Department of Food Technology

M.Sc. Food Technology

M.Sc. Food Technology

Course Contents & Syllabi

SRI DEV SUMAN UTTARAKHAND University
Badshahithol, Tehri (Grahwal)
Uttarakhand

To,

The Honorable Vice Chancellor,

Sri Dev Suman Uttarakhand University,

Badshahithol,Tehri (Garhwal) Uttarakhand

Sub :- Syllabus of M.Sc. Food Technology in semester system.

Sir,

Please find enclosed the syllabus of M.Sc. Food Technology as per the semester system.

Thanking you,

Yours sincerely,

Dr Devendra Singh Rawat,

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Dehra Dun, Uttarakhand Dehra Dun, Uttarakhand

Curriculum of M.Sc. In Food Technology

PREAMBLE

The potential of the Indian food processing industry, which is estimated at $33 billion, is poised to cross $100 billion in the near future. The current size of the food processing industry inIndia is more than the size of both Information Technology and Telecom industry put together. Astrong and dynamic food processing industry is important for diversification and commercialization of agriculture, which involves 70% of the country's population. It ensures value addition to agricultural products, generates employment, enhances income of farmers and creates surplus for export of agro foods. The food processing sector in India, though in the nascent stage, has a market size of $70 billion, employs 13 million persons directly and two-anda half times that number indirectly. Described as the 'Sunrise Industry,' the Ministry for Food Processing Industries, in its Vision 2015 document, aims at doubling the market size by 2009-10 and trebling it by 2014-15.

Agriculture and food processing, although, contributes only a quarter of Indian GDP, it sustains two-third of the population and continues to determine the growth rate of the national economy. Prime Minister Dr Manmohan Singh has recently called for a Second Green Revolution. Since we have already crossed the level of subsistence, the second revolution should aim at sustenance. What is required is to move from a crop-based approach to a farm management based approach, with improved practices, extension facilities and marketing to enhance production in agriculture. Agri-Business and Agri-Processing should be the main driver of the second round of the Green Revolution with crop diversification as one of the main strategies. The huge domestic and large international markets throw open great avenues for the Agri-Business sector. India has all the advantages viz., varied agro climatic conditions to produce every product of demand, easily available labour, abundant natural resources and largest agriculture extension and research institutions. What is required is the initiative to make huge investments coupled with strong policy support. This can happen only on the back of rapid growth in the food processing industries, since it increases shelf life, thereby reduces wastages, presently estimated at about Rs 60,000 crore, adds value, thereby enables better & stable prices to farmers, makes farm produce exportable - the share of processed food in global agri-trade has increased from one-half to two-thirds over the last two decades -generates employment opportunities - the sector is labour intensive, etc. From a nation dependent on food imports to feed its population, India today is not only self sufficient in grain production, but also has a substantial reserves. There are many challenges that still face Indian agriculture, what is gratifying is that the challenges that are faced are for development and not for survival. There is a feeling that Indian agriculture is again at crossroads. As we transit from a production oriented agriculture to a market driven agribusiness, some experts feel and rightly so that Indian agriculture is beginning to show signs of fatigue. Harvests and yields are not as big as they could have been. Soil erosion and depletion of water tables in areas that were the heart of the Green Revolution are reminders that there is only so much pressure you can put on a piece of land.

Equitable agriculture production, processing and management of post harvest losses will be the order in the new millennium. Pocketed revolutions will not be good enough to feed a population that is not only more than 1 billion but adds one Australia to it every year. Genetic modification can make a very substantial contribution by making various crops more resistant to diseases and pests, and /or better able to cope with difficult conditions (e.g. of temperature, drought, salty soil, consequences of global warming, etc). This means that science has to do the research, and to find ways of making it work effectively and safely. Food scientists take the view that the present and future food problems of the world food supply will not be solved by technology alone, but that they cannot be solved without technology. India faces post harvest losses, which are nearly equivalent to the total production in Australia. Lack of infrastructure to store grains fruits, vegetable and other degradable commodities add up another 10-15 % loss in the output. Proper cold storages, infestation free warehouses and proper temperature and humidity control for specific produce is the need of the hour. The mismatch between agricultural production and its subsequent management is a major handicap that rural India faces. Neither of the farmers, processors, exporters and consumers could get the advantage of immense potential for value addition to agricultural produce. Farmers suffer from lack of knowledge of market-oriented production. For processors and exporters there is no assured supply of raw materials and fresh produce. Dependence on imported processing technologies is high since R&D institutions in India fail to provide these. Primitive harvesting and post-harvest handling systems, long chain of intermediaries performing only minimal functions adding to costs and losses, miniscule processing industry, all add to the sufferings of farmers, processors and consumers and act as roadblocks to agriculture and rural development.

The Food and Agriculture Integrated Development Action (FAIDA) report (1997) prepared by McKinsey has estimated that, driven by changing consumer preferences, the annual consumption of 'value-added' foods alone would grow to Rs.225,000 crores by 2007, larger than the entire manufacturing sector! A more recent report has stated an absolute revenue increase of Rs. 900 billion in food manufacturing between 1993 and 2000. This is in contrast with Rs. 150 billion and Rs. 300 billion in the pharmaceutical and IT industries, respectively. Overall, the value of the Indian food industry has increased from Rs. 3.09 trillion in 1993-94 to Rs. 3.99 trillion in 2000-01. The segments with the largest growth potential have been identified as dairy, wheat, fruits and vegetables, and poultry. This report has also identified some of the major challenges for the emerging food industry in India. The challenges for the food preservation, distribution and processing sectors are diverse and demanding, and need to be addressed on several fronts to derive maximum market benefits. Presently, the organizations addressing the educational and R & D requirements are too few, and there is a pressing need for supplementing their efforts. In the emerging scenario, the Food Technology professional needs to develop sufficient awareness and appreciation of the relevant principles of life sciences, and physical sciences, as well as of a wide variety of other topics including: nutrition, preservation and storage techniques, processing unit operations, bioprocessing, waste management, distribution and supply chain management, food laws and regulations and so on. Besides, the professional needs to develop an appreciation of R&D and innovation in critical technology areas such as: newer or novel process development in reservation and storage techniques,

rheology, colloids and dispersal systems, packagingpolymers and composites, sensors for detection and process control, bioprocess engineering, andso on.

Food Technology provides an effective and timely platform for researchers in universities, research institutions, and industries, to conduct research in cutting-edge processing technologies, involved from the beginning of the food supply source to the dinner table of the consumers. The potential exists for the agri-food industry to improve process efficiency, enhance product quality and, extend shelf-life of fresh and processed agri-food products and to establish processes, innovative and emerging technologies, and trends and future research in food and bioproducts processing are particularly important.

Career opportunities

With the rising demand for processed food and increased exports of food and food products, food technology as a career option is becoming more and more popular. The last few years have seen plethora of innovations in the field of preservation and food engineering. So much so that the industry now is voraciously absorbing technologists at a very fast rate. A changing urban life style has been making processed food more dependable by the day. Besides, quality assurance of food is a major concern, which is opening up a quite a few opportunities in the Government and private sectors. Industry, Government agencies and educational and research institutions need the expertise of people holding advanced degree in food science and technology. In addition to food manufacturing companies, a host of other industries offer unlimited opportunities for food scientists in the areas of basic research, quality assurance, product development, regulatory affairs and the application of technology. As for prospects, the public and private sectors have been making a beeline. It is estimated around 200,000 jobs will be available by 2010 in the food and allied sector in our country. Self-employment through establishing start up projects is an important area for the graduates of food technology. There are several government and development department schemes for establishing small and medium enterprises by passing out food technologists and it is important that syllabus must inculcate entrepreneurship among the students of food technology. As a qualified food technologist, one can find umpteen opportunities in food processing multinational and national companies, research and development organizations, Government bodies and academic institutions in the world over. More thrust is laid on food processing and preservation technology in developed as well as developing countries. Therefore, there are more challenging jobs for trained food technologists to play a crucial role in developing value added, newer and nutritious processed food products of natural quality by converting waste in to wealth. Then only one can realize the dream of providing food to every living being across the globe and thereby no one will be deprived of for a morsel of food. It is in this context infinity opportunity beckons. A two years M. Sc. Program is formulated for developing competent Food Technologist for whom significant job opportunities exist in this country. The course is based on basic sciences involved viz. Food Chemistry, Biochemistry, Food Microbiology, Food preservation, Food processing and genetically modified foods. The program obliges students to read original publications and envisages significant inputs in laboratory work, communication skill, creativity, planning, execution and critical evaluation of the

studies undertaken. This program gives common basic knowledge (Biochemistry, Molecular Biology and genetic engineering for development of genetically modified foods, Research Methodology in Food science) during this course. With liberalization of Indian economy, all-round industrial growth has been witnessed in all sectors with improvement in social and economic conditions of our people. This has created demand for more and better quality foods. With advancement in production technology, high yield levels will lead to large amount of marketable surplus of food grains and crop residues, demanding appropriate handling, processing, preservation, storage, marketing and utilization. The development of processing industries to preserve the perishable agricultural produce will not only improve economic and nutritional status of our population but it may help in employment generation in rural as well as urban areas of the country. This can be achieved by linking production, and post harvest technology in synergistic way. At present the export from agrosector represents about 16% of total Indian exports. The primary export commodities are cereals,fruits, vegetables and their processed products, and marine products but fast growing specialty products have also penetrated in foreign markets. Considering the contribution of these products in Indian export, it is necessary to have appropriate technology for handling and processing of agricultural produce. The importance of Food Science and Technology lies in the fact that it has capability to provide food to our population through scientific conservations, eliminating avoidable losses and making available more balanced and nutritious food. High value products from low grade material can be produced by innovative and appropriate processing and packaging technologies and also from byproducts and residue waste using integrated approach. Thus modernization of post harvest operations and agro-processing industries through innovative and appropriate technology has a vital role to play in national economy in general and rural economy in particular. Considering the above aspects, the role of agricultural scientists does not stop at farm level but it continues till the harvested crops and animal products are processed, preserved and further modified into useful and nutritious products, until these are utilized by the consumer. Hence, the post-harvest handling and processing need to be attended on priority basis at national level.

The postgraduate education should meet the occupational demand and absorptive capacity of the economy. Specializations offered at postgraduate level are by and large needed for jobs in research and education sector. Moreover, with development of processing industries, it is quitelikely that the demand for food scientists and technologists will increase in the next few decades. Hence, specializations offered at postgraduate level need to be strengthened considering occupational needs as well as demands of the food industries. Food Technology is basically interdisciplinary program involving chemistry, microbiology and engineering. Hence, basic knowledge of these three disciplines becomes mandatory if student wishes to pursue career in this iscipline.In order to develop strong and need based program, core courses in above disciplines need to be added for developing Food Science and Technology discipline for effective preservation, processing and utilization of perishable produces.

Objectives:

To enable the students to gain an insight into basic aspect of fruit and vegetable processing, to understand the importance of advance techniques in food analysis, acquire knowledge of availability of fruits and vegetables in lean season, regarding processing of animal proteins, recent advances in dairy technology and to develop high quality protein concentrates and weaning foods, novel foodstuff, awareness of importance of cereal legume and oil seed technology. The students will also gain knowledge about various packaging materials and importance of packaging, to be familiar with testing and evaluation of packing media, packaging laws and regulations, to select appropriate packaging material for a variety of foodstuffs vis-à-vis the need for preventing environmental degradation. To develop new food products which are marketable, nutritionally and economically vialable. To develop entrepreneurial skills to set up small scale food industries.

Eligibility for Admission:

A) Candidate possessing B.Sc. Degree in Food Science and technology, Food Science and Quality control, Food Technology and Management, Agriculture, Horticulture and Home Science. Students with B.Sc. degree in Science, Agriculture and Horticulture are also eligible:

MSc Food Technology

FIRST SEMESTER (Theory & Practicals)				
Sr.No.	Subject Code	Subject Name	External Theory Marks Max. Passing marks 40% in each paper	Internal Theory Marks
1	MSFT 101	Principles of Food processing	60	40
2	MSFT 102	Food Microbiology	60	40
3	MSFT 103	Food Chemistry	60	40
4	MSFT 104	Enzymes in food processing	60	40
5	MSFT 105	Techniques in Food Analysis	60	40
6	MSFT 106	Practical 1 (Based on paper 1 & 2)	60	40
7	MSFT 107	Practical 1 (Based on paper 1 & 2)	60	40

SECOND SEMESTER (Theory & Practicals)				
Sr.No.	Subject Code	Subject Name	External Theory Marks Max. Passing marks 40% in each paper	Internal Theory Marks
1	MSFT 108	Fruits and vegetables Processing Technology	60	40
2	MSFT 109	Oilseeds, Cereal and legume technology	60	40
3	MSFT 110	Principles of Food Engineering	60	40
4	MSFT 111	Egg, Meat , Fish and Poultry Technology	60	40
5	MSFT 112	Food quality systems and management	60	40
6	MSFT 113	Practical 1 (Based on paper 1 & 2)	60	40
7	MSFT 114	Practical 1 (Based on paper 1 & 2)	60	40

THIRD SEMESTER (Theory & Practicals)				
Sr.No.	Subject Code	Subject Name	External Theory Marks Max. Passing marks 40% in each paper	Internal Theory Marks
1	MSFT 115	Technology of milk and milk products	60	40
2	MSFT 116	Food additives, contaminants and toxicology	60	40
3	MSFT 117	Principles of food analysis and sensory evaluation	60	40
4	MSFT 118	Food Packaging Technology	60	40
5	MSFT 119	Nutraceuticals and functional foods	60	40
6	MSFT 120	Practical 1 (Based on paper 1 & 2)	60	40
7	MSFT 121	Practical 1 (Based on paper 1 & 2)	60	40

FOURTH SEMESTER (Theory & Practicals)				
Sr.No.	Subject Code	Subject Name	External Theory Marks Max. Passing marks 40% in each paper	Internal Theory Marks
1	MSFT 122	Thesis Research and Presentation	200+200	50

FIRST SEMESTER

MSFT 101 PRINCIPLES OF FOOD PROCESSING

Objective

To acquaint with principles of different techniques used in processing and preservation of foods.

Theory

UNIT I

Definition and scope of food processing; historical developments; national and international perspectives, causes of spoilage and general principles of food processing and preservation; preservations of foods by different methods.

Food packing-function of primary packaging, design consideration and material suitable for rigid and flexible food containers. Preparation of food for processing- cleaning, selection and grading, and size reduction

UNIT II

Processing and preservation by high temperature, Principles of thermal processing, Basic steps in thermal processing,– blanching, pasteurization, sterilization and UHT processing, canning, extrusion cooking, microwave heating.

Effect of temperature on microorganisms, effect of temperature on foods and use of different temperatures for processing food, various steps in canning, processing equipments used for canning foods, aseptic canning.

Food preservation by heating: drying, osmotic dehydration, blanching, canning, pasteurization, sterilization;

UNIT III

Method of calculation of process time; different time- temperature combination, TDT curve and TDR curve, margin of safety, 12 D value.

pH classification of foods, microorganisms associated with spoilage of canned foods of different pH groups.

concentration-its application in food industry, concentration processes, equipments for concentration of foods. Drying: concept of water activity and its effect on physic-chemical and microbial changes in food. Mechanism of drying, factors affecting drying rate, effect of drying

on product quality; Intermediate moisture foods.

UNIT IV

Food preservation by low-temperature- refrigeration, freezing, CA, MA, and dehydro-freezing. Mechanism of freezing of water in foods, effect of freezing on quality of foods; methods of freezing, storage and thawing of frozen foods.

UNIT V

Non-thermal preservation: Hydrostatic pressure, dielectric heating, microwave processing, high pressure, pulsed electric field, hurdle technology, membrane technology, irradiation.

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.

Practical's for the above Reference Books:

Food Science Norman N.Potter

Food Processing technology P. Fellows.

Technology of Food Preservation Desosier & Desosier

Unit operations in Food Processing R. K. Singh & Sahai

Food Packaging Khetrapaul & Pania

Food Dehydration. Arsdel WB, Copley MJ & Morgan AI. 1973. 2nd Ed. Vols. I, II. AVI Publ.

Technology of Food Preservation. Desrosier NW & James N.1977. 4th Ed. AVI. Publ.

Food Processing Technology: Principle and Practice. Fellows PJ. 2005.2

Nd

Ed. CRC.

Introduction to Food Processing. Jelen P. 1985. Prentice Hall.

Food Science. Potter NN & Hotchkiss 1997.5th Ed. CBS.

Food Processing. Potty VH & Mulky MJ. 1993. Oxford & IBH.

Food Processing: Principles and Applications. Ramaswamy H & Marcotte M. 2006. Taylor & Francis.

MSFT 102 FOOD MICROBIOLOGY

Objective

To acquaint with different groups of micro-organisms associated with food, their activities, destruction and detection in food.

Theory

UNIT I

History of microbiology of food. Types of micro-organism normally associated with food- mold, yeast, and bacteria; sources of contaminations: air, water, soil, sewage, Factors influencing growth and survival of microorganisms in foods. Intrinsic factors and Extrinsic factors Microbial growth pattern, physical and chemical factors influencing destruction of micro-organisms.

UNIT II

Micro-organisms in natural food products and their control. Biochemical changes caused by micro-organisms.

Starter cultures, single and mixed strain cultures; propagation, maintenance and evaluation of cultures; factors affecting activity of cultures-bacteriophages, residual antibiotics and chemicals, mutations

UNIT III

Post-processing contamination of foods-stuffs, vegetables, cereals, pulses, oilseeds, milk and meat.Food Spoilage: spoilage of fresh and processed products: fruits and vegetables; meat, fish, egg and poultry, bread.Spoilage organisms of milk, fruits, vegetables, grains and oilseeds, meat and poultry. Spoilage of canned foods.Biochemical changes caused by microorganisms; Microbes in food fermentation, putrefaction, lipolysis; Antagonism and synergism in microorganisms.Food hygiene and sanitation: Contamination during handling and processing and its control;indicator organisms; Rapid methods in detection of microorganisms.

UNIT IV

Food Fermentations; Traditional fermented foods of India and other Asian countries; Probiotics and prebiotics; Fermented foods based on milk, meat and vegetables; Fermented beverages.

Food poisoning (Staphylococcus, Bacillus, Listeria, Salmonella) and microbial toxins, standards for different foods. Food borne infections and intoxicants. Microbial toxins and mycotoxins.

Practical for above.

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. 7

th

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.

Branen A.L. and Davidson, P.M. 1983. Antimicrobials in Foods. Marcel Dekker, New York.

Jay J.M. 1986. Modern Food Microbiology. 3rd Edn. VNR, New York.

Robinson, R.K. Ed. 1983. Dairy Microbiology. Applied Science, London.

MSFT 103 FOOD CHEMISTRY

Objective

• To acquaint with properties and role of various constituents in foods, interaction and changes during processing.

• To acquaint with importance of various foods and nutrients in human nutrition.

Theory

UNIT I

Food chemistry-definition and importance, major food constituents and their physicochemical properties. Water: Role of water in food, water activity and shelf life of food. Concept of water activity. Carbohydrate: Structure, classification, properties & nutritive aspects, sugars, starch, cellulose, hemicellulose, gums, pectic substances polysaccharides.

UNIT II

Protein and amino acids: structure, classifications, sources, denaturation and functional properties of proteins. Maillard browning. Changes in milk and muscle protein during processing Lipids and fatty acids: classification and use of lipids in foods, physical and chemical properties ; Processing aspects, of oil seeds including extraction, refining, hydrogenation and winterization of oil. auto-oxidation of lipids and rancidity, different groups of fats and oils; effects of processing on functional properties.

UNIT III

Properties of minerals, vitamins, anti-oxidants, flavor components, allergens, toxins and anti-nutritional factors in foods; Interaction of constituents in food systems; Effect of processing on vitamins and minerals; Browning reactions in foods. Enzymatic browning in foods and industrial applications of enzymes.

UNIT IV

Natural food flavours, extraction methods and characterization. Pigments in food and their industrial applications. Fiber: Classification and importance in human diet

UNIT V

Food and energy: PEV and GEV of food constituents, Bomb calorimeter and its functioning. Essential nutrients- sources, functions, deficiency diseases; requirements and recommended dietary allowances; digestion, absorption, transport and metabolism of nutrients in human system; protein quality evaluation.

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Practical for above.

Suggested Readings

Aurand, L.W. and Woods, A.E. 1973. Food Chemistry. AVI, Westport.

Bamji MS, Rao NA & Reddy V. 2003. Textbook of Human Nutrition. Oxford & IBH.

Belity & Grosch. Food chemistry.

Belitz HD.1999. Food Chemistry. Springer Verlag.

Birch, G.G., Cameron, A.G. and Spencer, M. 1986. Food Science, 3rd Ed. Pergamon

Dekker, New York.

DeMan JM. 1976. Principles of Food Chemistry. AVI.

Fenemma. Fundamentals of food chemistry .

Fennema OR.1996. Food Chemistry. Marcel Dekker.

Fennema, O.R. Ed. 1976. Principles of Food Science: Part-I Food Chemistry. Marcel

Frank A Lee . Basic food chemistry

Meyer LH. 1987. Food Chemistry. CBS.

Meyer, L.H. 1973. Food Chemistry. East-West Press Pvt. Ltd., New Delhi.

Potter, N.N. 1978. Food Science. 3rd Ed. AVI, Westport.

Press, New York.

Swaminathan M. 1974. Essentials of Foods and Nutrition. Vol. II. Ganesh & Co.

W.S.Wang .Mechanism and theory in food chemistry .

MSFT 104 ENZYMES IN FOOD PROCESSING

Objective

To develop an understanding of enzymes useful in food product technology and food processing with respect to production and purification protocols, applications in commodity technologies, and their impact on sensory and nutritional quality.

Theory

UNIT I

Enzymes– classification, properties, characterization, kinetics and immobilization; fermentative production of enzymes (amylases, proteases, cellulases, pectinases, xylanases, lipases) used in food industry and their downstream processing.

UNIT II

Enzymes for production of protein hydrolysates and bioactive peptides, maltodextrins and corn syrup solids (liquefaction, saccharification, dextrinization, isomerization for production of high-fructose-corn-syrup), fructose and fructo-oligosaccharides.

UNIT III

Enzymes as processing aids: Role of enzymes in cheese making and whey processing; fruit juices (cell wall degrading enzymes for liquefaction, clarification, peeling, debittering, decolourization of very dark coloured juices such as anthocyanases); baking (fungal α-amylase for bread making; maltogenic α-amylases for anti-staling; xylanses and pentosanases as dough conditioners; lipases or dough conditioning; oxidases as replacers of chemical oxidants; synergistic effect of enzymes); meat and meat processing (meat tenderization); egg processing.

UNIT IV

Enzyme processing for flavours (enzyme-aided extraction of plant materials for production of flavours, production of flavour enhancers such as nucleotides; flavours from hydrolyzed vegetable/animal protein); enzymatic approach to tailor- made fats.

Practical for above.

Suggested Readings

Flickinger MC & Drew SW. 1999. Encyclopedia of Bioprocess Technology. A Wiley- Inter Science Publ.

Kruger JE. et al. 1987. Enzymes and their Role in Cereal Technology. American Association of Cereal Chemists Inc.

Nagodawithana T & Reed G. 1993. Enzymes in Food Processing. Academic Press.

Tucker GA & Woods LFJ. 1991. Enzymes in Food Processing.

Whitehurst R & Law B. 2002. Enzymes in Food Technology. Blackwell Publ.

MSFT 105 TECHNIQUES IN FOOD ANALYSIS

UNIT I

Sampling techniques; Water activity, its measurements and significance in food quality; Calibration and standardization of different instruments.

UNIT II

Spectroscopic techniques using UV/Vis, fluorescence, IR, FTIR, NIR, NMR, atomic absorption, ICP, polarimetry, refractometry, microscopic techniques in food analysis (light microscopy, SEM, TEM, XRD, particle size analysis, image analysis etc.).

UNIT III

Chromatographic techniques: Adsorption, column, partition, affinity, ion exchange, size exclusion, GC, GLC, HPLC, HPTLC, GCMS, LCMS.

UNIT IV

Separation techniques: Gel filtration, dialysis, electrophoresis, sedimentation, ultrafiltration and ultracentrifugation, solid phase extraction, supercritical fluid extraction, isoelectric focusing, isotopic techniques, manometric techniques.

UNIT V

Special techniques: Immunoassay techniques; Isotopic, non-isotopic and enzyme immunoassays; surface tension; enzymatic methods of food analysis; thermal methods in food analysis (Differential scanning colorimetry and others).

Practical for above.

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. 3

rd

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.

SECOND SEMESTER

MSFT 108 FRUITS, VEGETABLES AND PLANTATION PRODUCTS

Unit-I

Structural, Compositional and Nutritional aspects of fruits and vegetables. Physiological development: Growth, Maturation, Ripening and Senescence. Post harvest handling including controlled and modified storage. Techniques of processing and preservation of fruits and vegetables by refrigeration and freezing, canning and bottling, drying and dehydration.

Unit-II

Technology of fruits and vegetable products: Juices and pulps, Concentrates and powders, Squashes and cordials. Beverage: Still and carbonated. James, Jellies and Marmalades.Preserves, candies and crystallized fruits. Tomato products: Puree, Paste, Ketchup, Sauce and soup. Chutneys, pickles and other products.

Unit-III

Spices: Composition, Structure and characteristics. Preservation and processing of major and minor spices of India; whole spice, Spice powder, Paste and extracts, Spice oils and oleoresins. Composition, Structure ,characteristics & processing of cashew nut and other dry fruits

Unit-IV

Composition, Production and processing of Tealeaves: Black tea, Green tea and Oolong tea. Instant tea. Production and processing of coffee cherries by wet and dry methods to obtain coffee beans, grinding, storage and preparation of brew, Soluble /Instant coffee, Use of chicory in coffee, decaffeinated coffee.

Unit-V

Production, processing and chemical composition of cocoa beans. Cocoa Processes: Cleaning, roasting, alkalization, cracking and fanning, Nib grinding for cocoa liquor, cocoa butter and

cocoa powder. Manufacturing process for chocolate: Ingredients, Mixing, Refining, Conching,

Tempering, Moulding etc. to obtain chocolate slabs, chocolate bars, enrobed and other

confectionary products.

Book References:

Author Title

G. Lal, G.S. Siddappa and G.L. Tondan Preservation of fruits & vegetables.

& G.L. Tandon B.L. Amla Food Industry.

B. Shrilakshimi Food Science.

Bernard. W. Minifie Chocolate, Cocoa and Confectionary: Science and Technology.

R.H.H. Wills et.al. An introduction to the Post-harvest physiology and handling of fruits and

vegetables.

MSFT 109 TECHNOLOGY OF CEREALS, LEGUMES AND OILSEEDS

Objective

To acquaint with production and consumption trends, structure, composition, quality evaluation,

and processing technologies for product development and value addition of various cereals,

pulses and oilseeds.

Theory

UNIT I

Importance of oil seeds processing in India, Commercial edible oil sources. Processing of crude

oils - oil extraction/expression and solvent extraction.Refining of crude oil- degumming, bleaching, deodourization. Hydrogenation and interesterification, Shortening-introduction, manufacturing and usesof shortening, types of shortening

. Margarine-manufacturing and uses of Margarine. Confectionery coatings.Immitation dairy products - peanut butter and vegetable ghee. Chemical adjuncts lecithins, GMS. Packing and storage of fats and oils, Cocoa butter, fat substitutes and low-calorie foods.

UNIT II

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; manufacture of bakery

products, pasta products and various processed cereal-based foods; manufacture of whole wheat

atta, blended flour and fortified flour.Technology of bread, biscuits, cakes, durum wheat, extruded products (pasta and

noodles).Corn-wet milling and dry milling, corn flakes, corn starch and its hydrolyzed syrups.

UNIT III

Rice: Classification, physicochemical characteristics; cooking quality; rice milling technology; by- products of rice milling and their utilization; Parboiling of rice- technology and effect on quality characteristics; aging of rice - quality changes; processed products based on rice.

UNIT IV

Corn: Types and nutritive value; dry and wet milling, manufacture of value-added products; processing of barley, oats, sorghum and millets.

UNIT V

Legumes: 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.

Preparation of protein concentrates and isolates and their use in high protein foods.

Practical for above.

Suggested Readings

Applied Science, London.

Baking. Royal Society of Chemistry, London.

Blanshard J.M.V., Frazier, P.J. and Galliard, T. Ed. 1986. Chemistry and Physics of

Chakrabarty MM. 2003. Chemistry and Technology of Oils and Fats. Prentice Hall.

Chakraverty, A. 1988. Postharvest Technology of Cereals, Pulses and oilseeds. Oxford

Chemist. St. Paul, Minnesota.

Chemistry, Technology and Utilization. VNR, New York.

CRC Press, Florida.

Dendy DAV & Dobraszczyk BJ. 2001. Cereal and Cereal Products. Aspen.

Durbey, S.C. 1979. Basic Baking: Science and Craft. Gujarat Agricultural University,

Hamilton RJ & Bhati A. 1980. Fats and Oils - Chemistry and Technology. App. Sci. Publ.

Hamilton, R.J. and Bharti, A. Ed. 1980. Fats and Oils: Chemistry and Technology.

Hoseney RS. 1994. Principles of Cereal Science and Technology. 2nd Ed. AACC.

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Kent NL. 1983. Technology of Cereals. 4th Ed. Pergamon Press.

Kent, N.L. 1983. Technology of Cereals. 3rd Edn. Pergamon Press, Oxford, UK.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.

Marcel Dekker, New York.

Marshall WE & Wadsworth JI. 1994. Rice Science and Technology. Marcel Dekker.

Mathews RH. 1989. Legumes Chemistry, Technology and Human Nutrition. Marcel Dekker.

Mathews, R.H. Ed. 1989. Legumes: Chemistry, Technology and Human Nutrition.

Matz SA. 1969. Cereal Science. AVI Publ.

Paquot C. 1979. Standard Methods of Analysis of Oils, Fats and Derivatives. Pergamon Press.

Pomeranz Y. 1987. Modern Cereal Science & Technology. VCH Publ.

Pomeranz, Y. 1987. Modern Cereal Science and Technology. VCH Pub., New York.

Pomeranz, Y. Ed. 1978. Wheat: Chemistry and Technology. Am. Assoc. of Cereal

Processing and Utilization, (3 vol. set). CRC Press, Florida.

Products. Metropolitan Book Co., New Delhi.

Salunkhe DK.1992. World Oilseeds: Chemistry, Technology and Utilization. VNR.

Salunkhe, D.K., Kadam, S.S. and Austin A. Ed. 1986. Quality of Wheat and Wheat

Salunkhe, D.K., Kadam, S.S. Ed. 1989. Handbook of World Food Legumes: Chemistry,

Salunkhe, O.K. Chavan, J.K, Adsule, R.N. and Kadam, S.S. 1992. World Oilseeds:

Swern D. 1964. Bailey's Industrial Oil and Fat Products. InterSci. Publ.

Watson SA & Ramstad PE.1987. Corn; Chemistry and Technology.AACC.

Wolf, I.A. Ed. 1983. Handbook of Processing and Utilization in Agriculture. (2 vol. set).

MSFT 110: Principles of Food Engineering

Theory

UNIT I

Introduction to food engineering & processes: principles of thermodynamics and heat transfer applied to food engineering;

fundamentals of heat and analogy to mass transfer in food processing.

UNIT II

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.

UNIT III

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;

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.

UNIT IV

Food chilling and freezing –

Pre cooling and cold storage;

CA and MA;

Properties of frozen foods,

freezing point depression;

general introduction to enthalpy change during freezing;

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.

UNIT V

Mechanical separation-filtration, membrane concentration, sieving, centrifugation, sedimentation, Mechanical handling-conveying and elevation. Size reduction and classification-mixing, kneading, blending.

Practical for above.

Suggested Readings

Aeldmam & Lunde Hand book of Food Engineering

Batty, J.C. and Folkman, S.L. 1983. Food Engineering Fundamentals. John Wiley and Sons,

New York.

Fennema O.R. Ed. 1985, Principles of Food Science: Part-II Physical Principles of food

Harper, J.C. 1975. Elements of Food Engineering. AVI, Westport.

Heldman, D.R. and Lund, D.B. Ed. 1992. Handbood of Food Engineering Marcel Dekker, New

York.

Preservation. Marcel Dekker, New York.

R.P. Singh Hand book of food Engineering

T.Toledo .Fundamentals of Food Process Engineering

MSFT 111 EGG, POULTRY, MEAT & FISH PROCESSING TECHNOLOGY

UNIT-I

Current levels of production, consumption and export of category products. Nutritional, safety/health and hygienic considerations.

UNIT-II

Egg: Structure, composition, nutritional and functional characteristics of eggs. Grading, spoilage, storage and transportation of whole eggs. Processing of eggs for liquid products (white, yolk and whole egg) and solid products (albumen, whole egg powder) for preservation through freezing & drying.

UNIT-III

Poultry: Pre-slaughter care and consideration; Operations in preparation of dressed poultry, its storage and marketing; Quality and safety considerations; utilization of by-products. Poultry cuts.

UNIT-IV

Meat: Ante-mortem examination of meat animals, scientific techniques of slaughtering, dressing, post-portem inspection, storage, tenderization, cuts, packaging; beef, mutton, pork as human foods, cured meat products, sausages, by-products, frozen and canned meat products.

UNIT-V

Fish: Types, catch, examination; care in handling & transportation; processing of shell-fish,crabs, oysters, lobsters, frog legs etc. for domestic and export markets. Filleting and freezing, canning salting & drying of fish. Fish sauce and protein concentrates.

Books Recommended:

1. Meat Science by R.A. Lawrie,Pergamon Press.

2. Poultry Products Technology by G.J. Mountney.

3. Meat, Poultry & Sea Food Technology by R.L.Henricksons.

4. Poultry Meat and Egg Production by Parkhurst & Mountney.

MSFT112 FOOD QUALITY SYSTEMS AND MANAGEMENT

Objective

To acquaint with food quality parameters and control systems, food standards, regulations, specifications.

Theory

UNIT I

Concept of quality: Quality attributes- physical, chemical, nutritional, microbial, and sensory; their measurement and evaluation; Sensory vis-àvis instrumental methods for testing quality. Objectives, importance and functions of quality control. Methods of quality, assessment of food materials-fruits, vegetables, cereals, dairy products, meat, poultry, egg and processed food products.

UNIT II

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; Global Food safety Initiative;

UNIT III

Various organizations dealing with inspection, traceability and authentication, certification and quality assurance (PFA, FPO, MMPO, MPO, AGMARK, BIS); Labeling issues; International scenario, International food standard.Sanitation and hygiene, GMP, GLP, Statistical quality control. Food laws and standard, PFA, AGMARK.

Unit IV

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; 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.

Unit V

Sampling and specification of raw materials and finished products, Concept of Codex Almentarious/ /USFDA/ISO 9000 series , rules and regulations for waste disposals.Food adulteration and food safety. HACCP, Sensory evaluation-introduction, panel screening, Sensory and instrumental analysis in quality control, IPR and patents.

Practical for above.

Suggested Readings

Amerine MA et al 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 Horwoood.

Krammer A & Twigg BA.1973. Quality Control in Food Industry. Vol. I, II. AVI Publ.

Macrae R. et al.1994. Encyclopedia of Food Science & Technology & Nutrition. Vol. XVI.

Academic Press.

Piggot JR. 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.

Export/import Policy by Govt of India.

THIRD SEMESTER

FT 115: Technology of Milk and Milk Products

Unit-1

Sources, and composition of milk, processing of market milk, standardization, toning of milk, homogenization, pasteurization, sterilization, storage, transportation and distribution of milk.Technology of fluid milk: collection, chilling, transportation, cream separation, standardization, pasteurization, sterilization, homogenization, packaging, storage and distribution of fluid milk, flavoured milk, enriched milk.

Unit-2

Milk product processing-cream, butter, condensed milk, evaporated milk, whole and skimmed milk powder.

Unit-3

Instantization of milk and milk products, ice cream, khoa, channa, paneer, milk sweets.

Judging and grading of milk and its products.

Unit-4

Technology of fermented milk: principles and practices of manufacture, packaging, storage and marketing of dahi, cultured butter milk, acidophilus milk,yoghurt, shrikhand.

Technology of cheese: standards of manufacture of hard, semi hard, soft and processed cheeses.Storage and marketing of cheese. Cheese defects and their control.

Dairy equipments and sanitization.Unit V

Technology of fat rich dairy products: manufacture, packaging, storage and marketing of butter & cream and butter defects and their control.

Technology of frozen milk products: classification, standards manufacture,packaging, storage and marketing. Defects of frozen products and their control.

Technology of concentrated, evaporated and dried milk: standards manufacture, packaging, Storage, defects and their control.

Technology of Indigenous dairy products – Khoa (manufacture, classification and use) Paneer, Ghee.

Technological aspects of casein manufacture; by- products utilization

Practical for above.

Suggested Readings

B.L.Herrington .Milk and Milk Processing

Considine, D.M. Ed. 1982. Foods and Food Production Encyclopaedia, VNR, NewYork.

Dey, S. 1994. Outlines of Dairy Technology. Oxford Univ. Press, New Delhi.

Edgar Spreer .Milk and Dairy Technology

Fox Cheese – chemistry , physics & microbiology vol. I & II

Gregory D.Miller. Handbook of Dairy Foods and Nutrition.

MaCrae, R., Robinson, R.K. and Sadler, M.J. Ed. 1993. Encyclopaedia of Food Science, Food Technology and Nutrition Academic Press, London.

Robinson, R.K. (2 vol. set). 1986. Modern Dairy Technology Elsevier Applied Science, UK.

Rosenthal, I. 1991. Milk and Milk Products. VCH, New York.

Su Kumar De.Outlines of dairy technology.

V.Cheke. Cheese and Butter

Walastra, Geuts, Normen .Dairy Technology.

Warner, J.M. 1976. Principles of Dairy Processing. Wiley Eastern Ltd. New Delhi.

Yarpar, WJ. and Hall, C.W. 1975. Dairy Technology and Engineering AVI, Westport.

MSFT 116 FOOD ADDITIVES, CONTAMINANTS AND TOXICOLOGY

Objective

To get an insight in to the additives that are relevant to processed food industry for shelf life extension, processing aids and sensory appeal. To develop an understanding of isolation of various biopolymers from food resources and their relevant applications.

Theory

UNIT I

Food additives- definitions, classification and functions, Preservatives, antioxidants, colours and flavours (synthetic and natural), emulsifiers, sequesterants, humectants, hydrocolloids, sweeteners, acidulants, buffering salts, anticaking agents, etc. - chemistry, food uses and functions in formulations; indirect food additives; toxicological evaluation of food additives.

UNIT II

Flavour technology: Types of flavours, flavours generated during processing – reaction flavours, flavour composites, stability of flavours during food processing, analysis of flavours, extraction techniques of flavours, flavour emulsions; essential oils and oleoresins; authentication of flavours etc.

UNIT III

Proteins, starches and lipids as functional ingredient; isolation, modification, specifications, functional properties and applications in foods and as nutraceuticals. Introduction to nutraceuticals: definitions, synonymous terms, basis of claims for a compound as a nutraceutical, regulatory issues for nutraceuticals including CODEX.

UNIT IV

Definition scope and general principles of food toxicology; manifestation of toxic effects; classification of food toxicants; factors affecting toxicity of compounds; methods used in safety evaluation-risk assessments.

UNIT V

Toxicants and allergens in foods derived from plants, animals, marine, algae & mushroom; Derived Food toxicants- Processing & Packaging; Toxicants generated during food processing such as nitrosamines, acrylamide, benzene, dioxins and furans; persistent organic pollutants. Toxicology & food additives; Toxicological aspects of nutrient supplements; Chemicals from processing such as fumigants, chlorinated solvents, autoxidation products, carcinogens in smoked foods and pyrolysis, agrochemicals; heavy metals; intentional and unintentional additives.

Practical for above

Suggested Readings

Branen A.L. and Davidson, P.M. 1983. Antimicrobials in Foods. Marcel Dekker, New

Branen AL, Davidson PM & Salminen S. 2001. Food Additives. 2nd Ed. Marcel Dekker.

Dekker, New York.

Fennema, O.R. Ed. 1976. Principles of Food Science: Part-I Food Chemistry. Marcel

Furia, T.E. 1980, Handbook of food additives, Vol I and Vol II.

Gerorge AB. 1996. Encyclopedia of Food and Color Additives. Vol. III. CRC Press.

Gerorge AB. 2004. Fenaroli's Handbook of Flavor Ingredients. 5th Ed. CRC Press.

Madhavi DL, Deshpande SS & Salunkhe DK. 1996. Food Antioxidants: Technological,

Toxicological and Health Perspective. Marcel Dekker.

Morton ID & Macleod AJ .1990. Food Flavours. Part A, BC. Elsevier.

Nakai S & Modler HW. 2000. Food Proteins. Processing Applications. Wiley VCH.

Potter, N.N. 1978. Food Science. 3rd Ed. AVI, Westport.

Stephen AM. (Ed.). 2006. Food Polysaccharides and Their Applications.Marcel Dekker.

York.

MSFT117 Principles of Food Analysis and Sensory Evaluation

UNIT I

Scope and importance of food evaluation in food industry. Importance of proximate composition analysis. Determination of different constituents in different food sample along with the principle involved in their estimation. Fractionation of ash and their importance in food analysis. Principles and methods involved in the estimation of calcium, phosphorus and iron in food samples.

UNIT II

Principles and procedures involved in estimation of starch and sugars. Principles and procedures involved in estimation of vitamins: Vitamin A, C, Riboflavin and thiamin. Determination of enzymatic and non-enzymatic browning in food samples. Importance of rheological properties in food. Techniques and principles involved in their estimation.

UNIT III

Introduction to sensory analysis; general testing conditions, Requirements of sensory laboratory; organizing sensory evaluation programme.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.

Unit IV

Different tests for sensory evaluation– discrimination, descriptive, affective; Flavour profile and tests; Ranking tests; Methods of sensory evaluation of different food products.

Computer-aided sensory evaluation of food & beverage, statistical analysis of sensory data.

Practical for above

Suggested Readings

Amerine MA, Pangborn RM & Rossles EB. 1965. Principles of Sensory Evaluation of Food. Academic Press.

Early R.1995. Guide to Quality Management Systems for Food Industries. Blackie Academic.

Jellinek G. 1985. Sensory Evaluation of Food - Theory and Practice. Ellis Horwoood.

Lawless HT & Klein BP. 1991. Sensory Science Theory and Applicatons in Foods. Marcel Dekker.

Macrae R, Rolonson Roles & Sadlu MJ.1994. Encyclopedia of Food Science & Technology & Nutrition. Vol. XI. Academic Press.

Maslowitz H. 2000. Applied Sensory Analysis of Foods. Vols. I, II. CRC Press.

Piggot JR. 1984. Sensory Evaluation of Foods. Elbview Applied Science Publ.

Potter NN & Hotchleiss JH. 1997. Food Science. 5th ed. CBS.

Rai SC & Bhatia VK. 1988. Sensory Evaluation of Agricultural Products.Indian Agricultural Statistics Research Institute (ICAR).

Stone H & Sidel JL. 1985. Sensory Evaluation Practices. Academic Press.

Watts CM, Ylimaki CL, Jaffery LE & Elias LG. 1989. Basic Sensory Methods for Food Evaluation. Int. Dev. Res. Centre, Canada.

MSFT118 FOOD PACKAGING TECHNOLOGY

Objective

To acquaint the students with packaging methods, packaging materials, packaging machineries, modern packaging techniques etc.Theory

UNIT I

Introduction to packaging. Packaging operation, package-functions and design. Principle in the development of protective packaging. Packaging requirements and selection of packaging materials; Types of packaging materials: Paper; Glass; 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.Deteriorative changes in foodstuff and packaging methods for prevention, shelf life of packaged foodstuff, methods to extend shelf-life.

UNIT II

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: 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.

UNIT III

Food packaging systems: Different forms of packaging such as rigid, semi-rigid, 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.

UNIT IV

Packaging equipment and machinery: Vacuum, CA and MA packaging machine; gas packaging machine; seal and shrink packaging machine; form and fill sealing machine; Shrink packaging., aseptic packaging systems ; aseptic and retortable pauches; bottling machines; carton making machines. Flexible and laminated pouches, aluminium as packaging material. Bio-degradable packaging. Active packaging. Modified atmosphere packaging.

UNIT V

Special problems in packaging of food stuff, consideration in the packaging of perishables and processed foods. Evaluation of packaging, and package performance, packaging equipment, package standards and regulation, Bar coding material.

Practical for above

Suggested Readings

Painy, F.A. and Painy, H.Y. 1983. A Handbook of Food Packaging. Leonard Hill, Glasgow, UK.

Scicharow, S. and Griffin, R.C. 1970. Food Packaging. AVI, Westport.

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.

MSFT119 NUTRACEUTICALS AND FUNCTIONAL FOODS

Objective

To cater to the newly emerging area of nutraceuticals with respect to the types, mechanisms of action, manufacture of selected nutraceuticals, product development, clinical testing and toxicity aspects.

Theory

UNIT I

Introduction to nutraceuticals: definitions, synonymous terms, basis of claims for a compound as a nutraceutical, regulatory issues for nutraceuticals including CODEX.

UNIT II

Concept of angiogenesis and the role of nutraceuticals/functional foods; Nutraceuticals for cardiovascular diseases, cancer, diabetes, cholesterol management, obesity, joint pain, immune enhancement, age-related macular degeneration, endurance performance and mood disorders – compounds and their mechanisms of action, dosage levels, contraindications if any etc.

UNIT III

Manufacturing aspects of selected nutraceuticals such as lycopene, isoflavonoids, prebiotics and probiotics, glucosamine, phytosterols etc.; formulation of functional foods containing nutraceuticals – stability and analytical issues, labelling issues.

UNIT IV

Clinical testing of nutraceuticals and health foods; interactions of prescription drugs and nutraceuticals; adverse effects and toxicity of nutraceuticals; nutrigenomics – an introduction and its relation to nutraceuticals.

Practical for above

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. Angi-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. 2

nd

Ed. Wildman.

Shi J. (Ed.). 2006. Functional Food Ingredients and Nutraceuticals:Processing Technologies.

CRC Press.

Webb GP. 2006. Dietary Supplements and Functional Foods. Blackwell Publ.

FOURTH SEMESTER

MSFT 122 Thesis Research and Presentation