

JIWAJI UNIVERSITY

Centre for Food Technology

M.Sc. Food Technology, (Choice Based Credit System)

Course Structure, Scheme of Examination & Syllabus

2015 -2017

SEMESTER I

Code	Title of Course	Core / Elective	T	P	Total Credits	Marks		
						IA	EA	Total
FT-101	Food Biochemistry & Nutrition	Core	3	0	3	40	60	100
FT-102	Food Chemistry	Core	3	0	3	40	60	100
FT-103	Food Microbiology	Core	3	0	3	40	60	100
FT-104	Food Processing and Preservation	Core	3	0	3	40	60	100
FT-105	Laboratory-I	Core	0	3	3	100	-	100
FT-106	Laboratory-II	Core	0	3	3	100	-	100
FT-107	Seminar/Assignment	Core	1	0	1	25	-	25
FT-108	Skill development in food product formulations/ Personality development	Core	1	0	1	25	-	25
FT-109	Comprehensive Viva-voce (virtual credit)	Core	0	2	4	50	50	100

Total Credit Value: # 24 (20 + 4 virtual credits)

SEMESTER II

Code	Title of Course	Core / Elective	T	P	Total Credits	Marks		
						IA	EA	Total
FT-201	Fruits & Vegetable Technology	Core	3	0	3	40	60	100
FT-202	Food Engineering	Core	3	0	3	40	60	100
FT-203	Food Packaging	Core	3	0	3	40	60	100
FT-204	Food Quality control, Laws & Management	Core	3	0	3	40	60	100
FT-205	Laboratory-I	Core	0	3	3	100	-	100
FT-206	Laboratory-II	Core	0	3	3	100	-	100
FT-207	Seminar/Assignment	Core	1	0	1	25	-	25
FT-208	Skill development in food product formulations/ Personality development	Core	1	0	1	25	-	25
FT-209	Comprehensive Viva-voce (virtual credit)	Core	0	2	4	50	50	100

Total Credit Value: # 24 (20 + 4 virtual credits)

SEMESTER III

Code	Title of Course	Core / Elective	T	P	Total Credits	Marks		
						IA	EA	Total
FT-301	Processing of Cereals, Pulses, oil seeds, & Sugar crops	Core	3	0	3	40	60	100
FT-302	Dairy Technology	Core	3	0	3	40	60	100
FT-303	a. Meat, Fish & Poultry products	Centric	3	0	3	40	60	100
	b. Fermentation technology	Centric/ Generic						
	c. Product development from food industry refuse	Centric/ Generic						
FT-304	a. Food additives, Spices, & Flavor technology	Centric/ Generic	3	0	3	40	60	100
	b. Food Biotechnology	Generic						
	c. Biostatistics, computer applications	Generic						
FT-305	Baking & Snacks food technology	Core	2	0	2	40	60	100
FT-306	Laboratory-I	Core	0	3	3	100	-	100
FT-307	Laboratory-II	Core	0	3	3	100	-	100
FT-308	A. Skill development programme B. Seminar	Core	1 + 1	0	2	75 + 25	-	100
FT-309	Comprehensive Viva-voce (virtual credit)	Core	0	2	2	50	50	100

Total Credit Value: 24 (22+2 virtual credit)

SEMESTER IV

Code	Title of Course	Core / Elective	T	P	Total Credits	Marks		
						IA	EA	Total
FT-401	Advances in Food technology	Core	3	0	3	40	60	100
FT-402	a. Nutraceuticals & Functional foods	Centric	3	0	3	40	60	100
	b. Food Toxicology	Centric/ Generic						
	c. Entrepreneurship & Business management in food technology	Centric/ Generic						
FT-403	Personality/Skill development	Centric/Generic	2	0	2	40	60	100
FT-404	Major project	Centric	12	0	12	200	200	400
FT-405	Comprehensive viva	Centric	2	0	2	50	50	100

Total Credit Value: # 22 (virtual credit)

NOTE: Lecture (L): 1 hr = 1 Credit: Tutorial (T): 2 hr = 1 Credit . Practical (P): 2 hr = 1 Credit

- The generic credits may be obtained from other departments/faculties/Institutes.
- Elective credits may be obtained from same or other departments of the faculty
- Minimum credits be earned for award of degree - 96 Credit (Valid credits - 80 + Virtual Credits - 16)
- Minimum credits for promotion to next semester - 12 valid credits/semester
- As part of skill development new product development will be practiced
- Every student would deliver minimum one seminar in a semester which would be evaluated.
- Comprehensive viva is based on all papers of given semester.
- The grading will be made on 10-point scale as described below:

Letter Grade	Grade Points	Description	Range of Marks (%)
O	10	Outstanding	90-100
A+	9	Excellent	80-89
A	8	Very good	70-79
B+	7	Good	60-69
B	6	Above Average	50-59
C	5	Average	40-49
P	4	Pass	35-39
F	0	Fail	0-34
Ab	0	Absent	Absent

- The Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) will be calculated as weighted average of valid and virtual credit points secured by the student, except the credits of additional courses, if any. The SGPA and CGPA shall be rounded off up to 2 decimal places and reported in the grade sheet.
- SGPA is a measure of performance of the student in a semester. It is ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester, i.e.

$$SGPA (S_i) = \frac{\sum(C_i \times G_i)}{\sum C_i}$$

where C_i is the number of credits of the i th course in a semester and G_i is the grade point

scored by the student in the ith course.

- CGPA is a measure of overall cumulative performance of a student over all the semesters completed. The CGPA is the ratio of total credit points secured by a student in various courses in all the semesters completed and the sum of the total credits of all courses in all the semesters completed, i.e.

$$\text{CGPA} = \frac{\sum(C_i \times S_i)}{\sum C_i}$$

where S_i is the SGPA of the i th semester and C_i is the total number of credits in the semester.

- On completing all requirements for award of the degree, the CGPA will be calculated and this value will be indicated on the degree along with Division. The Final degree should also indicate the Division obtained as per follows:

Division	Criterion
First division with distinction	The candidate has earned minimum number of credits required for the award of the degree in first attempt with CGPA of 8.00 or above
First division	The candidate has earned minimum number of credits required for the award of the degree with CGPA of 6.50 or above
Second division	The candidate has earned minimum number of credits required for the award of the degree with CGPA of 5.00 or above but less than 6.50
Pass division	The candidate has earned minimum number of credits required for the award of the degree with CGPA of 4.00 or above but less than 5.00

- The student will be promoted to the next semester if he/ she secures at least 12 valid credits in a semester. In case the student secures less than 12 valid credits in any semester, then the student will be asked to repeat the entire semester and that semester will be treated as zero semester.
- The student should not carry more than 5 courses (combining theory and practical) in 1st year, 2nd year or 3rd year to be promoted to the next year.
 - Repetition of a theory / practical course is allowed only to those candidates who get F or Ab in the course. The student has to pay the prescribed fee for repeating the course.
 - On account of valid reasons, a student may withdraw from a semester. In such case the semester will be treated as zero semester.
 - In case of zero semester, the student will not be promoted to the next semester till he/ she clears that semester. The UTD may allow such a student to register in the subsequent semester whenever it is offered by the concerned UTD. The student has to pay semester fee again in such cases. If the student withdraws within one month from starting of the semester then semester fee will not be charged again.

- The practical course can be repeated as and when it is offered.
- Dissertation / project report/ internship of 3-6 credits will be assessed by the internal supervisor, in general, however, UTD may get it assessed by an internal supervisor and an external expert.
- A comprehensive viva-voce of 4 virtual credits will be conducted at the end of each semester of the programme by a board of four examiners, at least ONE of whom shall be external. The grades awarded in the viva-voce shall be shown separately in the grade-sheet.
- The conversion of CGPA in to percentage will be as follow to facilitate its application in other academic matters:

$$\text{Equivalent Percentage} = \text{CGPA} \times 10$$

SYLLABUS (2015 -2016)

FT 101 FOOD BIOCHEMISTRY AND NUTRITION

UNIT -I

Introduction to different food groups and its importance in nutrition.

Carbohydrate: Introduction, digestion, food sources. Metabolic pathways for breakdown of carbohydrates: glycolytic pathway, pentose phosphate pathway, citric acid cycle, electron transport chain, ATP balance, gluconeogenesis, deficiency, metabolic defects such as diabetes associated with carbohydrates.

UNIT -II

Protein: Introduction, Essential amino acids. food sources, metabolic defects, Metabolism of proteins – outlines (digestion and absorption); Nitrogen balance & nitrogen pool; Evaluation of quality of proteins, deficiency symptoms, prevention and cure.

Fat: Digestion: Introduction, digestion, metabolism outlines, essential fatty acids, food sources, metabolism of fat and fatty acid, nutritive functions, effects of excess and deficiency: obesity, cardiovascular diseases. Nutritional significance of lipo proteins.

UNIT –III

Fat soluble vitamins: Salient features, requirements, food sources, effects of excess and deficiency, principles.

Water soluble vitamins: salient features, requirements, food sources, effects of excess and deficiency.

Minerals: salient features, requirements, food sources, effects of excess (if any) and deficiency factors affecting utilization.

Principles and outlines of estimation of micro and macro elements.

Principles and outlines of estimation of fat soluble vitamins and water soluble vitamins.

Unit IV

Energy metabolism: Basal metabolic requirements and activity, SDA- specific dynamic action of food, respiratory quotient of food, caloric requirement of humans.

Recommendatory dietary allowance: concept of balance diet, menu planning in different ages and diseases.

Unit V

Introduction to sensory evaluation, Selection of sensory panelists; Factors influencing sensory measurements; Sensory quality parameters -Size and shape, texture, aroma, taste, color and gloss; Detection, threshold and dilution tests Different tests for sensory evaluation–discrimination, descriptive, affective; Flavour profile and tests; Ranking tests; Methods of sensory evaluation of different food products. Selection and training of sensory panel; Detection and threshold tests; Ranking tests for taste, aroma colour and texture; Sensory evaluation of various food products using different scales, score cards and tests;

Text Books / References :

1. Lehninger, Nelson & Cox, Principle of Biochemistry, CBS Publication
2. Modern Experimental Biochemistry, Boyer, Pearson Education
3. Lubert stryer, Biochemistry, Freeman & Co, N.Y.
4. Voet & Voet, Fundamentals of Biochemistry, Jonh Willey & Sons
5. Hames, B. D. (Ed), Biochemistry, Viva Books
6. Essentials of Food and Nutrition, Swaminathan, Vol 1 & 2
7. Fundamentals of Food and Nutrition by Sumati. R. Muldambi
8. Nutrition and dietetics by Rose
9. Nutrition and dietetics by Joshi

FT 102 FOOD CHEMISTRY

UNIT -I

Carbohydrate : General introduction, classification, structure, properties and functions of carbohydrates, role of carbohydrate in food industries, sugars, starch, cellulose, glucans, hemicelluloses, gums, pectic substances, polysaccharides, Modified starch.

Browning reactions in food: Enzymatic and non-enzymatic browning in foods of vegetable and animal origin during storage and processing of foods.

Non-calorific sweeteners: Artificial and Natural

Methods of estimation of carbohydrates-principles and outlines

UNIT -II

Proteins : General introduction, classification, structure, properties, purification and denaturation of proteins, protein derived from milk, egg protein, meat protein, fish muscle protein, oil seed protein and cereal protein. Allergens associated with food proteins. Modified proteins and application in food industry. Single Cell Protein.

Methods of estimation of protein-principles and outlines.

Food Adulteration-Outlines and detection methods.

UNIT -III

Lipids : General introduction, classification, properties, functions and requirements of food lipids, refining of crude oil, hydrogenation and winterization. Vegetable and animal fat, margarine, lard, butter. Frying and shortenings. Flavor changes in fats and oils, lipid oxidation & factors affecting lipid oxidation.

Methods of estimation of lipids-Principles and outlines.

Unit IV

Vitamins: General introduction, Fat and Water soluble Vitamins, effect of various processing treatments and fortification of foods.

Minerals: General introduction, effect of various processing treatments

Water: Chemistry, role in food storage, water activity and growth of microorganisms, physical, chemical and microbiological characteristics of water.

Unit V

Enzymes: General introduction, Nature, function, nomenclature & structure, its classification and properties of enzymes and its activity in different food systems, factors affecting rate of enzymatic action .Flavor production by enzymes.

Plant pigments and their role in Food Industry: Carotenes, Xanthophylls, Chlorophyll, Bitter Substances and Tannins.

Text books and Reference materials

1. Beltz, H.D. 2005. *Food Chemistry*. Springer Verlag.
2. Fennema, O.R, 2006, *Food Chemistry*, Academic Press.
3. Meyer, L.H. 1987. *Food Chemistry*. CBS publishers and Distributors, New Delhi.
4. Potter, N.N. and Hotchikiss, J.H. (2006), *Food Sciences*, Fifth edition, CBS publishers and Distributors, New Delhi.
5. Fennema, O.R.2006. *Food Chemistry*. Marcel Dek

FT 103 FOOD MICROBIOLOGY

UNIT I

Definition, Historical Development, Classification and importance of Yeast, Mold and Bacteria. Importance and significance of microorganisms in Food science. Micro-organisms importance in food - Factors affecting the growth of micro organisms in food – Intrinsic and Extrinsic parameters that affect microbial growth.

UNIT II

Food Hygiene and Sanitation: Contamination during handling and processing and its control ; indicator; indicator organisms; rapid methods in detection of microorganisms. Thermal inactivation of microbes- Concept,determination & importance of TDT, F, Z & D values,factors affecting heat resistance, pasteurization and sterilization.

UNIT III

Protection and preservation of Foods: Modified atmosphere, Radiation in foods from the microbiological angle. Outlines of indicators of water and food safety and quality-Microbiological criteria of foods and their significance.

UNIT IV

Food spoilage: Characteristic features, dynamics and significance of spoilage of different groups of foods - Cereal and cereal products, vegetables and fruits, meat, poultry and sea foods, milk and milk products, packed and canned foods.

s: Bacterial food borne diseases (Staphylococcal intoxicification, Botulism, Salmonellosis, Shigellosis, Enteropathogenic Escherichia Coli Diarrhoea, Clostridium Perfringens gastroenteritis, Bacillus cereus Gastroenteritics), *Mycotoxins:* Aflatoxicosis, Deoxyeni valenol Mycotoxicosis, Ergotism.

UNIT V

Colorimetry : Introduction,beers & lamberts law,extinction coefficient,general principles of colorimeter,application in food industry.

Flourimetry: Introduction,principle,instrumentation & application.,
Flame photometry: Instrumentation & application.

Spectroscopy: General principle,instrumentation,types-atomic absorption spectrophotometer, UV-Visible,principle ,instrumentation & applications.

Text Books / References :

1. Essentials of Microbiology; K. S. Bilgrami; CBS Publishers, Delhi
2. Food Microbiology; WC Frazier; Tata McGraw Hill, Delhi
3. Modern Food Microbiology; James M Jay; CBS Publishers, Delhi
4. Microbiology; Pelczar, Chan and Krieg; Tata McGraw Hill, Delhi
5. Basic Food Microbiology; Bannett, Chapman and Hall
6. Food Microbiology; M. R. Adams
7. Hand Book of Microbiology; Bisen

FT104 PRINCIPLES OF FOOD PROCESSING & PRESERVATION

UNIT -I

Introduction: Definition and scope of Food science and technology, historical development of food processing and preservation, general principles of food preservation

Processing and preservation by heat: Blanching, pasteurization, sterilization and UHT processing,

canning, extrusion cooking, dielectric heating, microwave heating, baking, roasting and frying. Retort processing of ready to eat (RTE) products.

Baking: Milling, Principle of baking various of baked products.

UNIT -II

Radiation: Source of radiations, mode of action effect on microorganisms and different nutrients dose requirements for radiation preservation of food.

Microwave heating: Principles and application in Food processing

UNIT -III

Refrigeration and Freezing Preservation: Refrigeration and storage of fresh food major requirement of refrigeration plant atmospheric storage , refrigerated storage of various food freezing point of selected food influence of freezing and freezing rate of quality of the food product. Method of freezing storage ,and thawing of frozen food

Unit IV

Chemical Preservation: Preservation of food by use of sugar, salt, chemicals, antibiotics & by smoking

Concentration: Application in food industry processes and equipment for manufacture of various concentrated foods and their keeping quality

Fermentation: Application in preservation of food pickling. curing etc

Unit V

Drying: Processing and preservation by drying, concentration and evaporation ,various methods employed in production of dehydrated food products , selection of methods based on characteristics of foods to be produced, advantages and disadvantages of different methods, sun-drying , tray or tunnel drying , spray drying , drum drying , freeze drying, fluidized bed drying. Physical and chemical changes during drying control of chemical changes, desirable and undesirable changes. Packaging and storage of dehydrated food products.

Outlines of moisture analysis.

Text books and Reference materials

1. Desrosier NW & James N. (2007). Technology of food preservation. AVI. Publishers
2. Fellows, P.J. (2005). Food processing technology: Principle and Practice. 2nd Ed. CRC Publishers
3. Jelen, P. (2005). Introduction to Food Processing. Prentice Hall

4. N.M.Potter, Food Science and Technology.

FT 105 : LAB COURSE-I

1. Qualitative analysis of carbohydrates
2. Qualitative analysis of Proteins
3. Analysis of lipids: acid value, iodine value, saponification value etc
4. Estimation of carbohydrates in food materials
5. Estimation of proteins in food materials
6. Estimation of crude fibre in food materials
7. Estimation of ascorbic acid in food materials
8. Estimation of calcium in food materials
9. Estimation of cholesterol in food materials
10. Estimation of calorific value of foods
11. **Sensory evaluation:**
 - a. Taste panel
 - b. Basic taste
 - c. Difference test
 - d. Ranking test for color, aroma and texture
 - e. Threshold test
 - f. Hedonic scale

FT 106: Lab course-II

A) Processing Of Food And Food Microbiology

1. Determination of moisture in different food samples.
2. Determination of TSS in different food samples.
3. Quality assessment by Blanching and browning control
4. Quality assessment by different drying methods.
5. Determination of acidity and PH different food samples.
6. Determination of ash in food samples.
7. Instruments used for food processing.
8. Determination of gelatinization
9. Stages of sugar cookery
10. Estimation of gluten content

B) Food Microbiology Lab

1. Preparation of common laboratory media and study of a compound microscope.
2. Staining: Gram's staining,
3. Sub culturing of a bacterial strain in liquid and solid medium.
4. Study of growth of E. coli by a spectrophotometer.

5. Study of microbiological quality of milk by MBRT test.
6. Preparation of synthetic medium for yeast and mould and inoculation with standard strains of yeasts and moulds.
7. Microbiological analysis of typical processed food and unprocessed food.
8. Dilution and Plating by spread –plate and pour –plate techniques.
9. Isolation of pure culture.
10. Test for adulteration in different food samples.

FT 107: SEMINAR / ASSIGNMENT

Every student shall deliver atleast one seminar on topic of the curriculum/ advances in food technology which will individually be assessed by every available teacher on the basis criteria laid down by the Staff council. Students in audience will also be encouraged to assess the seminar on the given criteria and their evaluation will also be given due consideration. The average marking will be taken into consideration.

FT 108: PERSONALITY DEVELOPMENT/ SKILL DEVELOPMENT IN FOOD PRODUCT FORMULATION

Every student will be imparted skills in development of new products and will be evaluated by the concerned teacher.

FT 109: COMPREHENSIVE VIVA

A comprehensive viva-voce of 4 virtual credits will be conducted at the end of semester of the programme by a board of four examiners.

FT 201: FRUITS AND VEGETABLE TECHNOLOGY

UNIT -I

Introduction, definition, role, importance and status of post harvest technology.

Fruits and vegetables: Morphology of fruits and vegetables, maturity indices and methods of maturity determinations. Post-harvest physiological and biochemical changes in fruits and vegetables, ripening of climacteric and non climacteric fruits; regulations, methods.

UNIT –II

Post harvest disorders- Factors affecting post harvest changes, handling and packaging of fruits and vegetables, chilling injury & disease, storage practices: CA and MA, hypobaric storage, pre-cooling and cold storage, Zero energy cool chamber, commodity pretreatments - chemicals, wax coating, VHT and irradiation.

UNIT –III

Drying and dehydration of fruits and vegetables, problems related to storage of dehydrated products., Canning of fruits and vegetables, its process, spoilage in canned foods. Changes during freezing of fruits of vegetables and problems related to storage of frozen products.

UNIT –IV

Vinegar: Method of preparation and quality control

Tea, Coffee and Cocoa: Production and manufacturing.

Pectin: Raw material processes and uses of pectin, products based on pectin, manufacturing and quality control.

UNIT –V

Fruits and Vegetables: Preparation of juice, syrup, squashes, jam, jellies, marmalades, cordials and nectars, fortification and soft drinks.

Tomato products: Preparation of various tomato products and quality control.

Pickles and chutney: Preparation of various pickles, sauces and chutneys, problems related to shelf life of pickles and chutneys, quality control.

References :

1. Bose, T.K. Ed. 1985. Fruits of India: Tropical and Sub-tropical. Naya Prokash, Calcutta. Dauthy, M.E. 1997. Fruit and Vegetable Processing. International Book Distributing Co. Lucknow, India.
2. Hamson, L.P. 1975. Commercial Processing of Vegetables. Noyes Data Corporation, New Jersey.
3. Lai, G., Siddappa, G. and Tondon G.L. 1986. Preservation of Fruits and Vegetables, Indian Council of Agril. Research, New Delhi.
4. Salunkhe, D.K. and Kadam, S.S. Ed. 1995. Handbook of Fruit Science and Technology: Production, Composition and Processing. Marcel Dekker, New York. Salunkhe, D.K. and Kadam, S.S. Ed. 1995. Handbook of Vegetable Science and Technology. Production,

Composition, Storage and processing Marcel Dekker, New York.

5. Srivastava, R.P. and Kumar, S. 1998. Fruit and Vegetable Preservation: Principles and Practices. 2nd Ed. International Book Distributing Co. Lucknow.

FT 202: FOOD QUALITY CONTROL, LAWS AND MANAGEMENT

UNIT -I

Food safety and hygiene

Food safety concept- Importance of food safety in food processing. Food hygiene and its practices (GMP/GHP, GAP, GLP). Hygiene verification on food industry, cleaning and sanitation (CIP, ETP,WTP, Pest control) prevention and control.

UNIT –II

Concept of quality: Quality attributes- physical, chemical, nutritional, microbial and sensory, their measurement and evaluation. Quality measurement techniques, process design and control and product design and control, TQM, IPR and Patent.

UNIT –III

Food laws and regulations: Food safety 2006, 2011 act and regulation, FSSAI. Various organizations dealing with inspection and traceability and authentication, Certifications (BIS, AGMARK,ISO, FPO, MFPO, PFA, MPO, etc.)

UNIT –IV

International food laws and regulations: US Federal laws, USDA, FDA, FAO, WHO, CODEX, HACCP.

Differential financial institutions: NABARD, WTO, World Bank.

UNIT –V

Entrepreneurship in food processing: Concept of entrepreneur and entrepreneurship, quality, functions of an entrepreneur. Current status of entrepreneurship in Indian food industries.

Introduction to marketing (demand, supply, sample survey techniques, marketing information, consumer trends and behavior), and HRM (concept, planning and appraisal).

References:

1. Early R.1995.*Guide to Quality Management Systems for Food Industries*. Blackie Academic.
2. Krammer A & Twigg BA.1973. *Quality Control in Food Industry*. Vol. I, II. AVI Publ.
- 3.Chhabra TN & Suria RK. 2001. *Management Process and Perspectives*. Kitab Mahal.
- 4.Jhingam ML. 2005. *International Economics*. 5th Ed. Virnda Publ.
- 5.Kotler P. 2000. *Marketing Management*. Prentice Hall.
6. Reddy SS, Ram PR, Sastry TVN & Bhavani ID. 2004. *Agricultural Economics*. Oxford & IBH.

FT 203: FOOD ENGINEERING

UNIT -I

Introduction: General concept, essential scope & scenario

Size Reduction process: Principles, theories & laws, energy consideration, equipments & size reduction of various food products

Mixing & forming: Theory & applications, mixing indices, equipments for solid and liquid foods products.

UNIT –II

Process Heat Transfer - Modes of heat transfer and overall heat transfer; thermal properties of foods such as specific heat and thermal conductivity, Fourier's law, steady state and unsteady state conduction, heat exchange equipment; energy balances; rate of heat transfer; thermal boundary layer, heat transfer by forced convections, heat transfer to flat plate and in non Newtonian fluids, heat transfer in turbulent flow; heating and cooling of fluids in forced convection outside tubes, natural convection

UNIT –III

Food dehydration: Mechanism of drying, moisture & drying rate curves, constant and falling rate periods, spray, drum, cabinet, tunnel, fluidized bed dryer, batch & continuous operation, osmotic dehydration & freeze drying.

Evaporation: Properties of liquid, heat & mass balance, single & multiple effect evaporation, steam economy, heat recovery, efficiency, equipments & systems.

UNIT - IV

Chilling, refrigeration & freezing : Introduction, types of freezers, precooling & cold storage, Shelf life extension requirements, theories, characteristic curve, cooling rate calculations, chilling & freezing equipments, cryogenics, freeze drying, properties of frozen foods.

UNIT-V

Separation processes:

Centrifugation: General principles, instrument & types of centrifuges, preparatory & analytical centrifugation & applications

Chromatographic Techniques: General introduction to principles, partition & adsorption chromatography-paper, thin layer, gas & liquid, ion exchange & affinity chromatography, gel filtration, HPLC and application in food industry

Membrane filtration technology: Principles of other food processing such as- RO, UF, Dialysis, osmosis, microfiltration, and nano filtration-outlines

FT 204 : FOOD PACKAGING

UNIT I

Introduction to Food Packaging: Packaging terminology- definition, types of packaging. Functions of food packaging, characteristics of food stuff that influences packaging selection.

UNIT II

Packaging material and their properties: Glass, paper and paper board, corrugated fiber board (CFB), Metal containers-Tin Plate and Aluminum, composite containers, collapsible tubes, plastic films, laminations, metalized films, Co-extruded films, testing of packaging material.

UNIT III

Packaging systems and methods: vacuum packaging, controlled atmospheric packaging, modified atmospheric packaging, aseptic packaging, retort processing, microwave packaging, active packaging, intelligent packaging, edible packaging, shrink and stretch packaging.

UNIT IV

Packaging of fresh and processed foods: Packaging of fruits and vegetables, fats and Oils, spices, meat, Poultry and sea foods, dairy Products, bakery, beverages, dehydrated and frozen foods. Liquid and powder filling machines – like aseptic system, form and fill (volumetric and gravimetric), bottling machines. Form Fill Seal (FFS) and multilayer aseptic packaging machines.

UNIT V

Packaging Laws, Regulations, Evaluation and Quality control- Toxicity, shelf life testing, corrosion, tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, their methods of testing and evaluation, 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, prediction of shelf life of foods, selection and design of packaging material for different foods.

Text Books and Reference materials

1. Robertson, G.L. 2006 Food Packaging: Principles and Practice (2nd ed.), Taylor & Francis
2. NIIR. (2003). Food Packaging Technology Handbook, National Institute of Industrial Research Board, Asia Pacific Business Press Inc.
3. Ahvenainen, R. (Ed.) 2003 Novel Food Packaging Techniques, CRC Press,
4. Han, J.H. (Ed.) 2005 Innovations in Food Packaging, Elsevier Academic Press,
5. Coles, R., McDowell, D. and Kirwan, M.J. (Eds.) 2003 Food Packaging Technology,

FT – 205: LAB COURSE I

1. Canning of fruits and vegetables.
2. Dehydration of fruits and vegetables.
3. Preparation of tomato juice.
4. Preparation of tomato puree.
5. Preparation of tomato paste.
6. Preparation of various types of pickles.
7. Preparation of tomato ketchup.
8. Preparation of tomato mock tail.
9. Preparation of tomato soup.
10. Preparation of tomato chutney.
11. Preparation of jackfruit pickles.
12. Preparation of jams
13. Preparation of lime squashes.
14. Preparation of jellys.
15. Preparation of jam marmalades.
16. Pectin determination
17. Determination of chemical preservatives in fruits and vegetables.
18. Blanching of fruits and vegetables for quality estimation.

FT- 206: LAB COURSE II

1. Testing of different types of packaging materials.
2. Determine moisture content in given package samples.
3. Test for modified starch in different package materials.
4. Test for water absorbency in corrugated fibre board box.
5. Test for types of adhesive used in CFB.
6. Development of new food products and formulations.
7. To perform flap bend test in CFB.
8. Test for formal shock resistance in glass bottles.
9. Graphical representation of moisture contents in different food products.
10. Determination of shelf lives.

FT 207: SEMINAR / ASSIGNMENT

Every student shall deliver atleast one seminar on topic of the curriculum/ advances in food technology which will individually be assessed by every available teacher on the basis criteria laid down by the Staff council. Students in audience will also be encouraged to assess the seminar on the given criteria and their evaluation will also be

given due consideration. The average marking will be taken into consideration.

FT 208: PERSONALITY DEVELOPMENT/ SKILL DEVELOPMENT IN FOOD PRODUCT FORMULATION

Every student will be imparted skills in development of new products and will be evaluated by the concerned teacher.

FT 209: COMPREHENSIVE VIVA

A comprehensive viva-voce of 4 virtual credits will be conducted at the end of semester of the programme by a board of four examiners.