing – II (Sem VII)

No.	Topic	Total Practical (30) (8h/week)
1	Preparation of bread (three types)	03
2	Preparation of cakes (three types)	03
3	Preparation of biscuits (six types)	03
4	Preparation of rice products (minimum three types)	03

5	Preparation of milk products (minimum five products)	04
6	Preparation of fermented food products (minimum three types)	03
7	Preparation of fish and chicken products (minimum two of each type)	02
8	Preparation of white and red wine	03
9	Preparation of premixes (minimum three types)	03
10	Preparation of confectionary products (minimum three types)	03

FDP 1021: Analysis of Foods – II (Sem VII)

No.	**Topic**	**Total Practical (15) (4h/week)**
1	Analysis of food samples for calorific value using bomb calorimeter	01
2	UV-Vis Spectro-photometric analysis of a carotenoid	01
3	Hunter Lab colorimetric studies of food samples.	01
4	Texture analysis of food samples.	01
5	Rheology of food samples	01
6	Sensory evaluation of foods	01
7	Gas chromatographic analysis of food constituents	01
8	Densitometric (HPLTC) assay of food constituents	01
9	HPLC separation of food constituents	02
10	Differential scanning calorimetry (DSC) for food samples	02
11	Polarimetric estimation of sugars	01
12	Conductometric analysis of polyelectrolytes in solution	01
13	Atomic absorption spectroscopic analysis of heavy metals in foods	01

FDT 1028: Food safety, quality and regulations (Sem VIII)

No.	Topic	Number of lectures (30)
1	Introduction to food safety and security: Hygienic design of food plants and equipments, Food Contaminants (Microbial, Chemical, Physical), Food Adulteration (Common adulterants), Food Additives (functional role, safety issues), Food Packaging & labeling. Sanitation in warehousing, storage, shipping, receiving, containers and packaging materials. Control of rats, rodents, mice, birds, insects and microbes. Cleaning and Disinfection	10
2	Food quality: Various Quality attributes of food, Instrumental, chemical and microbial Quality control. Sensory evaluation of food and statistical analysis. Water quality and other utilities.	05
3	Critical Quality control point in different stages of production including raw materials and processing materials. Food Quality and Quality control including the HACCP system. Food inspection and Food Law.	05
4	Indian and global regulations: FAO in India, Technical Cooperation programmes, Bio-security in Food and Agriculture, World Health Organization (WHO), World Animal Health Organization (OIE), International Plant Protection Convention (IPPC) Codex Alimentarius Commission - Codex India – Role of Codex Contact point, National Codex contact point (NCCP), National Codex Committee of India – ToR, Functions, Shadow Committees etc.	10

Suggested Reading:

1. Handbook of food toxicology by S. S. Deshpande
2. The food safety information handbook by Cynthia A. Robert, 2009
3. Nutritional and safety aspects of food processing by Tannenbaum SR
4. Microbiological safety of food by Hobbs BC, 1973
5. Food Safety Handbook by Ronald H. Schmidt, Gary E. Rodrick

FDT 1029: Current Topics in Food Science and Technology (Sem VIII)

No.	Topic	Number of lectures (30)
1	Enzymes in Food Processing	05
2	Genetically Modified Foods, detection, safety and ethical issues	02
3	Newer Food Processing and Packaging Technology. High hydrostatic pressure processing	08
4	Newer Sources of Ingredients, Nutraceuticals, functional foods, specialty foods and food product development	05
5	Advanced topics in food Chemistry	03
6	Advanced topics in Food Safety, Food Analysis, update on Food law	07

Suggested reading:

1. Enzymes in Food Processing G.A. Tucker and L.F.J. Woods, 1991.
2. Enzymes in Industry: production and applications, Aehle W., 2004.

Elective III- FDT 1053: Waste Management in Food Processing (Sem VIII)

No.	Topic	Number of lectures (30)
1	Water quality, treatment and recycle. BOD, COD and definitions, Discharge limits for effluents. Primary treatment, secondary and tertiary treatments by physical, chemical and biological methods.	07
2	Effluent and solid waste utilization food processing industry by biological methods – for SCP, biogas and other products	05
3	Value added products from of agri food processing industry	05
4	Recovery of biological from dairy, meat, fish and poultry processing industry	05
5	Case studies: Cane Sugar waste, molasses for alcohol, baggasse for paper pulp, chemicals, bioethanol, cogeneration. Other processes including vermi culture.	05
6	Equipment, Economics and Ethics	03

Suggested reading:

1. Environmental Pollution Control Engineering – C.S. Rao
2. Food Processing Waste Management – J.H.Green and A. Kramer
3. Handbook of Waste management and co-product recovery in Food Processing – Vol.1- Keith Waldron

FDP 1023: Food Processing – III (Sem VIII)

No.	Topic	Total Practical (15) (4h/week)
1	Study of canning of fruits and vegetables	02
2	Study of different types of dehydration techniques and dryers for drying fruits and vegetables	02
3	Study of spray drying for milk powder production	01
4	Study of drum drying for potato powder production	01
5	Study of freezing and different types of freezers (plate freezer and for freezing fruits, vegetables and prawns	02
6	Study of retort processing of fruits and vegetables	02
7	Study of extrusion cooking in single screw extruder for preparation of macaroni	02

8	Study of extraction of oleoresins from spices using liquid carbon dioxide	02
9	Study of UHT for processing of sugarcane juice	01