



Department of Food Science & Technology
Mahatma Phule Krishi Vidyapeeth
Rahuri-413 722, Dist. Ahmednagar (MS)



Doctoral Programme in Food Technology

Course Layout

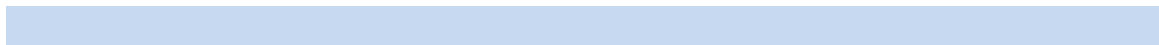
Minimum Credit Requirements

Sr. No.	Subject	Minimum credit(s)
1.	Major	18
2.	Minor	09
3.	Supporting	06
4.	Seminar	02
5.	Research	45
	Total Credits	80
	Compulsory Non Credit Courses	06

Sr. No.	Course No.	Course Title	Credits
Major Courses (Min. 18 credits)			
1.	FST 601	Advances in Food Chemistry and Nutrition	2+1=3
2.	FST 602	Modern Food Microbiology	2+1=3
3.	FST 603	Advances in Food Engineering	2+1=3
4.	FST 604	Food Processing	2+0=2
5.	FST 605	Food Packaging	1+1=2
6.	FST 606	Food Analysis	0+2=2
7.	FST 625	Confectionery Technology	2+1=3
		Total	11+7=18
Minor Courses (Min. 09 credits)			
1.	FST 611	Advances in Food Biotechnology	2+1=3
2.	FST 618	Juice Processing Technology	2+1=3
3.	FST 624	Protein Chemistry and Technology	2+1=3
		Total	6+3=9

Supporting Courses (Min. 06 credits)			
1.	STAT 601	Advanced Statistical Methods	2+1=3
2.	FST 533	Business Management and International Trade	3+0=3
		Total	5+1=6
Seminar (02 credits)			
1.	FST 691	Doctoral Seminar-I	1+0=1
2.	FST 692	Doctoral Seminar-II	1+0=1
		Total	2+0=2
Research (45 credits)			
1.	FST 699	Doctoral Research	0+45=45
		Total	0+45=45
Compulsory Non-credit Courses			
1.	PGS 501	Library and Information Services	0+1=1
2.	PGS 502	Technical Writing and Communication Skills	0+1=1
3.	PGS 503	Intellectual Property and its Management in Agriculture	1+0=1
4.	PGS 504	Basic Concepts in Laboratory Techniques	0+1=1
5.	PGS 505	Agricultural Research, Research Ethics and Rural Development Programmes	1+0=1
6.	PGS 506	Disaster Management	1+0=1
		Total	3+3=6

Total Credits: 80 (35 course work + 45 thesis)



I. Semester wise Course Distribution

Semester I

A. Major Courses		
FST 601	Advances in Food Chemistry & Nutrition	2+1=3
FST 602	Modern Food Microbiology	2+1=3
FST 603	Advances in Food Engineering	2+1=3
B. Minor Courses		
FST 611	Advances in Food Biotechnology	2+1=3
C. Supporting Courses		
STAT 601	Advanced Statistical Methods	2+1=3
D. Compulsory Non-Credit Courses		
PGS 501	Library and Information Services	0+1=1
PGS 504	Basic Concepts in Laboratory Techniques	0+1=1

Semester II

A. Major Courses		
FST 604	Food Processing	2+0=2
FST 605	Food Packaging	1+1=2
FST 606	Food Analysis	0+2=2
B. Minor Courses		
FST 618	Juice Processing Technology	2+1=3
C. Supporting Courses		
FST 533	Business Management and International Trade	3+0=3
D. Compulsory Non-Credit Courses		
PGS 502	Technical Writing and Communication Skills	0+1=1
PGS 503	Intellectual Property and its Management in Agriculture	1+0=1

Semester III

A. Major Courses		
*FST 625	Confectionery Technology	2+1=3
B. Minor Courses		
FST 624	Protein Chemistry and Technology	2+1=3
C. Supporting Courses		
-		
D. Seminar		
FST 691	Doctoral Seminar-I	1+0=1
E. Compulsory Non-Credit Courses		
PGS 505	Agricultural Research, Research Ethics and Rural Development Programmes	1+0=1
PGS 506	Disaster Management	1+0=1

Semester IV

A. Major Courses		
-		
B. Minor Courses		
-		
C. Supporting Courses		
-		
D. Seminar		
FST 692	Doctoral Seminar-II	1+0=1
E. Compulsory Non-Credit Courses		
-		

Semester V

A. Major Courses		
-		
B. Minor Courses		
-		
C. Supporting Courses		
-		
D. Seminar		
-		
E. Compulsory Non-Credit Courses		
-		

Semester VI

A. Major Courses		
-		
B. Minor Courses		
-		
C. Supporting Courses		
-		
D. Compulsory Non-Credit Courses		
-		

Research

FST 699	Doctoral Research	0+45=45
Total		45

Grand Total of Major + Minor +Research + Supporting Course Credits	80
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II. Theory, Practical Syllabus and Teaching Schedule

Course No. FST 601

Course Title: ADVANCES IN FOOD CHEMISTRY & NUTRITION

Credit: 3 (2+1)

Semester: I

Theory:

Lecture No.	Topic	Weightage %
1-4	Interactions among food components and their effect on sensory, nutritional and processing quality, Natural antioxidants, mechanisms of action and their evaluation techniques, Advanced glycation end products and their nutritional significance;	13
5-8	Free radical chemistry, reactive oxygen, photosensitized oxidation, metal catalyzed reactions. Antioxidants: chemistry, mechanisms of action, evaluation of antioxidant activity, use	13
9-12	Water relationships in foods: water activity and its relevance to deteriorative processes in foods (chemical, enzymic, physical and microbial changes). Glass transitions and molecular mobility in foods, their relevance to quality and stability of food products,	13
13-15	Food Carbohydrates: structural, analytical, physicochemical, nutritional & functional aspects of carbohydrates and polysaccharides of plant & microbial origin.	9
16-19	Fragrance and flavouring compounds: essential oils, terpenoids-oleoresins biochemical pathways for the production of volatile compounds in specific plant species; Chemical structure, distribution, diurnal and seasonal fluctuations; Intraspecific differences in volatiles oil production, differentiation between geographical origins; Turpentine and terpene industry and, biological Interactions among food components and flavours,	13
20-22	Interactions among food flavours and packaging materials, Interactions among food additives and their significance in food processing.	9
23-27	Therapeutic, Parenteral and Geriatric nutrition and relevant food formulations, genetic disorders and nutritional requirements,	15
28-30	Gene regulation in secondary metabolism, Tissue specificity (phenyl propanoids) and stress responsiveness (terpenoids indole alkaloids), Compartmentation, storage and transport.	9
30-32	Appetite suppressants, phytosterols, polyphenols, phytoestrogens, ω -fatty acids, glucosinolates, non-digestible oligosaccharides, Glycemic index and its role in human nutrition, Prebiotics and probiotics, Chemistry of Alkaloids, Flavonoids and other Phenolics	6
	Total	100

Practical:

Practical No.	Topic
1-2	Study browning reactions in model systems
3-4	Study browning reactions in model systems
5-7	Estimation of natural antioxidants in foods
8-10	Measurement of water activity and plotting of sorption isotherm of selected foods
11-12	Determination of physical, chemical, enzymatic and microbial changes in relation to water activity, physicochemical and functional properties of carbohydrates
13	Separation and estimation of essential oils and oleoresins
14	Study of interaction among food components, additives and flavours with food packaging
15	Formulation of therapeutic and probiotics foods
16	Determination of glycemic index of selected foods

Suggested Readings:

Advances in Food and Nutrition Research. Elsevier Book Series.

Aurand LW, Woods A & Wells MR. 1987. Food Composition and Analysis. AVI Publ.

Baynes JW, Monnier VM, Ames JM & Suzanne R. 2005. The Maillard Reaction: Chemistry at the Interface of Nutrition, Aging, and Disease Thorpe. Annals of the New York Academy of Science.

Birch GG & Lindley MG. 1986. Interactions of Food Components. Elsevier.

Fennema OR. 1996. Food Chemistry. Marcel Dekker.

Kumar A & Gaonkar G. 1995. Ingredient Interaction: Effect on Food Quality. Marcel Dekker.

Course No. FST 602
Credit: 3(2+1)

Course Title: MODERN FOOD MICROBIOLOGY
Semester: I

Theory:

Lecture No.	Topic	Weightage %
1-5	Foods as ecological niches, Relevant microbial groups, Microbes found in raw materials and foods that are detrimental to quality, Factors that influence the development of microbes in food,	16
6-10	Newer and rapid methods for qualitative and quantitative assay demonstrating the presence and characterization of microbes, Stress, damage, adaptation, reparation, death.	16
11-15	Microbial growth in food: intrinsic, extrinsic and implicit factors, Microbial interactions, Inorganic, organic and antibiotic additives. Effects of enzymes and other proteins,	16

16-20	Combination systems, Adaptation phenomena and stress phenomena, Effect of injury on growth or survival, Commercial available databases.	16
21-25	Microbial behavior against the newer methods of food processing, Adoption and resistance development,	16
26-28	Microbes as test organisms, as sensors and as tools for future applications in energy production and food and non food industrial products.	10
29-32	Modern methods of cell culture: synchronous and co- cell culture, continuous cell culture in liquid and solid media, Cell immobilization and applications, Pre and probiotics cultures.	10
	Total	100

Practical:

Practical No.	Topic
1-3	Evaluation of microorganism in raw and processed products by using various techniques
4-5	Study of factors influencing growth of microorganisms
6-8	Determination of effects of various preservatives including antibiotics on the suppression of microbial growth
9-11	Development of cell cultures using various techniques
12-14	Production of newer microbial metabolites of industrial importance
15-16	Development of probiotics in lab

Suggested Readings:

- Adams M. 2006. Emerging Food-borne Pathogens. Woodhead Publ.
- Adams MR & Moss MO. 2000. Food Microbiology. Panima.
- Easter MC. 2003. Rapid Microbiological Methods in the Pharmaceutical Industry.
- Harrigan W. 2003. Laboratory Methods in Food Microbiology. University of Reading, UK, Elsevier.
- James MJ, Loessner MJ & David A. 2005. Modern Food Microbiology. 7th Ed. Golden Food Science Text Series.
- Pederson CS. 1979. Microbiology of Food Fermentations. AVI Publ.
- Roberts R. 2002. Practical Food Microbiology. Blackwell Publ.
- Rossmore HW. 1995. Handbook of Biocide and Preservative. Blackie
- Wood JBB. 1999. Microbiology of Fermented Foods. Vols. I, II. Blackwell Academic.
- Yousef AE. 2002. Food Microbiology: A Laboratory Manual. AVI.

Course No.FST 603 **Course Title: ADVANCES IN FOOD ENGINEERING**
Credits: 3(2+1) **Semester: I**

Theory:

Lecture No.	Topic	Weightage %
1-3	Engineering properties of foods, their significance in equipment design, processing and handling of food and food products, steady state and unsteady state heat transfer	9
4-6	Numerical, graphical and analog methods in the analysis of heat transfer. Solution of unsteady state equations, solar radiation.	9
7-11	Mass transfer, molecular diffusion and diffusivity, equilibrium stage process, convective mass transfer co-efficient, mass transfer with laminar and turbulent flow. Design equations for convective mass transfer, simultaneous momentum	12
11-14	Separation by equilibrium stages, immiscible phases, distillation of binary mixtures and multi-component separations.	12
14-16	Aerodynamics and hydrodynamic characteristics, drag coefficient, terminal velocity	9
17-20	Reynold's number application of aerodynamic properties to the separation, pneumatic handling and conveying of food products, material and energy balance.	12
20-25	Thermodynamic properties of moist air, kinetics of water absorption, Evaporation and dehydration of foods, design of single and multi-effect evaporators, mechanics of movement of air through stationary bed, thin layer and thick layer bed drying, simulation models for drying systems, use of weather data for drying operations, design of dryers	13
25-30	New direction in freeze bed drying, cyclic pressure freeze drying. Microwave drying and vacuum drying, efficient drying systems, infrared heating, freezing of foods, freeze concentration and drying, freezing point curves, phase diagrams, methods of freeze concentration, design problems.	13
30-32	Theory of ultra-filtration and reverse osmosis, selection and types of membranes and properties, concentration polarization, mathematical description of flow through membrane, application and use in food industry.	11
	Total	100

Practical:

Practical No.	Topic
1-2	Determination of engineering properties of foods
3-4	Design problems on evaporators; measurement of heat transfer using selected heat exchangers in model study

4-5	Evaluation of mass transfer and estimation of mass transfer coefficient of selected foods in evaporators and dehydrators
6-7	Separation of immiscible phase using appropriate centrifuge, fractional distillation of multi component mixtures
8-10	Air classification and determination of particle size index of powdered food materials
11-12	Study of pneumatic conveyers using fluidized solids
12-13	Determination of drying rate and curves under various drying conditions
14-15	Determination of freezing curves for selected fresh fruits and vegetables
16	Application of ultra-filtration and reverse osmosis in processing of fruit juices

Suggested Readings:

- Charm SE. 1971. Fundamental of Food Engineering. AVI Publ.
- Cheryan M. 1998. Ultra-filtration and Micro-filtration Handbook. Technomic Publ.
- Duckworth R. 1975. Water Relations in Foods. Academic Press.
- Heldman DR & Singh RP. 1984. Food Process Engineering. AVI Publ.
- Hendrickx and Knorr. Rockland LB & Stewart GF. 1991. UHP Treatments of Foods. KA/PP Publ.
- Mohsenin NN. 1986. Physical Properties of Plant and Animal Materials. Gordon & Breach Science Publ.
- Rao MA & Rizvi SS. 1986. Engineering Properties of Foods. Marcel Dekker.
- Robertson GL. 1992. Food Packaging (Principles and Practices). Marcel Dekker.
- Watson EL & Harper JC. 1989. Elements of Food Engineering. AVI Publ.

Course No. FST 604
Credits: 2(2+0)

Course Title: FOOD PROCESSING
Semester: II

Theory:

Lecture No.	Topic	Weightage %
1-5	Membrane technology: Introduction to pressure activated membrane processes: micro- filtration, UF, NF and RO and their industrial application.	15
6-10	Supercritical fluid extraction: Concept, property of near critical fluids NCF and extraction methods.	15
11-15	Microwave and radio frequency processing: Definition, Advantages, mechanism of heat generation, application in food processing: microwave blanching, sterilization and finish drying.	15
15-20	Hurdle technology: Types of preservation techniques and their principles, concept of hurdle technology and its application.	15
21-24	High Pressure processing: Concept, equipments for HPP treatment, mechanism of microbial inactivation and its application in food processing. Ultrasonic processing: Properties of ultrasonic, application of ultrasonic as processing techniques.	12
25-28	Newer techniques in food processing: Application of technologies of high intensity light, pulse electric field, ohmic heating, IR heating.	12

29-32	Inductive heating and pulsed X-rays in food processing and preservation. Nanotechnology: Principles and applications in foods.	16
	Total	100

Suggested Readings:

Barbosa-Canovas 2002. Novel Food Processing Technologies. CRC.

Dutta AK & Anantheswaran RC.1999. Hand Book of Microwave Technology for Food Applications.

Frame ND. (Ed.). 1994. The Technology of Extrusion Cooking. Blackie.

Gould GW. 2000. New Methods of Food Preservation. CRC.

Course No. FST 605 **Course Title: FOOD PACKAGING**
Credits: 2(1+1) **Semester: II**

Theory:

Lecture No.	Topic	Weightage %
1-4	Active and intelligent packaging, Active packaging techniques, Intelligent packaging techniques, Current use of novel packaging techniques, Oxygen, ethylene and other scavengers, Oxygen scavenging technology, Ethylene scavenging technology, Carbon dioxide and other scavengers, Antimicrobial food packaging: Constructing an antimicrobial packaging system, Factors affecting the effectiveness of antimicrobial packaging.	25
5-7	Non-migratory bioactive polymers (NMBP) in food packaging, Advantages of NMBP, limitations, inherently bioactive synthetic polymers: types and applications, Polymers with immobilized bioactive compounds.	25
8-10	Time-temperature indicators (TTIs), Defining and classifying TTIs, Requirements for TTIs, The development of TTIs, Current TTI systems, Maximizing the effectiveness of TTIs, Using TTIs to monitor shelf-life during distribution, Using TTIs to optimize distribution and stock rotation.	18
11-13	Packaging-flavour interactions, Factors affecting flavour absorption, role of the food matrix, role of differing packaging materials, Case study: packaging and lipid oxidation, Modeling flavour absorption, Packaging-flavour interactions and active packaging, Novel MAP applications for fresh-prepared produce, Novel MAP gases, Testing novel MAP applications, Applying high O ₂ MAP.	18
14-16	Modern packaging systems: Green plastics for food packaging, The problem of plastic packaging waste, The range of biopolymers, Developing novel biodegradable materials, Legislative issues, Current applications, Integrating intelligent packaging, role of packaging in the supply chain, Creating integrated packaging, storage and distribution: alarm systems and	14

	TTIs, Traceability: radio frequency identification, Recycling packaging materials: The recyclability of packaging plastics, Improving the recyclability of plastics packaging, Testing the safety and quality of recycled material, Using recycled plastics in packaging.	
	Total	100

Practical:

Practical No.	Topic
1-2	Determination of GTR and WVTR in different packaging materials
3-4	Use of oxygen and ethylene scavengers I packaging of fresh fruits
5-6	Application of anti microbial packaging for moisture sensitive foods
7-10	Evaluation of pesticide residue migration from package to food
11-12	Application of MAP and active packaging in selected foods
13-14	Determination of oxidative changes in packaged foods
15-16	Packaging of foods under inert atmosphere

Suggested Readings:

Ahvenainen R. 2001. Novel Food Packaging Techniques. CRC.
 Crosby NT. 1981. Food Packaging Materials. App. Sci. Publ.
 Mahadeviah M & Gowramma RV. 1996. Food Packaging Materials. Tata McGraw Hill.
 Painy FA. 1992. A Handbook of Food Packaging. Blackie.
 Palling SJ. 1980. Developments in Food Packaging. App. Sci. Publ.
 Rooney ML. 1988. Active Food Packaging. Chapman & Hall.
 Sacharow S & Griffin RC. 1980. Principles of Food Packaging. AVI Publ.

Course No. FST 606	Course Title: FOOD ANALYSIS
Credits: 2(0+2)	Semester: II

Practical:

Practical No.	Topic
1-2	Texture analysis of foods
3-5	Colour measurements in raw and processed foods
6-7	Viscosity measurements and its significance in food quality
8-9	Water activity measurements and its significance in food quality
10-11	Techniques for dough rheology and starch characterization
12-14	Surface tension and its significance in food analysis
15-17	Enzymatic methods of food analysis
18-20	Microscopic techniques in food analysis (light microscopy, SEM, TEM, XRD, particle size analysis, image analysis etc.)
21-22	Thermal methods in food analysis (Differential scanning calorimetry and others)
23-25	Chromatographic methods in food analysis and separation
26-28	Extraction techniques in food analysis
29-30	Fluorimetric and polarimetric techniques in food analysis

31-32	Application and operating parameters of Spectrophotometer, AAS, GC, HPLC, NMR, FTIR, GC-MS, LC-MS
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Suggested Readings:

Clifton M & Pomeranz Y. 1988. Food Analysis - Laboratory Experiments. AVI Publ.
 Gruenwedel DW & Whitaker JR. 1984. Food Analysis Principles and Techniques. Vol. I. Physical Characterization. Marcel Dekker.
 Gruenwedel DW & Whitaker JR. 1984. Food Analysis Principles and Techniques. Vol. II. Physicochemical Techniques. Marcel Dekker.
 Gruenwedel DW & Whitaker JR. 1984. Food Analysis Principles and Techniques. Vol. III. Biological Techniques. Marcel Dekker.
 Gruenwedel DW & Whitaker JR. 1984. Food Analysis Principles and Techniques. Vol. IV. Separation Techniques. Marcel Dekker.
 Leenheer AP, Lambert WE & van Bocxlaer JF. 2000. Modern Chromatographic Analysis of Vitamins. 3rd Ed. Marcel Dekker.
 Nollet LML. 1986. Handbook of Food Analysis. Vol. I. Marcel Dekker.

Course No. FST 611	Course Title: ADVANCES IN FOOD BIOTECHNOLOGY
Credits: 3 (2+1)	Semester: I

Theory:

Lecture No.	Topic	Weightage %
1-3	Prospectus of biotechnology- definition, scope and applications, Application of Biotechnology in food (Food industries)	9
4-6	Pharmaceuticals and agriculture, Application of biotechnology for food plant waste utilization, biogas plants	9
7-10	Biological role of DNA in cell metabolism, Molecular genetics i.e. fundamentals of molecular biology with special reference to chemistry and biology and DNA	12
11-13	Primary secondary and tertiary structures of DNA	12
14-17	Genetic recombination mechanisms and technique used for improvement in microbial strains. Recombinant-DNA technology (plasmids and cloning)	12
18-20	Expression of foreign genes, Promoters (Enzyme), Biomass production by using various micro organisms.	12
21-26	Applications of genetical control mechanism in industrial fermentation process, (Induction, manipulation and recombination).	19
27-32	Cell and tissue culture, Continuous cultures, Secondary metabolites synthesis.	15
	Total	100

Practical:

Practical No.	Topic
1-2	Study of auxotroph, Micropropagation through tissue culture
3-4	Strain improvement through U.V. mutation for lactose utilization
5-6	Chemical mutagenesis using chemical mutagens (Ethidium bromide)
7-8	Determination of survival curves using physical and chemical mutagens
9-10	Isolation and analysis of chromosomal / genomic DNA from <i>E.coli</i> and <i>Bacillus cereu</i>
11-12	Separation of protoplast using cellulytic enzymes, Production of Biogas from fruit and vegetable waste
13-14	Introduction of ELISA / Southern blot / DNA finger printing etc.
15-16	Agarose gel electrophoresis of plasmid DNA, Pesticide degradation by <i>pseudomonas spp.</i>

Suggested Readings:

Bains W. 1993. Biotechnology from A to Z. Oxford Univ. Press.

Crueger W & Crueger A. 2000. Biotechnology: A Textbook of Industrial Microbiology. Madison, USA.

Gambell CW & Vezina C. 1984. Advances in Biotechnology. Vol. I. Scientific and Engineering Principles.

Gambell CW & Vezina C.1984. Advances in Biotechnology. Vol. II. Fuels, Chemicals, Foods and Waste Treatments.

Joshi VK & Pandey A. 2003. Biotechnology Food Fermentation. Vols. I, II. Education Publ.

Knorr D. 2002. Food Biotechnology. Marcel Dekker.

Peppler & Perlman.1979. Microbial Technology. Vol. I. (Microbial Process) Academic Press VII International Biotechnology Symposium New Delhi. Part-I & II

Course No. FST 618

Course Title: JUICE PROCESSING TECHNOLOGY

Credits : 3(2+1)

Semester : II

Theory:

Lecture No.	Topic	Weightage %
1-3	Juice Processing: Present status of juice processing in India & Abroad. Recent advances in juice processing technology.	9
4-7	Prospects of future growth in juice processing in India.	12
8-12	Fruits & its processing: Harvesting and pre-processing consideration, Postharvest processing, washing, skin removal, cutting and trimming, blanching, canning, freezing & dehydration of fruits, Fruit Processing: Freezing, blanching, ascorbic acid dip, SO ₂ dip, sugar syrup preservation, salt preservation, vacuum dehydration, concentration and drying.	15
13-16	Application of membrane technology in processing of juices, Juice Processing : Orange juice, Grape fruit juice, Lemon & Lime juice, Pine apple juice, Apple juice, Mango juice.	12
17-21	Fruits Beverages & other processing: Fruit Beverage, Orange	15

	squash, Grape fruit squash, Lemon squash, Orange squash, Pine apple squash, Syrups, Rose, Sandal, pine apple, orange, mulberry & apple, Carbonated beverage, Lemon, lime, pine apple, Fruit juice concentrate.	
21-25	Tamarind Juice Concentrate and Fermented Beverages, Miscellaneous, fruit juices, tropical fruit beverages, Nectars, pulpy juices, tropic blends, Beverages-Classification, Scope, Manufacture of carbonated non alcoholic beverages.	15
26-32	Equipments & tools for juice extraction: Equipments for fruit juices, Washing equipment, sorting equipment, extraction equipment, Halving & burring machine, Roller type Press, Crusher for grape berries, Pulping equipment, Straining & screening, filtration equipment, Deareator & flash Pasteurizer.	22
	Total	100

Practical:

Practical No.	Topic
1-2	Preparation of fruit juices- orange, pineapple, apple, lemon etc
3-4	Preparation of syrups, preparation of fruit beverage i.e. orange squash, grape squash, lime squash
5-6	Lime juice cordial, preparation of fruit juice concentrates
7-9	Preparation of fermented beverages, preparation of carbonated beverages
10-12	Post harvest handling of fruits for juice extraction
13-14	Preparation of nectars
15	Packaging of fruit juices
16	Visit to fruit juice factory

Suggested Readings:

Desrosier NW & JamesN. 2004. The Technology of Food Preservation. 4th Ed. CBS.
 Lal G, Siddappa GS & Tandon GL. 1998. Preservation of Fruits and Vegetables. ICAR.
 Nelson PE & Tressler DK.1980. Fruit & Vegetable Juice Processing Technology. Vol. III. AVI Publ.
 Potter NN.1978. Food Science. 3rd Ed. AVI Publ.

Course No. FST 624 Course Title: PROTEIN CHEMISTRY AND TECHNOLOGY
Credits: 3(2+1) Semester: III

Theory:

Lecture No.	Topic	Weightage %
1-3	Protein structure and chemistry; protein –protein interactions, methods of evaluation of protein quality and amount.	9
4-7	Conventional and novel sourcesof protein.	9
8-11	Production of proteins, protein concentrates/isolates from	9

	legumes,oilseeds.	
12-14	Production of proteins, protein concentrates/isolates from fish, seafood, leaf, microbes.	9
15-18	Functional properties of proteins and their applications; Structure-function relationships of different food proteins.	12
19-21	Textured vegetable proteins and different methods of texturization.	9
22-26	High protein food formulations, Modification of proteins by enzymes.	15
27-30	Manufacture of protein hydrolysates, their characterization and applications, chemical and physical methods.	12
31-32	Interactions of proteins with flavours, polysaccharides, lipids and their technological effects, Protein-based fat substitutes, Protein engineering.	16
	Total	100

Practical:

Practical No.	Topic
1-5	Isolation of proteins from different raw materials such as soybeans, oilseed meals, fish, leaves, milk
6-9	Preparation of protein isolates, concentrates and hydrolysates and evaluation of their nutritional and functional properties
10-13	Development of high-protein food formulations
14-16	Visits to industrial units manufacturing protein-based products

Suggested Readings:

Damodaran S & Paraf A. 1997. Food Proteins and their Applications. Marcel Dekker.
 Gennadios A. 2002. Protein-Based Films and Coatings. CRC.
 Sikorski ZE. 2001. Chemical and Functional Properties of Food Proteins.CRC.
 Yada R. 2004. Proteins in Food Processing. Woodhead.

Course No.FST 625**Course Title: CONFECTIONERY TECHNOLOGY****Credit: 3(2+1)****Semester: III****Theory:**

Lecture No.	Topic	Weightage %
1-3	Raw Materials for Confectionery Manufacture, Comprehensive understanding of raw materials used in the confectionery manufacturing and processing industry, including quality control methods. Sugar, Dried milk products.	9
4-7	Special fats, Emulsifiers, Nut kernels, Alcoholic ingredients, The production of cocoa liqueur from the cocoa bean, manufacturing processes.	9
8-11	Chocolate Processing Technology, Compound Coatings & Candy Bars, Tempering technology, Chocolate hollow figures, Chocolate shells, Enrobing technology.	9

12-14	Manufacture of candy bars, Presentation and application of vegetable fats. Production of chocolate mass.	9
15-19	Sugar Confectionery manufacture, General technical aspects of industrial sugar confectionery manufacture, Manufacture of high boiled sweets–Ingredients.	15
20-24	Methods of manufacture/ co extruded products. Manufacture of gums and jellies–Quality aspects.	15
25-28	Manufacture of Miscellaneous Products, Caramel, Toffee and fudge–Liquorices paste and aerated confectionery, Lozenges, sugar panning and Chewing gum, Count lines Quality aspects, fruit confections.	12
29-32	Flour confectionary Ingredients and flour specification–Types of dough–Developed dough, short dough, semi-sweet, enzyme modified dough and batters- importance of the consistency of the dough. Indian flour confections manufacture–ingredients–manufacturing process–types of chemically aerated goods.	22
	Total	100

Practical:

Practical No.	Topic
1-4	Quality assessment of flour, batter rheology
5-8	Leavening agents, Different tests for leavening action of baking powder, sodium-bicarbonate and ammonium-bi-carbonate.
9-12	Preparation of different varieties of sugar, candies, chewing gums, and chocolate, flour confections, fruit confections.
13-16	Indian traditional confections, chikki, etc.

Suggested Readings:

Bent A, Bennion EB & Bamford GST. 1997. The Technology of Cake Making. 6th Ed. Blackie.
 Jackson EB. 1999. Sugar Confectionery Manufacture. 2nd Ed. Aspen Publ.
 Junk WR & Pancost HM. 1973. Hand Book of Sugars for Processors. Chemists and Technologists. AVI Publ.
 Manley DJR. 1983. Technology of Biscuits, Crackers, and Cookies. Ellis Horwood.
 Matz SA. 1992. Bakery Technology and Engineering. 3rd Ed. Chapman & Hall.
 Pomeranz Y. 1987. Modern Cereal Science and Technology. MVCH Pub

Course No. FST 533**Course Title; BUSINESS MANAGEMENT & INTERNATIONAL TRADE****Credit: 3 (3+0)****Semester: II****Theory:**

Lecture No.	Topics	Weightage %
1-5	Concept and functions of marketing, Concepts and scope of marketing management, Concepts and elements of marketing mix, Concept of market structure, Micro and macro environments	10
6-10	Consumer behaviour and consumerism, Marketing	10

	opportunities- Analysis, Marketing research, Market measurement- present and future demand	
11-15	Market forecasting, Market segmentation, targeting and positioning, Allocation and marketing resources, New product development process, Product brand	10
16-20	Services decisions, Marketing channel decisions, Retailing, wholesaling and distribution, Marketing Planning Process, Product policy and planning	10
21-25	Product –mix and product line, Product life cycle, Price determination and pricing policy of milk products in organized and unorganized sectors of dairy industry, Promotion- mix decisions,	10
26-30	Deciding advertising objectives, Advertising budget and advertising message, Media Planning, Personal Selling, Publicity	10
31-35	Sales Promotion, Food Products Marketing, Dairy Products Marketing, Salient features of International Marketing	10
36-39	Composition and direction of Indian exports, International marketing environment, Deciding which and how to enter international market, Exports- Direct exports and indirect exports	10
40-42	Licensing, Joint Ventures	6
43-48	Direct investment and internationalization process, Deciding marketing Programme, Product, Promotion, Price Distribution Channels, Price Distribution Channels, World Trade Organization	14
	Total	100

Suggested Readings:

- Chhabra TN and Suria RK. 2001. Management Process and Perspectives. Kitab Mahal.
 Jhingam ML. 2005. International Economics. 5th Ed. Virnda Publ.
 Kotler P. 2000. Marketing Management. Prentice Hall.
 Reddy SS, Ram PR, Sastry TVN and Bhavani ID. 2004. Agril. Economics. Oxford and IBH.