



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



Master's Programme in Food Technology

Course Layout

Minimum Credit Requirements

Sr. No.	Subject	Minimum credit(s)
1.	Major	20
2.	Minor	09
3.	Supporting	06
4.	Seminar	01
5.	Research	20
	Total Credits	56
	Compulsory Non Credit Courses	06

Sr. No.	Course No.	Course Title	Credits
Major Courses (Min. 20 credits)			
1.	FST 501	Food Chemistry and Nutrition	2+1=3
2.	FST 502	Food Microbiology	2+1=3
3.	FST 503	Food Engineering	2+1=3
4.	FST 504	Principles of Food Processing	2+1=3
5.	FST 505	Food Packaging Technology	1+1=2
6.	FST 506	Food Quality Systems and Management	2+1=3
7.	FST 507	Techniques in Food Analysis	1+2=3
		Total	12+8=20
Minor Courses (Min. 09 credits)			
Group I			
1.	FST 512	Technology of Fruits and Vegetable Processing	2+1=3
2.	FST 513	Technology of Cereals , Pulses and Oilseeds	2+1=3
Group II			
1.	FST 523	Nutraceuticals and Health Foods	2+1=3
		Total	6+3=9

Supporting Courses (Min. 06 credits)			
1.	STAT 511	Statistical Methods for Applied Science	2+1=3
2.	FST 533	Business Management and International Trade	3+0=3
		Total	5+1=6
Seminar (01 credit)			
1.	FST 591	Master's Seminar	1+0=1
		Total	1+0=1
Research (20 credits)			
1.	FST 599	Master's Research	0+20=20
		Total	20
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: 56 (36 course work + 20 thesis)

I. Semester wise Course Layout

Semester I

A. Major Courses		
FST 501	Food Chemistry & Nutrition	2+1=3
FST 502	Food Microbiology	2+1=3
FST 503	Food Engineering	2+1=3
FST 504	Principles of Food Processing	2+1=3
B. Minor Courses		
FST 512	Technology of Fruits and Vegetable Processing	2+1=3
C. Supporting Courses		
STAT 511	Statistical Methods for Applied Science	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 506	Food Quality Systems and Management	2+1=3
FST 507	Techniques in Food Analysis	1+2=3
B. Minor Courses		
FST 513	Technology of Cereals, Pulses and Oilseeds	2+1=3
FST 523	Nutraceuticals and Health Foods	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 505	Food Packaging Technology	1+1=2
B. Minor Courses		
-		
C. Supporting Courses		
-		
D. 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 591	Master's Seminar	1+0=1
E. Compulsory Non-Credit Courses		
-		

Research

FST 599	Master's Research	0+20=20
Total		20

Grand Total of Major + Minor + Research + Supporting Course Credits	24+12=36
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II. Theory, Practical Syllabus and Teaching Schedule

Course No. FST 501
Credit: 3 (2+1)

Course Title: FOOD CHEMISTRY AND NUTRITION
Semester: I

Theory:

Lecture No.	Topic	Weightage %
1-3	Definition and importance; major food constituents and their physicochemical properties; role of water in food.	9
4-8	Carbohydrates, proteins and lipids: classification, physical, chemical, nutritional, and functional properties and their structural correlations;	16
9-11	Auto-oxidation of lipids and rancidity.	9
12-18	Properties of minerals, vitamins, pigments, anti-oxidants, flavour components, allergens, toxins and anti-nutritional factors in foods;	22
19-21	Interaction of constituents in food systems; Changes during storage and processing; Browning reactions in foods.	9
22-28	Food groups and their typical composition; essential nutrients-sources, functions, deficiency diseases; requirements and recommended dietary allowances;	22
29-32	Digestion, absorption, transport and metabolism of nutrients in human system; protein quality evaluation.	13
	Total	100

Practical:

Practical No.	Topic
1-2	Proximate analysis of foods
3-4	Calorific value of foods
5-6	Determination of TSS; pH; acidity of foods
7-8	Estimation of browning intensity of foods
9-10	Determination of vitamin C and beta carotene
11-14	Determination of sugars; estimation of calcium, phosphorus and iron
15-16	Estimation of antinutritional factors in foods

Suggested Readings:

Bamji MS, Rao NA & Reddy V. 2003. Textbook of Human Nutrition. Oxford & IBH.
 Belitz HD. 1999. Food Chemistry. Springer Verlag.
 DeMan JM. 1976. Principles of Food Chemistry. AVI.
 Fennema OR. 1996. Food Chemistry. Marcel Dekker.
 Meyer LH. 1987. Food Chemistry. CBS.
 Swaminathan M. 1974. Essentials of Foods and Nutrition. Vol. II. Ganesh & Co.

Course No. FST 502
Credits: 3 (2+1)

Course Title: FOOD MICROBIOLOGY
Semester: I

Theory:

Lecture No.	Topic	Weightage %
1-6	Growth and survival of microorganisms in foods; spoilage organisms of milk, fruits, vegetables, grains and oilseeds, meat and poultry.	19
7-12	Physical and chemical methods to control microorganisms	20
13-17	Biochemical changes caused by microorganisms; Microbes in food fermentation, putrefaction, lipolysis;	16
18-21	Antagonism and synergism in microorganisms; Food poisoning and food borne infections; Microbial toxins.	12
22-26	Food hygiene and sanitation: Contamination during handling and processing and its control; indicator organisms;	15
27-29	Rapid methods in detection of microorganisms.	9
30-32	Food Fermentations; Traditional fermented foods of India and other Asian countries; Probiotics and prebiotics; Fermented foods based on milk, meat and vegetables; Fermented beverages.	9
	Total	100

Practical:

Practical No.	Topic
1-3	Microscopic examination of bacteria, and yeast and molds
4-7	Standard plate count; Yeast and mould count; Spore count
8-10	Detection and enumeration of pathogenic and indicator organisms in food
11-13	MPN of coli forms
14-15	Enumeration of physiological groups- psychrophile, thermodurics, osmophiles and halophiles
16	Evaluation of microbiological quality of commonly consumed street foods

Suggested Readings:

- Banawart GJ. 1989. Basic Food Microbiology. 2nd Ed. AVI Publ.
 Frazier J & Westhoff DC. 1988. Food Microbiology. 4th Ed. McGraw Hill.
 Garbutt J. 1997. Essentials of Food Microbiology. Arnold Heinemann.
 Jay JM, Loessner MJ & Golden DA. 2005. Modern Food Microbiology. 7th Ed. Springer.
 Ray B. 2004. Fundamentals of Food Microbiology. 3rd Ed. CRC.
 Robinson RK. (Ed.). 1983. Dairy Microbiology. Applied Science.
 Steinkraus KS. 1996. Handbook of Indigenous Fermented Foods. Marcel Dekker.

Course No.FST 503
Credit: 3 (2+1)

Course Title: FOOD ENGINEERING
Semester: I

Theory:

Lecture No.	Topic	Weightage %
1-3	Introduction to food engineering & processes: principles of thermodynamics and heat transfer applied to food engineering;	9
4-5	Fundamentals of heat and analogy to mass transfer in food processing.	9
6-10	Kinetics of biological reactions - kinetics of reactions occurring in processed foods, reaction velocity constant, order of reaction; quality changes during storage of foods; application of Arrhenius equation to biological reactions.	16
11-16	Method for thermal process evaluation - Commercial sterility, pasteurization and sterilization methods based on slowest heating region; determination of the process time based on region of greatest temperature lag; the process equivalence in terms of minutes at 121.1°C;	19
17-20	Calculation of process time for fluids on stream line flow and turbulent flow heated in heat exchangers; general introduction to aseptic canning process, hydrostatic sterilizer and aseptic packaging practices and design problems.	13
21-25	Food chilling and freezing – Precooling and cold storage; CA and MA; Properties of frozen foods; freezing point depression; general introduction to enthalpy change during freezing;	15
26-28	Plank's equation for predicting rates of product freezing; Cryogenic freezing and IQF; design of food freezing equipment such as air blast freezers, plate freezers and immersion freezers.	9
29-32	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.	10
	Total	100

Practical:

Practical No.	Topic
1-3	Determination of viscosity of Newtonian fluid, Non Newtonian fluids
4-6	Design of pumping systems
7-8	Determination of thermal properties of foods such as thermal conductivity, thermal diffusivity, calorific value and specific heat
9-10	Calculation of freezing time for some typical foods
11-12	Study of different types of freezers
13-14	Calculation of thermal process time in canning of some foods
15	Determination of 'U' for PHE; Determination of 'U' for SSHE
16	Visit to Food Processing Plants

Suggested Readings:

Brennan JG, Butter JR, Corell ND & Lilly AVE. 1990. Food Engineering Operations. Elsevier.

Charm SE, McCabe WL, Smith JC & Harriott P.1993. Unit Operations of Chemical Engineering. McGraw Hills.

Earle RL. 1985. Unit Operations in Food Processing. Pergamon Press.

Fellows P. 1988. Food Processing Technology. VCH Ellis Horwood.

Heldman DR & Singh RP.1995. Food Process Engineering. AVI Publ.

McCabe WL & and Smith JC. 1971. Fundamental of Food Engineering. AVI Publ.

Sahay KM & Singh KK. 1994. Unit Operation of Agricultural Processing. Vikas Publ. House.

Singh RP & Heldman DR. 1993. Introduction to Food Engineering. Academic Press.

Course No. FST 504
Credit: 3 (2+1)

Course Title: PRINCIPLES OF FOOD PROCESSING
Semester: I

Theory:

Lecture No.	Topic	Weightage %
1-2	Scope of food processing; historical developments; principles of food processing and preservation.	6
3-6	Processing and preservation by heat – blanching, pasteurization, sterilization and UHT processing, canning,	13
7-9	Extrusion cooking, dielectric heating, microwave heating, baking, roasting and frying, etc.	8
10-13	Processing and preservation by low-temperature-refrigeration, freezing,	13
14-16	CA, MA, and dehydro-freezing.	8
17-20	Processing and preservation by drying, concentration and evaporation	13

21-24	Types of dryers and their suitability for different food products; ultra- filtration, reverse osmosis.	13
25-28	Processing and preservation by non-thermal methods, irradiation, high pressure, pulsed electric field, hurdle technology.	13
29-32	Use and application of enzymes and microorganisms in processing and preservation of foods; food fermentations, pickling, smoking etc; Food additives: definition, types and functions, permissible limits and safety aspects.	13
Total		100

Practical:

Practical No.	Topic
1-3	Seaming and testing of cans
4-6	Tin coating measurement and tests for sulphide stain and crystal size of tin plates
7-9	Determination of thermal inactivation time of enzymes
10-12	Thermal processing of foods; Dehydration of foods; Refrigeration, Freezing of foods; Concentration of foods
13-14	Use of chemicals in preservation of foods
15	Fermented food products; Extrusion cooking of foods
16	Visit to a food processing plant

Suggested Readings:

- Arsdel WB, Copley MJ & Morgan AI. 1973. Food Dehydration. 2nd Ed. Vols. I, II. AVI Publ.
- Desrosier NW & James N. 1977. Technology of Food Preservation. 4th Ed. AVI. Publ.
- Fellows PJ. 2005. Food Processing Technology: Principle and Practice. 2nd Ed. CRC.
- Jelen P. 1985. Introduction to Food Processing. Prentice Hall.
- Potter NN & Hotchkiss 1997. Food Science. 5th Ed. CBS.
- Potty VH & Mulky MJ. 1993. Food Processing. Oxford & IBH.
- Ramaswamy H & Marcotte M. 2006. Food Processing: Principles and Applications. Taylor & Francis.

Course No.FST 505
Credit: 2 (1+1)

Course Title: FOOD PACKAGING TECHNOLOGY
Semester: III

Theory:

Lecture No.	Topic	Weightage %
1-3	Definitions, objectives and functions of packaging and packaging materials; Packaging requirements and selection of packaging materials; Types of packaging materials: Paper: pulping, fibrillation and beating, types of papers and their testing methods;	18
4-6	Glass: composition, properties, types of closures, methods of bottle making; Metals: Tinplate containers, tinning process, components of tinplate, tin free steel (TFS), types of cans, aluminum containers, lacquers; Plastics: types of plastic films, laminated plastic materials, co-extrusion, edible films, biodegradable plastics.	19
7-10	Properties of materials such as tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, their methods of testing and evaluation; Barrier properties of packaging materials:	18
11-13	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.	19
14-15	Food packaging systems: Different forms of packaging such as rigid, semirigid, flexible forms and different packaging system for (a) dehydrated foods (b) frozen foods (c) dairy products (d) fresh fruits and vegetables (e) meat, poultry and sea foods.	19
16	Packaging equipment and machinery: Vacuum, CA and MA packaging machine; gas packaging machine; seal and shrink packaging machine; form and fill sealing machine; aseptic packaging systems; bottling machines; carton making machines.	7
	Total	100

Practical:

Practical No.	Topic
1-2	Identification and testing of packaging materials
3-4	Determination of wax from wax paper
5-6	Testing of lacquered tin plate sheets
7-8	Measurement of tin coating weight by Clarke's method; To perform sulphide stain test; To conduct ferricyanide paper test for porosity
9-10	Determination of equilibrium moisture content; Grading of glass bottles for alkalinity
11-12	Determination of water vapour transmission rate of packaging material; To perform vacuum packaging of food sample and carry out its storage study; Testing the compression strength of the boxes
13-14	Packaging the food material in seal and shrink packaging machine and study its shelf life
15-16	Testing the strength of glass containers by thermal shock test; Testing the strength of filled pouches by drop tester

Suggested Readings:

Crosby NT.1981. Food Packaging: Aspects of Analysis and Migration Contaminants. App. Sci. Publ.

Kadoya T. (Ed). 1990. Food Packaging. Academic Press.

Mahadeviah M & Gowramma RV. 1996. Food Packaging Materials. Tata McGraw Hill.

Palling SJ. (Ed). 1980. Developments in Food Packaging. App. Sci. Publ.

Painy FA. 1992. A Handbook of Food Packaging. Blackie Academic.

Sacharow S & Griffin RC. 1980. Principles of Food Packaging. AVI Publ.

Stanley S & Roger CG.1970. Food Packaging. AVI Publ.

Course No.FST 506 Course Title: FOOD QUALITY SYSTEMS & MANAGEMENT
Credit: 3 (2+1) Semester: II

Theory:

Lecture No.	Topic	Weightage %
1-6	Concept of quality: Quality attributes- physical, chemical, nutritional, microbial, and sensory; their measurement and evaluation;	19
7-12	Sensory <i>vis-à-vis</i> instrumental methods for testing quality.	19
13-18	Concepts of quality management: Objectives, importance and functions of quality control; Quality management systems in India; Sampling procedures and plans; Food Safety and Standards Act, 2006; Domestic regulations;	19
19-23	Global Food safety Initiative; Various organizations dealing	15

	with inspection, traceability and authentication, certification and quality assurance (PFA, FPO, MMPO, MPO, AGMARK, BIS); Labeling issues.	
24-29	Quality assurance, Total Quality Management; GMP/GHP; GLP, GAP; Sanitary and hygienic practices; HACCP; Quality manuals, documentation and audits; Indian & International quality systems and standards like ISO and Food Codex;	19
30-32	Export import policy, export documentation; Laboratory quality procedures and assessment of laboratory performance; Applications in different food industries; Food adulteration and food safety. IPR and Patent.	9
	Total	100

Practical:

Practical No.	Topic
1-2	Testing and evaluation of quality attributes of raw and processed foods
3-4	Detection and estimation of food additives and adulterants
5-6	Quality assurance procedure, GMP, GAP documentation
7-8	Preparation of quality policy & documentation
9-10	Application of HACCP to products, Preparation of HACCP chart
11-12	Preparation of documentation & records
13-14	Visit to Units with ISO systems; Visit to Units with HACCP certification
15-16	Visit to Units implementing GMP, GAP; Mini-project on preparation of a model laboratory manual

Suggested Readings:

- Amerine MA, Pangborn RM & Rosslos EB. 1965. Principles of Sensory Evaluation of Food. Academic Press.
- Early R. 1995. Guide to Quality Management Systems for Food Industries. Blackie Academic.
- Furia TE. 1980. Regulatory status of Direct Food Additives. CRC Press.
- Jellinek G. 1985. Sensory Evaluation of Food - Theory and Practice. Ellis Horwood.
- Krammer A & Twigg BA. 1973. Quality Control in Food Industry. Vol. I, II. AVI Publ.
- Macrae R, Roloson R & Sadlu MJ. 1994. Encyclopedia of Food Science & Technology & Nutrition. Vol. XVI. Academic Press.
- Piggot J.R. 1984. Sensory Evaluation of Foods. Elbview Applied Science.
- Ranganna S. 2001. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2nd Ed. Tata-McGraw-Hill.

Suggested Readings:

- AOAC International. 2003. Official methods of analysis of AOAC International. 17th Ed. Gaithersburg, MD, USA, Association of Analytical Communities.
- Kirk RS & Sawyer R. 1991. Pearson's Chemical Analysis of Foods. 9th Ed. Longman Scientific & Technical.
- Leo ML. 2004. Handbook of Food Analysis. 2nd Ed. Vols. I-III.
- Linden G. 1996. Analytical Techniques for Foods and Agricultural Products. VCH.
- Macleod AJ. 1973. Instrumental Methods of Food Analysis. Elek Sci. Marcel Dekker.
- Nielsen S. (Eds.). 1994. Introduction to Chemical Analysis of Foods. Jones & Bartlett.
- Pomrenz Y & Meloan CE. 1996. Food Analysis - Theory and Practice. 3rd Ed. CBS.
- Ranganna S. 2001. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2nd Ed. Tata-McGraw-Hill.
- Robinson JW. 1970. Undergraduate Instrumental Analysis. Marcel Dekker.

Course No. FST 512 Course Title: TECHNOLOGY OF FRUITS AND VEGETABLE PROCESSING
Credit: 3(2+1) Semester: I

Theory:

Lecture No.	Topic	Weightage %
1-3	Indian and global scenario on production and processing of fruits and vegetable; Quality requirements of raw materials for processing; sourcing and receiving at processing plants;	10
4-6	Primary processing: grading, sorting, cleaning, washing, peeling, slicing and blanching; minimal processing.	10
7-10	Processing for pulp, puree and concentrates, especially from mango, tomato, guava, papaya, apple, pineapple, pomegranate, grapes etc.	10
11-14	Aseptic packaging, canning, RTS fruit beverages, IQF and frozen fruits and vegetables; for peas, mango pulps	13
15-18	Technology for processed products like pickles, chutneys, sauces particularly from raw mango and other regional fruits and vegetables of importance.	13
19-21	Technology for processed products like pickles, chutneys, sauces particularly from lime and other regional fruits and vegetables of importance.	10
22-26	Processing of fruits for candies, bars, toffees, jams and jellies, squashes and syrups using locally available fruits like papaya and mango.	15
27-29	Processing of fruits for candies, bars, toffees, jams and jellies, squashes and syrups using locally available fruits like aonla and other under-utilized fruits.	10
30-32	Dehydration of fruits and vegetables using various drying technologies like sun drying, solar drying (natural and forced	9

	convection), osmotic, tunnel drying, fluidized bed drying, freeze drying, convectional and adiabatic drying; applications to raisins, dried figs, vegetables, intermediate moisture fruits and vegetables. Fruit powders using spray drying.	
	Total	100

Practical:

Practical No.	Topic
1	Evaluation of pectin grade
2-3	Canning of mango/guava/papaya
3-5	Preparation and quality evaluation of fruit jam: apple/ mango/ guava /papaya /aonla /strawberry and fruits of regional importance
6-9	Preparation and quality evaluation of fruit jelly, woodapple, sweet orange/mandarin/guava,/tamarind; fruit marmalade: ginner marmalade
10-12	Preparation and quality evaluation of fruit preserve and candy; fruit RTS, squash, syrup and candy; preparation of grape raisin, dried fig and dried banana
13	Processing of tomato products; preparation of <i>anardana</i> ; preparation of papain /guava cheese
14	Preparation of pickle, mixed pickle; preparation of dried ginger; preparation of <i>amchur</i> ; preparation of dried onion and garlic
15-16	Preparation of banana and potato wafers; preparation of dehydrated vegetables.

Suggested Readings:

- Barret DM, Somogyi LP & Ramaswamy H. 2005. Processing of Fruits. CRC Press
- FAO. 2007. Handling and Preservation of Fruits and Vegetables by Combined Methods for Rural Areas- Technical Manual. FAO Agr. Ser. Bull., 149.
- Fellows P. 2007. Guidelines for Small-Scale Fruit and Vegetables Processors. FAO Agr. Ser. Bull., 127.
- Lal G, Siddappa GS & Tandon GL. 1998. Preservation of Fruits and Vegetables. ICAR.
- Salunkhe DK & Kadam SS. 1995. Handbook of Fruit Science & Technology: Production, Composition and Processing. Marcel Dekker.
- Salunkhe DK & Kadam SS. 1995. Handbook of Vegetables Science & Technology: Production, Composition, Storage and Processing. Marcel Dekker.
- Somogyi LP. et al. 1996. Processing Fruits - Science and Technology. Vols I, II. Technomic Publ.
- Srivastava RP & Kumar S. 2003. Fruit and Vegetable Preservation -Principles and Practices. International Book Distributors.
- Verma LR & Joshi VK. 2000. Post Harvest Technology of Fruits and Vegetables. Indus Publ.

Course No. FST 513 Course Title: TECHNOLOGY OF CEREALS, PULSES AND OILSEEDS Credit: 3(2+1) Semester: II

Theory:

Lecture No.	Topic	Weightage %
1-3	General introduction and production and utilization trends; Structure and composition of common cereals, pulses and oilseeds.	10
4-9	Wheat: Types and physicochemical characteristics; wheat milling – products and byproducts; factors affecting quality parameters; physical, chemical and rheological tests on wheat flour; additives used in bakery products; flour improvers and bleaching agents;	19
10-14	Manufacture of bakery products, pasta products and various processed cereal-based foods; manufacture of whole wheat <i>atta</i> , blended flour and fortified flour.	15
15-19	Rice: Classification, physicochemical characteristics; cooking quality; rice milling technology; by- products of rice milling and their utilization;	15
20-24	Parboiling of rice- technology and effect on quality characteristics; aging of rice – quality changes; processed products based on rice.	15
25-28	Corn: Types and nutritive value; dry and wet milling, manufacture of value-added products; processing of barley, oats, sorghum and millets.	13
29-32	Legumes and oilseeds: composition, anti-nutritional factors, processing and storage; processing for production of edible oil, meal, flour, protein concentrates and isolates; extrusion cooking technology; snack foods; development of low cost protein foods.	13
	Total	100

Practical:

Practical No.	Topic
1-2	Physical-tests on wheat and rice
3-4	Physicochemical and rheological properties
5-7	Determination of gluten content in wheat flour; Conditioning of wheat
8-9	Milling of wheat and rice by laboratory mill; Parboiling of rice; Quality tests of rice; Amylose content determination in rice
10-11	Malting of barley; puffing and popping of grains; experimental parboiling and assessment of degree of polishing
12-13	Preparation of protein concentrates and isolates and their evaluation for protein content and solubility
14-15	Extraction of oil using expeller and solvent extraction methods
16	Visit to related processing industries.

Suggested Readings:

- Chakrabarty MM. 2003. Chemistry and Technology of Oils and Fats. Prentice Hall.
 Dendy DAV & Dobraszczyk BJ. 2001. Cereal and Cereal Products. Aspen.
 Hamilton RJ & Bhati A. 1980. Fats and Oils - Chemistry and Technology. App. Sci. Publ.
 Hosney RS. 1994. Principles of Cereal Science and Technology. 2nd Ed. AACC.
 Kay DE. 1979. Food Legumes. Tropical Products Institute.
 Kent NL. 1983. Technology of Cereals. 4th Ed. Pergamon Press.
 Kulp K & Ponte GJ. 2000. Handbook of Cereal Science and Technology. 2nd Ed. Marcel Dekker.
 Lorenz KL. 1991. Handbook of Cereal Science and Technology. Marcel Dekker.
 Marshall WE & Wadsworth JI. 1994. Rice Science and Technology. Marcel Dekker.
 Mathews RH. 1989. Legumes Chemistry, Technology and Human Nutrition. Marcel Dekker.
 Matz SA. 1969. Cereal Science. AVI Publ.
 Pomeranz Y. 1987. Modern Cereal Science & Technology. VCH Publ.
 Salunkhe DK. 1992. World Oilseeds: Chemistry, Technology and Utilization. VNR.
 Swern D. 1964. Bailey's Industrial Oil and Fat Products. InterSci. Publ.
 Watson SA & Ramstad PE. 1987. Corn; Chemistry and Technology. AACC.

Course No. FST 523 Course Title: NUTRACEUTICALS AND HEALTH FOODS
Credit: 3 (2+1) Semester: II

Theory:

Lecture No.	Topic	Weightage %
1-3	Introduction to nutraceuticals: definitions, synonymous terms, basis of claims for a compound as a nutraceutical,	9
4-5	Regulatory issues for nutraceuticals including CODEX.	6
6-12	Concept of angiogenesis and the role of nutraceuticals/functional foods; Nutraceuticals for cardiovascular diseases, cancer, diabetes, cholesterol management, obesity, joint pain, immune enhancement,	22
13-18	Age-related macular degeneration, endurance performance and mood disorders – compounds and their mechanisms of action, dosage levels, contraindications if any etc.	19
19-23	Manufacturing aspects of selected nutraceuticals such as lycopene, isoflavonoids, prebiotics and probiotics, glucosamine, phytosterols etc.;	15
24-28	Formulation of functional foods containing nutraceuticals – stability and analytical issues, labeling issues.	15
29-30	Clinical testing of nutraceuticals and health foods; interactions of prescription drugs and nutraceuticals;	7
31-32	Adverse effects and toxicity of nutraceuticals; nutrigenomics – an introduction and its relation to nutraceuticals	7
	Total	100

Practical:

Practical No.	Topic
1-3	Market survey of existing health foods
4-6	Identification and estimation of selected nutraceuticals
7-10	Production and quality evaluation of foods containing nutraceuticals
11-13	Development of labels for health foods
14-16	Visit to relevant processing Units.

Suggested Readings:

- Brigelius-Flohé, J & Joost HG. 2006. Nutritional Genomics: Impact on Health and Disease. Wiley VCH.
- Cupp J & Tracy TS. 2003. Dietary Supplements: Toxicology and Clinical Pharmacology. Humana Press.
- Gibson GR & William CM. 2000. Functional Foods - Concept to Product.
- Goldberg I. 1994. Functional Foods: Designer Foods, Pharma Foods.
- Losso JN. 2007. Anti-angiogenic Functional and Medicinal Foods. CRC Press.
- Manson P. 2001. Dietary Supplements. 2nd Ed. Pharmaceutical Press.
- Campbell JE & Summers JL. 2004. Dietary Supplement Labeling Compliance.
- Neeser JR & German BJ. 2004. Bioprocesses and Biotechnology for Nutraceuticals. Chapman & Hall.
- Robert EC. 2006. Handbook of Nutraceuticals and Functional Foods. 2nd Ed. Wildman

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 opportunities- Analysis, Marketing research, Market measurement- present and future demand	10
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,	10

	wholesaling and distribution, Marketing Planning Process, Product policy and planning	
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.
- Jhingan 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.