REVISED REGULATION, CURRICULUM AND SYLLABI

(With effect from the academic year 2011 – 2012 onwards)

M.Sc Food Science and Technology

DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

PONDICHERRY UNIVERSITY

R. Venaktaraman Nagar, Kalapet

Puducherry – 605 014

INDIA

PONDICHERRY UNIVERSITY

M.Sc Food Science and Technology

REGULATIONS

Of late, with increasing demand for processed food and increased export of food and food products, food technology has gained so much importance that economists and policy makers look for a tremendous boost in the GDP of our country. The changing urban life style coupled with compulsions has enabled the food industry to become lucrative and prosperous. Food technology provides an effective and timely platform for researchers in Universities and industries as well to develop and innovate cutting edge processing technologies for the development of our nation. Development of curriculum in consultation with the constellation of food industries would open up new vistas for employment to the graduates. Therefore, it is timely and challenging to offer this course in Pondicherry University.

Programme of study:

M.Sc Food Technology programme is interdisciplinary in nature comprising of microbiology, biotechnology, biochemistry, Food Science and Technology and nutrition, engineering etc. The main thrust would be hands on experience in different areas of food processing, nutrition, packaging, preservation and marketing. The students admitted in the programme shall be required to take up dissertation work on any emerging areas of food technology which demand attention. Field visits, industrial visits, etc by the students would immensely help them to understand and analyze in depth the problems, challenges, remedial measures and management of industries.

Entrance Examination:

The entrance examination shall be conducted on the specified dates and locations as given in University brochure.

Infrastructural facilities:

The department of Food science and Technology offers an M.Sc degree programme in Food Science and Nutrition besides M.Sc Food Technology programme. The department has well qualified teaching faculty specialized in various disciplines of food technology. The department has spacious and well lit class rooms and laboratories. All the sophisticated facilities including equipments are available in multiples where necessary. The University has a central instrumentation facility where SEM, X-ray diffraction UNIT; NMR, FTIR, etc are available. Since the food technology programme is interdisciplinary in nature the faculties are drawn from other departments such as biotechnology, biochemistry and molecular biology, statistics etc, and this adds credence to the quality of education, imparted to the students.

Eligibility for Admission

B.Sc/B.Tech Degree in Agriculture / Agricultural Engineering/ Food Technology/ Home Science/ Food Science and Nutrition/ Food Science and Quality Control/ Clinical Nutrition/ Biochemistry, Biotechnology/ Microbiology and other life science related subjects. **Maths at +2 / P.U.C. level is compulsory.**

Duration of course: Two years

CURRICULUM – M.Sc FOOD SCIENCE AND TECHNOLOGY

Semester	Course Code	Title	Credit/ Hours	Nature of the course
I	FT401	Food chemistry	3	HC
	FT451	Food chemistry lab	1	HC
	FT402	Food microbiology	3	HC
	FT452	Food microbiology lab	1	HC
	FT403	Food process engineering	3	HC
	FT404	Research methodology and Biostatistics	3	SC
	FT405	Food processing and preservation Technology	3	HC
	FT453	Food processing and preservation Technology Lab	1	HC
	FT406	Nutraceuticals and functional foods	3	HC
	FT454	Techniques in food analysis lab	2	HC
II	FT407	Food plant equipment	3	HC
	FT408	Baking and confectionery technology	3	SC
	FT455	Baking and confectionery technology lab	1	SC
	FT409	Food product development and quality evaluation	3	HC
	FT456	Food product development and quality evaluation lab	1	HC
	FT410	Enzymes in food processing	3	HC
	FT457	Enzyme technology and Down Stream processing Lab	1	HC
	FT411	Fermentation technology	3	HC
	FT412	Pollution in food industries	3	HC
III	FT501	Food biotechnology	3	HC
	FT502	Food packaging	3	HC
	FT503	Elective paper (any two from FT503-FT506 with lab) Technology of animal products	3	HC
	FT551	Technology of animal products lab	1	HC
	FT504	Technology of fruits and vegetables	3	HC
	FT552	Technology of fruits and vegetables lab	1	HC
	FT505	Technology of cereals , legumes and oil seeds	3	HC
	FT553	Technology of cereals, legumes and oil seeds lab	1	HC
	FT506	Technology of Spices and plantation products	3	HC
	FT554	Technology of Spices and plantation products lab	1	HC
	FT507	Food safety and quality control	3	HC
	FT555	Food safety and quality control lab	1	SC
	FT508	Elective paper (any one from FT508-FT509) Food plant organization and management	3	SC
	FT509	Food laws and regulations	3	SC
	FT510	Dissertation	2	HC
IV	FT511	Dissertation	6	HC

PONDICHERRY UNIVERSITY

Department of Food Science and Technology

M.Sc Food Science and Technology

Semester I

Course Code	Title of the Course	Credits	Category
FT401	Food chemistry	3	HC
FT451	Food chemistry lab	1	HC
FT402	Food microbiology	3	HC
FT452	Food microbiology lab	1	HC
FT403	Food process engineering	3	HC
FT404	Research methodology and biostatistics	3	SC
FT405	Food processing and preservation technology	3	HC
FT453	Food processing and preservation technology lab	1	HC
FT406	Nutraceuticals and functional foods	3	HC
FT454	Techniques in food analysis lab	2	HC

UNIT - I **8 hours**

Water and Ice: Physical properties, structure of water and ice, water soluble interaction, water activity and relative vapor pressure. **Dispersed systems:** Surface phenomena, colloidal interactions, Liquid dispersions, gels, emulsions and Foam.

UNIT - II **8 hours**

Carbohydrates: Monosaccharides,Oligosaccharides,Polysaccharides,Starch,Cellulose,Gu ar and Locust Bean Gum, Xanthan, Carrageenans, Algins, Pectins, Gum Arabica and Dietary fiber

UNIT - III **8 hours**

Lipids: Classification, physical aspects, chemical aspects, chemistry of fats and oil processing, role of food lipids in flavor, physiological effects of Lipids.

UNIT - IV **6 hours**

Amino Acids, Peptides and Proteins: Physiochemical properties of amino acids, protein structure, protein denaturation, functional properties of proteins, nutritional properties of proteins, processing induced physical and chemical changes of protein.

UNIT - V **6 hours**

Food colorants: pigments in animal and plant tissues. **Flavors:** Taste and nonspecific saporous sensations, vegetable, fruit and spice flavor. **Food additives:** Acid, bases, buffer systems, chelating agent, antioxidant, antimicrobial agent, sweeteners, fat replacers and Mastigatory substances.

Text books and Reference materials

1. Beltz, H.D. 2005. *Food Chemistry*. Springer Verlag.
2. Fennema, O.R, 2006, Food Chemistry, Academic Press.
3. Meyer, L.H. 1987. *Food Chemistry*. CBS publishers and Distributors, New Delhi.
4. Potter, N.N. and Hotchikiss, J.H. (1996), Food Sciences, Fifth edition, CBS publishers and Distributors, New Delhi.
5. Fennema, O.R.1996. *Food Chemistry*. Marcel Dekker.

1. Determination of boiling point and freezing point of water
2. Estimation of sugars
3. Stages of sugar cookery
4. Estimation of gluten content
5. Estimation of polyphenols
6. Determination of acidity
7. Determination of gelatinization
8. Determination of natural pigments in foods
9. Fat acidity in foods-flour
10. Determination of refractive index of fats

FT402 **FOOD MICROBIOLOGY** **CREDIT 3**

UNIT I **6 hours**

Importance and significance of microorganisms in food science. Micro-organisms importance in food - Factors affecting the growth of micro organisms in food - Intrinsic and Extrinsic parameters that affect microbial growth.

UNIT II **8 hours**

Determination of micro organisms and their products in food: Sampling, sample collection, transport and storage, sample preparation for analysis. Microscopic and culture dependent methods- Direct microscopic observation, culture, enumeration and isolation methods; Chemical and Physical methods-Chenical, immunological and nucleic acid based methods; Culture independent techniques – PCR Based, DGGE, Metagenomics, etc.; Analytical methods for microbial metabolites- microbial toxins and metabolites.

UNIT III **8 hours**

Protection and preservation of Foods: Chemical, Modified atmosphere, Radiation in foods from the microbiological angle. Indicators of water and food safety and quality: Microbiological criteria of foods and their Significance. The HACCP and ISO systems for food safety.

UNIT IV **6 hours**

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

UNIT V **8 hours**

Food borne diseases: *Bacterial food borne diseases* (Staphylococcal intoxification, Botulism, Salmonellosis, Shigellosis, Enteropathogenic Escherichia Coli Diarrhoea, Clostridium Perfringens gastroenteritis, Bacillus cereus Gastroenteritics) *Food Borne Viral Pathogens* (Norwalk virus, Norovirus, Reovirus, Rotavirus, Astrovirus, Adenovirus, Parvovirus, Hepatitis A Virus) *Food Borne Animal Parasites* Protozoa – Giardiasis, Amebiasis, Toxoplasmosis, Sarcocystosis, Crypotosporiodiosis. Cysticercosis/Taeniasis. Roundworm – Trichinosis, Anisakiasis. *Mycotoxins:* Aflatoxicosis, Deoxyni valenol Mycotoxicosis, Ergotism

Text books and reference materials

1. Pelezar, M.I and Reid, R.D. (1993) Microbiology McGraw Hill Book Company, New York, 5th Edition.
2. James, M.J. (2000) Modern Food Microbiology, 2nd Edition. CBS Publisher
3. Adams, M.R. and M.G. Moss (1995): Food Microbiology, 1st Edition, New Age International (P) Ltd.
4. Frazier, W.C. (1988) Food Microbiology, Mc Graw Hill Inc. 4th Edition.
5. Doyle, P., Bonehat, L.R. and Mantville, T.J (1997): Food Microbiology, Fundamentals and Frontiers, ASM Press, Washington DC.

1. Preparation of common laboratory media and special media.
2. Staining: Gram's staining, acid-fast, spore, capsule and flagellar staining, Motility of bacteria, Staining of yeast and molds..
3. Identification of important molds and yeast.
4. Microbiology of milk.
5. Microbiology of water.
6. Microbiology of hand and effect of sanitation on the hand microbiology in a small food joint.
7. Microbiological analysis of typical processed food.
8. Microbiological analysis of a typical unprocessed food.
9. Isolation of specific culture

FT403 FOOD PROCESS ENGINERRING CREDIT 3

UNIT -I **8 hours**

Transport Phenomena: Nature and properties of fluids. Transport phenomena with respect to foods. Transport property, Flow of food fluid - Laminar and turbulent flow. Laws governing fluid flow. Newtonian and non Newtonian fluids. Visco-elastic behaviour of dough. Pressure measurement and fluid metering, Pumping of liquid food

UNIT -II **8 hours**

Heat processing of food: Mechanism of heat transfer. Study of heat exchangers, boiling and condensation, Evaporation. Multiple effect evaporators in sugar and fruit juice industry.

Thermal processing as applicable in canning, sterilization, microbial death rates. Batch and continuous processing. Operation of plate heat exchangers, shell and tube and other designs for aseptic processing, HTST, UHT.

UNIT -III **8 hours**

Drying curves, equilibrium moisture, adsorption isotherms and relation to storage, water activity, absolute humidity and relative humidity. Drying of milk, fruit juices and liquid foods as well as convective drying for solid foods.

UNIT -IV **6 hours**

Principles of mass and energy balance. Factors affecting heat and mass transfer. Phase change operations - Freezing and thawing. Mechanical refrigeration and refrigerants.

UNIT -V **6 hours**

Principles of other food processing such as membrane filtration (ultra, osmosis and reverse osmosis, dialysis), pulsed electric, irradiation and other non-thermal technologies.

Text Books and Reference Materials

1. Smith, P.G. “Introduction to Food Process Engineering” Springer, 2005.
2. Gopala Rao, Chandra, “Essential of Food Process Engineering”, BS Publications, 2006.
3. Majumdar, A.S. “Dehydration of Products of Biological Origin”, Oxford & IBH Publication, 2004.
4. Das, H. “Food Processing Operations Analysis”, Asian Books, 2005.
5. Rao, M.A., S.S.H. Rizvi and A.K. Datta “Engineering Properties of Rood”, 3rd

Edition, Taylor & Francis, 2005.

6. Fellows, P.J. “food Processing Technology : Principles and Practice”, Wood head Publishing, 1997.

7. Aguilera, J.M. “Microstructural Principles of Food Processing and Engineering”, 2nd Edition, Aspen, 1999.

FT 404 RESEARCH METHODOLOGY AND BIOSTATISTICS CREDIT 3

UNIT I **3 hours**

Research Methodology: Meaning, objectives and types of research, research approaches, Significance of research, Research and scientific methods, research process and criteria of good research Definition and identification of a research problem – Selection of research problem, Justification, theory, hypothesis, basic assumptions, limitations and delimitations of the problem.

UNIT II **10 hours**

Population and sample – types of statistical data – collection and classification of data – Frequency tables – Diagrammatic Representation of data – Measures of central tendencies – Mean, Median and Mode: Measures of dispersion – Range, Quartile deviation, standard deviation, Skewness and Kurtosis – Sampling techniques – Simple and Stratified Random Sampling techniques.

UNIT III **10 hours**

Elementary Probability Theory – Addition and Multiplication – Bayes Theorem – Random Variables and Probability distribution- Binomial, Poisson, and Normal. Study of relationship between variables – correlation: Simple, Partial, Multiple Correlation (three variables); Regression – Simple, Multiple (three Variables). Measures of association – Chi square test for goodness of fit & contingency table.

UNIT IV **10 hours**

Basic concept of hypothesis testing - Type I and type II errors. Tests based on Means & Proportions on Normal, t & F. One way analysis of variance (CRD), Two way analysis of variance (RBD), LSD, - Multiple comparison tests (DMRT, Bonferonni, Dunnett's). Carrying out Data Analysis using MS- excel: Descriptive Statistics – Diagrammatic representation – t test for independent samples, paired samples, F test two sample variances: One-way ANOVA, two-way ANOVA, Correlation & Regression(three variables).

UNIT V **3 hours**

Framing Proposal for acquiring grants: The question to be addressed – Rationale and importance of the question being addressed – Empirical and theoretical framework – Presenting pilot study / data or background information - Research proposal and time frame – Specificity of methodology – Organization of different phases of study – Expected outcome of study and its implications – Budgeting - Available infra-structure and resources - Executive summary.

Text books and Reference materials

1. Bandarkar, P.L. and Wilkinson T.S. (2000): Methodology and Techniques of Social Research,Himalaya Publishing House, Mumbai.
2. Copper, H.M. (1990). Intergrating research : A guide for literature reviews (2nd Edition). California: Sage
3. Harman, E & Montages, I. (Eds.) (1997). The thesis and the book, New Delhi : Vistar.
4. Mukherjee, R. (1989): The Quality of Life: Valuation in School Research, Sage Publications, New Delhi.
5. Stranss, A and Corbin, J. (1990): Basis of Qualitative Research: Grounded Theory Procedures and Techniques, Sage Publications, California

FT405 FOOD PROCESSING AND PRESERVATION TECHNOLOGY CREDIT 3

UNIT I **6 hours**

Principles of fresh food storage: Nature of harvested crop, plant, animal; product storage; effect of cold storage and quality – storage of grains.

UNIT II **9 hours**

Processing and preservation by heat: Blanching, pasteurization, sterilization and UHT processing, canning, extrusion cooking, dielectric heating, microwave heating, baking, roasting and frying. Retort processing of Ready to eat (RTE) products. Drying – water activity, microbial spoilage due to moisture. Dehydration of fruits, vegetables, milk, animal products Newer methods of thermal processing – batch and continuous

UNIT III **9 hours**

Processing and preservation by low Temperature – refrigeration, freezing, CA, MA , and dehydro-freezing. Food irradiation, history and mechanism, the electro-magnetic spectrum, forms of radiant energy. Principles of using electromagnetic radiation in food processing. ionizing radiations and non ionizing radiations, advantages and disadvantages. Controlling undesirable changes in food during irradiation.

UNIT IV **6 hours**

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

UNIT V **6 hours**

Processing and preservation by non-thermal methods: High pressure, pulsed electric field, hurdle technology. GRAS and permissible limits for chemical preservatives and legal aspects for gamma irradiation. Use and application of enzymes and microorganism in processing and preservation of foods; food

fermentations, pickling smoking etc; Food additives; Definition, types and functions, permissible limits and safety aspects.

Text books and Reference materials

1. Desrosier NW & James N. (1977). Technology of food preservation. AVI. Publishers
2. Fellows, P.J. (2005). Food processing technology: Principle and Practice. 2nd Ed. CRC Publishers
3. Jelen, P. (1985). Introduction to Food Processing. Prentice Hall

FT453 FOOD PROCESSING AND PRESERVATION TECHNOLOGY LAB CREDIT 1

1. Blanching and browning control
2. Preparation of fruit preserves (jam, jelly).
3. Preparation of vegetable preserves (pickle)
4. Dehydrated products – vegetables dices tray drying, osmotic dehydration of seasonal fruit.
5. Tomato processing
6. Fruit pulping / juice / beverage preparation
7. Preparation and standardization of traditional Indian fermented foods
8. Bread making - texture.
9. Confectionery
10. Visit to food processing and preservation UNIT.

FT406 NUTRACEUTICALS AND FUNCTIONAL FOODS CREDIT 3

UNIT -I **6 hours**

Nutraceuticals and functional Foods –Definition, concept, history and market; Evolution of nutraceuticals and functional foods market. Classification of nutraceuticals and functional foods. Significance and relevance of nutraceuticals and functional foods in the management of diseases and disorders.

UNIT -II **8 hours**

Natural occurrence of certain phytochemicals- Antioxidants and flavonoids: omega – 3 fatty acids, carotenoids, dietary fiber, phytoestrogens; glucosinates; organosulphur compounds. Dosage for effective control of disease or health benefit with adequate safety; studies with animals and humans; acute and chronic studies. Regulatory issues.

UNIT -III **8 hours**

Isolation of phytochemicals from plant materials: Care in handling and storage of raw materials with minimal damage to sensitive bioactive compounds; Extractive methods for maximum recovery and minimal recovery and minimal destruction of active material; stability studies. Recent developments in the isolation, purification and delivery of phytochemicals.

UNIT -IV **8 hours**

Prebiotics, probiotics and symbiotics- Probiotics: Definition, types and relevance; Usefulness in gastro intestinal health and other health benefits; development of a probiotic products; recent advances in probiotics; Challenges and regulatory issues related to probiotic products. Prebiotics: Prebiotic ingredients in foods; types of prebiotics and their effects on gut microbes; health benefits of prebiotics; recent development in prebiotics. Symbiotics.

UNIT -V **6 hours**

Functional foods - Definition, development of functional foods, use of bioactive compounds in appropriate form with protective substances and activators; Effect of environmental condition and food matrix; Effects of processing conditions and storage; Development of biomarkers to indicate efficacy of functional ingredients; Research frontiers in functional foods; delivery of immunomodulators /vaccines through functional

foods. Nutrigenomics- concept of personalized medicine. Use of anotechnology in functional food industry.

Text Books and Reference materials

1. Wildman, R.E.C. (2007) Handbook of Nutraceuticals and Functional Foods, second edition. CRC Press.
2. Gibson GR & William CM. *Functional Foods - Concept to Product*. 2000.
3. Goldberg I. *Functional Foods: Designer Foods, Pharma Foods*. 1994.
4. Brigelius-Flohé, J & Joost *HG. Nutritional* Genomics: Impact on Health and Disease. Wiley VCH. *2006.*
5. Cupp J & Tracy TS. *Dietary Supplements: Toxicology and Clinical Pharmacology*. Humana Press. 2003.

1. Estimation of moisture content
2. Estimation of soluble and insoluble ash content
3. Estimation of sugars
4. Estimation of fat
5. Estimation of free fatty acids
6. Estimation of Iodine number
7. Estimation of Peroxide value
8. Estimation of protein
9. Estimation of crude fibre
10. Estimation of ascorbic acid
11. Estimation of calcium
12. Estimation of Total Antioxidants
13. Estimation of thiamine
14. Estimation of Riboflavin
15. Estimation of Vitamin A
16. Estimation of β carotene
17. Estimation of cholesterol
18. Estimation of calorific value

PONDICHERRY UNIVERSITY

Department of Food Science and Technology

M.Sc Food Science and Technology

Semester II

Course Code	Title of the Course	Credits	Category
FT407	Food plant equipment	3	HC
FT408	Baking and confectionery technology	3	SC
FT455	Baking and confectionery technology lab	1	SC
FT409	Food product development and quality evaluation	3	HC
FT456	Food product development and quality evaluation lab	1	HC
FT410	Enzymes in food processing	3	HC
FT457	Enzyme technology and down Stream processing lab	1	HC
FT411	Fermentation technology	3	HC
FT412	Pollution in food industries	3	HC

FT407 FOOD PLANT EQUIPMENT CREDIT 3

UNIT -I **8 hours**

Milling Equipments : Types of equipment used for milling rice and wheat, pearling and flaking equipment; dhal mills.

UNIT -II **8 hours**

Washing, Filtration & Centrifugation equipment. Different Fruits and Vegetable washing systems; Conveyor belts - types, material of construction, product specific conveyors. Screw, bucket, belt, oscillating and vibratory conveyors. Filtration of liquid foods (dairy, fruit & vegetables); centrifugation systems: Solid bowl and disc bowl centrifuges; cyclone separator and self cleaning centrifuge.

UNIT -III **8 hours**

Heat Processing & Cooling Equipments: Heat exchangers – Plate, shell and tube etc. Autoclaves - types, operation; Different Dryers and freezers – Tray, tunnel, Fluidized. Spray dryer, Blast and IQF, Freezers, short tube and pan evaporators.

UNIT -IV **6 hours**

Mixing, Blending. extrusion & Filling Equipments: Agitation and mixing of liquid foods, powders and pastes; Mixers - ribbon blenders, augur, nauta, cone.

Cold and hot extruders, single screw, twin screw, extrusion cooking.

UNIT -V **6 hours**

Screening; Types of screens; Grizzly; Revolving screen; Shaking screen, Rotary screen, Vibratory screen; Horizontal screen; Perforated metal screens; Wiremesh screens; Ideal and Actual screens; Effectiveness of screen; Air-screen cleaners; Separators

Storage: Direct damages; Indirect damages; Sources of infestation; Traditional storage structures; Improved storage structures; Modern storage structures; Storage of agricultural perishables; Controlled and modified atmosphere storage.

Text Books and Reference materials

1. Lopez – Gomez, A. and Barbosa – Canovas, G.V. “Food Plant Design”, Taylor & Francis, 2005.
2. Smith, P.G. “Introduction to Food Process Engineering”, Springer, 2005.
3. Rao, M.A. Rizvi, S.S.H. and Datta, A.K. “Engineering Properties of Food”, 3rd Edition, Taylor & Francis, 2005.
4. Sahay, K.M. and Singh, K.K. UNIT operations of agricultural processing. Vikas Publishing house Pvt. Ltd., 2001

FT408 BAKING AND CONFECTIONERY TECHNOLOGY CREDIT 3

UNIT-I **6 hours**

INTRODUCTION: Raw materials required for bread making and their functional properties. Essential ingredients: Flour, yeast, water, salt. Other ingredients: Sugar, colour, flavor, fat, milk and milk powder and bread improvers. Functions of various raw materials used in baking industries Materials of Baking. Leaveners and yeast foods, shortenings, emulsifiers and antioxidants, Sweeteners and, water and salt, Ingredients from milk and eggs. Fruits, vegetables, and nuts, Spices, flavors and colors. Preservation methods.

UNIT-II **8 hours**

BAKERY EQUIPMENT: Introduction to utensils and equipments used in bakery UNIT and their uses small equipments, big equipments and oven. Bulk handling of ingredients, Dough mixing and mixers, dividing, rounding, sheeting, and laminating, fermentation enclosures and brew equipment. Ovens and Slicers, Packaging materials and equipment.

UNIT-III **8 hours**

BREAD MANUFACTURING PROCESS: Straight dough fermentation, Sponge and dough, Accelerated processing. Chorley wood bread process, Dough retarding and freezing, Stages in processing of bread and bread making methods and advantages and disadvantages of various methods of bread-making. Characteristics of good bread: Internal characters; external characters. Bread defects/faults and remedies. Spoilage of bread Causes, detection and prevention.

UNIT-IV **8 hours**

BISCUITS AND COOKIES: Production of cakes and cookies/biscuits. Types of biscuit dough's – Developed dough, short dough's, semi-sweet, enzyme modified dough's and batters – importance of the consistency of the dough. Cake making: Ingredients and their function structure builders. Tenderizers, moisteners and flavor enhancers – Selection and preparation of mould Temperature and time required for different type of cake, problems of baking.

UNIT-V **6 hours**

CONFECTIONERY PRODUCTS: Definition, importance of sugar confectionery and flour confectioner. Types of confectionery products-chocolate boiled sweets caramels toffees. Fondants. Manufacturing process and spoilage of confectionery products. Good manufacturing practices (GMP) in baking and confectionery industries. Computerization in plant and laboratory, Sanitation and safety.

Text Books and Reference materials

1. Matz, Samuel A., “Bakery Technology and Engineering”, Third Edition, Chapman & Hall, London,
2. Cauvain, Stanley P, and Yound, Linda S., “ Technology of Bread Making”, Second Edition Aspen publication, Maryland, 1999.
3. Pomeranz. Y. “Modern Cereal Science and Technology”. MVCH Publications, New York. 1987.
4. Samuel A., Matz., “ Equipment for Bakers”, Pan Tech International Publication, 1988.
5. Manley, Duncan., “ Biscuit Doughs Manual 2”, Woodhead Publishing Ltd., England. 1998.

1. Study of ingredients (major and minor): Characteristics of flour, yeast, shortening, sugar, egg and salts.
2. Experiment on leavening action of baking powder, sodium-bicarbonate and ammonium-bi-carbonate.
3. Estimation of gluten content (atta and maida)
4. Estimation of water absorption power (atta and maida)
5. Determination of yeast-ferment test and dough rising capacity
6. Studies of flour and dough characteristics
7. Preparation of biscuits – different types
8. Preparation of cookies-different types
9. Preparation toffees.
10. Preparation sugar boiled confectionary.
11. Preparation of chocolates, fruit drops.
12. Preparation of fruit toffees candies and preserves.

UNIT I **6 hours**

Food needs and consumer preference: market survey and its importance in; designing a questionnaire to find consumer needs for a product or a concept; advantages of processed foods in urbanized modern society; why people buy processed foods. Developing a product to meet the requirements

UNIT II **9 hours**

Designing new products new food product development(NPD)process and activities, NPD success factors, new product design, food innovation case studies , market –oriented NPD methodologies, organization for successful NPD ; recipe development; use of traditional recipe and modification; recent development in food ingredients\additives flavorings, colourings, emulsifiers, stabilizer and sweeteners; Involvement of consumers, chefs and recipe experts; selection of materials\ingredients for specific purposes ; modifications for production on large Scale , cost effectiveness, nutritional needs or uniqueness

UNIT III **6 hours**

Standardization & large scale production: process design, equipment needed and design; establishing process parameters for optimum quality; sensory evaluation; lab requirements; different techniques and test; statistical analysis ; application in product development and comparison of market samples; stages of the integration of market and sensory analysis.

UNIT IV **7 hours**

Quality , safety and regulatory aspects: product stability ; evaluation of shelf life; changes in sensory attributes and effects of environmental conditions; accelerated shelf life determination; developing packaging systems for maximum stability and cost effectiveness; interaction of package with food; regulatory aspects; whether standard product and conformation to standards; approval for proprietary product.

UNIT V **8 hours**

Advertisement, marketing and case studies; product performance testing; market positioning, marketing; developing test market strategies; various tools and methodologies to evaluate consumer attitudes, preferences and market acceptance factors; case studies of some successes and failures – factors that influence NPD

success, innovation case studies to highlight best practice in terms of the integration of technological and marketing approaches to NPD; food choice models and new product trends.

Text books and Reference materials

1. Lyon, D.H.; Francombe, M.A.; Hasdell, T.A.; Lawson, K. (eds) (1992): Guidelines for Sensory Analysis in Food Products Development and Quality Control. Chepman and Hall, London.

2. Lawless, H.T. and Klein, B.P. (1991): Sensory Science Theory and Applications in Foods. Marcel Dekker Inc. New York.

3. Piggott, J.R. (ed) (1988): Sensory Analysis of Foods. Elservier Applied Science, London.

4. Ranganna S. 2006. HandBook of Analysis and Quality Control for Fruits and Vegetables Products 2nd Ed. Tata McGraw- Hill Publishing company Limited. New Delhi.

FT 456 FOOD PRODUCT DEVELOPMENT AND QULAITY EVALUATION LAB CREDIT 1

Product development

1. Permutation combination method
2. Response surface methodology

Evaluation of product

3. Analysis of physical properties
4. Analysis of chemical properties

Sensory evaluation

5. Selection of panel
6. Threshold test

Collection and analysis of sensory data

7. Statistical analysis
8. Interpretation
9. Reporting

FT410 ENZYMES IN FOOD PROCESSING CREDIT 3

UNIT -I **6 hours**

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 **6 hours**

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

UNIT III **8 hours**

Enzymes as processing aids: Role of enzymes in Dairy processing (cheese making and whey processing). Role of enzymes in meat processing (tenderization and flavour development) and fish processing(De-skinning, collagen extraction etc.,) Egg processing.

UNIT IV **8 hours**

Role of enzymes in Brewing**,** Baking (fungal -amylase for bread making; maltogenic -amylases for anti-staling; xylanses and pentosanases as dough conditioners; lipases or dough conditioning; oxidases as replacers of chemical oxidants; synergistic effect of enzymes);

UNIT V **8 hours**

Role of enzymes in the production of flavours (enzyme-aided extraction of plant materials for production of flavours, production of flavour enhancers such as nucleotides, MSG; flavours from hydrolyzed vegetable/animal protein)

Text books and References

1. Whitehurst,R.J. & Van-Oort,M., (2010), Enzymes in Food technology, Second edition, Blackwell Publishing Ltd

2. Aehle, W. (2007) Enzymes in Industry: Production and application. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim

3.Rastall,R (2007) Novel enzyme technology for food applications Woodhead Publishing Limited, Abington Hall, Abington, Cambridge CB21 6AH, England

4. Kalaichelvan, P.T., (2002), Bio process technology, MJP publishers, Chennai.

FT457 ENZYMES TECHNOLOGY AND DOWNSTREAM PROCESSING LAB CREDIT 1

1. Assay of enzymes for activity
2. Effect of pH on enzymes
3. Effect of temperature on enzymes
4. Immobilization of enzyme by entrapment and comparison with free enzyme
5. Enzyme deactivation by heat and / or relation with blanching
6. Enzymes in meat tenderization
7. Batch Sedimentation
8. Flocculation
9. Centrifugation
10. Enzyme Lysis
11. Brewery Industry Visit

FT 411 FERMENTATION TECHNOLOGY CREDIT 3

UNIT I **7 hours**

Fermentation, types of fermentation, Fermentation Pathways for Industrial Products: Biochemical pathways of metabolic reactions for utilization of carbon sources and formation of different metabolites by micro organisms; Strain Development -Various techniques of modifying the strains for increased production of industrial products. Use of chemicals, UV rays, genetic engineering to produce newer strains.

UNIT II **7 hours**

Typical media, Media formulation:- Carbon Source, Nitrogen source, Minerlas, Growth Factors, Buffers, Precursors and Inhibitors, O_2 requirement and antifoams.

UNIT III **7 hours**

Fermentor design, Instrumentation and control, Types of fermentors (Shake flask, Batch/stir tank, Continuous, Bubble column, airlift and Tower fermenter), Types of fermentation processes ,aeration and agitation (The oxygen requirement for industrial fermentation , Determination of K_La values).

UNIT IV **7 hours**

Downstream Processing: Various equipment for product recovery; micro-filters and Ultrafiltration systems for separation of cells and fermentation medium and for concentration of medium containing product; chromatographic systems of separation; extraction of product with solvent; evaporation and crystallization; centrifugation, different types of centrifuges; drying techniques; instrumentation and controls.

UNIT V **8 hours**

Fermentative Production: a) Foods: Processes for preparing fermented products including Yogurt (curd) and other Traditional Indian Products like idli, dosa, dhokla, shrikhand, etc.,Soya based products like soya sauce, natto, etc., Cocoa, Cheese etc.; Alcoholic Beverages based on fruit juices (wines), cereals (whisky, beer, vodka etc,), sugar cane (rum) etc. Process description, quality of raw materials, fermentation process controls etc.b) Industrial chemicals: Fermentative Production of Organic acids like (Citric Acid, Lactic Acid), Amino Acids (Glutamic acid, Lysine), Antibiotics (Erythromycin, Penicillin), Polysaccharides (Dextran, Xanthan) etc.; steroids transformation; process descriptions and key controls for optimal production.

Text books and Reference material

1. Vogel, H.C. and C.L. Todaro, 2005 Fermentation and Biochemical Engineering Handbook : Principles, Process Design and Equipment , 2nd Edition, Standard Publishers.

2. El-Mansi, E.M.T, 2007, Fermentation Microbiology and Biotechnology 2nd Edition,

CRC / Taylor & Francis.

3. Joshi, V.K. and Ashok Pandey, 1999, Biotechnology: Food Fermentation, Microbiology, Biochemistry and Technology , Vol. I & vol. II Educational Publisher.

4. Peppler, H.J. and D. Perlman, 2004, Microbial Technology : Fermentation Technology , 2nd Edition, Vol. II Academic Press / Elsevier.

5. Stanbury, P.F., A. Whitaker and S.J. Hall, 1997 Principles of Fermentation Technology ,2nd Edition Aditya Books (P) Ltd.

FT412 POLLUTION IN FOOD INDUSTRIES CREDIT 3

UNIT -I **7 hours**

Environment and Pollution: Components of environment; Environmental pollutions, its measurements and management; Air pollution and its control; Water pollution and its control; Xenobiotic compounds; Pesticides and pest management; processes; Solid wastes and management; Microorganisms as components of the environment; microorganisms as indicators of environmental pollution; bioorganic pollution; microbial toxicants and pollutants, and their bio-degradation; biodegradation of plastics, biofouling and biofilms; bioremediation.

UNIT -II **6 hours**

Control of Air Quality: Air duct design and room air distribution; air conditioning systems; clean-room air conditioning; important pollutants of air; properties of particulate matter and air pollution control methods; air quality in the processing plants, legal requirements.

UNIT -III **7 hours**

Waste Water Treatment: Waste water sources characteristics - standards for disposal of water, physical, chemical and biological characteristics of waste water; measurement of organic content in waste water; Physical UNIT operations in waste water treatment - screening; racks, mixing, flocculation, sedimentation, floatation, elutriation, vacuum filtration, incineration; chemical UNIT operations in waste water treatment - reaction kinetics; chemical precipitation, aeration and gas transfer process, rate of gas transfer, adsorption, disinfection; biological UNIT operations - aerobic and anaerobic

UNIT -IV **6 hours**

Storage & Disposal of Waste: Types of waste generated; Non- degradable & biodegradable wastes, Solid waste storage and disposal methods- land-filling, burial, incineration, recycling; Biological treatment of food industry wastes, storage and disposal of liquid and gaseous waste; legal aspects related to storage and disposal; environmental laws; pests & their control.

UNIT -V **10 hours**

Utilization of Waste: Methods of utilizing wastes to make value added products-
CASE STUDIES: Pectin, food colourants, antioxidants from fruit peels (citrus, mango, pomegranate), lycopene from tomato peels, vegetable seed oils, biomolecules and enzymes from meat processing. Generation of biogas, SCP, microalgae, animal feeds, zero emission plants; recovery & recycling of materials.

Reference

1. Potter, N.N., and Hotchkiss, J.H. “Food Science”, 5th Edition, CBS, 1996.
2. Moorthy, C.K. “Principles and Practices of Contamination Control and Clean rooms”, Pharma Book Syndicate, 2003.
3. Roday, S. “Hygiene and Sanitation in Food Industry”, Tata McGraw – Hill Publishing, 1999.
4. Wilson, C.L. “Microbial Food Contamination”, 2nd Edition, CRC, 2008.

PONDICHERRY UNIVERSITY

Department of Food Science and Technology

M.Sc Food Science and Technology

Semester III

Course Code	Title of the Course	Credits	Category
FT501	Food biotechnology	3	HC
FT502	Food packaging	3	HC
FT503	Elective paper (any two from FT503-506 with lab) Technology of animal products	3	HC
FT551	Technology of animal products lab	1	HC
FT504	Technology of fruits and vegetables	3	HC
FT552	Technology of fruits and vegetables lab	1	HC
FT505	Technology of cereals , legumes and oil seeds	3	HC
FT553	Technology of cereals, legumes and oil seeds lab	1	HC
FT506	Technology of Spices and plantation products	3	HC
FT554	Technology of Spices and plantation products lab	1	HC
FT507	Food safety and quality control	3	HC
FT555	Food safety and quality control lab	1	SC
FT508	Elective paper (any one from FT508-509) Food plant organization and management	3	SC
FT509	Food laws and regulations	3	SC
FT510	Dissertation	2	HC

FT501 FOOD BIOTECHNOLOGY CREDIT 3

UNIT -I **8 hours**

Basics of Molecular Biology and genetics– Fundaments of molecular biology and genetics. Central dogma of protein synthesis. Concept of genetic engineering and molecular cloning. Plant and animal culture, transgenic plants, application of genetic engineering in food science and technology. Genetically modified foods – concept, types and application.

UNIT -II **8 hours**

Prospectus of biotechnology- Definition, scope and applications. Application of biotechnology in food. Basic principles of molecular biology and biotechnology: Introduction to Genetics, Mendelian genetics, Population & Evolutionary genetics, Gene Mapping. Microbial gene transfer mechanisms, Mutation, Types of mutations, Molecular mechanism of mutations, practical applications, DNA repair Mechanisms, Recombinant DNA Technology.

UNIT -III **6 hours**

Traditional applications of food biotechnology - Fermented foods: eg dairy products, oriental fermentations, alcoholic beverages, and food ingredients. Health benefits of fermented foods. Types of fermented foods and importance of food fermentation in food preservation and nutritional enhancement.

UNIT -IV **8 hours**

Starter cultures – types, designing and development, micro encapsulation and packaging, scopes and challenge; Development and formulation of novel products such as probiotic foods. Nutrogenomics - concept, working, significance and relevance. Biosensors and novel tools and their application in food science.

UNIT -V **6 hours**

Ethical issues concerning GM foods; testing for GMOs; current guidelines for the production, release and movement of GMOs; labeling and traceability; trade related aspects; biosafety; risk assessment and risk management. Public perception of GM foods. IPR. GMO Act –2004.

Text books and reference materials

1. Lopez, G.F.G. and Canovas, G.V.B. “Food Science and Food Biotechnology” CRC Press, Florida, USA. 2003.
2. Joshi, V.K., and Pandey, A. Biotechnology: Food Fermentation. Vols.I,II. Education

Publ. 1999.
3. Bains, W. Biotechnology from A to Z. Oxford Univ. Press. 1993.
4. Knorr, D. Food Biotechnology. Marcel Dekker. 1982.
5. Lee, B.H. Fundamentals of Food Biotechnology.VCH. 1996

FT502 **FOOD PACKAGING** **CREDIT 3**

UNIT I **6 hours**

Introduction to food packaging: Packaging terminology- definition . Functions of food packaging, Packaging environment. Characteristics of food stuff that influences packaging selection.

UNIT II **8 hours**

Packaging material and their properties: Glass, Paper and paper board, Corrugated fibre board (CFB), Metal containers: Tin Plate and Aluminum, Composite containers, Collapsible tubes, Plastic Films, Laminations, Metalized films, Co extruded films, Testing of packaging material.

UNITs III **8 hours**

Packaging Systems and methods: Vacuum Packaging, Controlled atmospheric packaging, Modified atmospheric packaging, Aseptic Packaging, Retort processing, Microwave packaging, Active Packaging, intelligent packaging, Edible packaging, Shrink and stretch packaging.

UNIT IV **8 hours**

Packaging of fresh and processed foods: Packaging of Fruits and vegetables, Fats and Oils, Spices, meat, Poultry and sea foods, Dairy Products, Bakery, beverages, Dehydrated and frozen foods. Liquid and powder filling machines – like aseptic system, form and fill (volumetric and gravimetric), bottling machines. Form Fill Seal (FFS) and multilayer aseptic packaging machines.

UNIT V **6 hours**

Packaging Design & Environmental Issues in Packaging: Food marketing and role of packaging-Packaging aesthetic and graphic design; Coding and marking including bar coding; Consumer attitudes to food packaging materials; Packaging Laws and regulations, safety aspects of packaging materials; sources of toxic materials and migration of toxins into food materials; Packaging material residues in food products; Environmental & Economic issues, recycling and waste disposal.

Text Books and Reference materials

1. Robertson, G.L. 2006 Food Packaging: Principles and Practice (2nd ed.), Taylor & Francis
2. Parry, R. T. and Blakistone, B. A. 1999 Principles & Applications of MAP Springer, New York,
3. NIIR. (2003). Food Packaging Technology Handbook, National Institute of Industrial Research Board, Asia Pacific Business Press Inc.
4. Ahvenainen, R. (Ed.) 2003 Novel Food Packaging Techniques, CRC Press,
5. Han, J.H. (Ed.) 2005 Innovations in Food Packaging, Elsevier Academic Press,
6. Coles, R., McDowell, D. and Kirwan, M.J. (Eds.) 2003 Food Packaging Technology, CRC Press

UNIT I **6 hours**

Meat composition from different sources; muscle structure and compositions; post-mortem muscle chemistry; Factors influencing the quality of meat. Meat Microbiology and safety.

UNIT II **8 hours**

Ante mortem inspection and handling , Stunning types, Slaughtering types. Steps in slaughtering (Pig, Cattle, Sheep/ Goat) and dressing .Slaughter house operations-Hoisting rail and traveling pulley system; .Modern abattoirs, typical layout and features, Offal handling and inspection. Grading of meat- retail and whole sale cuts.Operational factors affecting meat quality. Byproduct utilization .Meat plant hygiene – GMP and HACCP.

UNIT III **7 hours**

Processing and preservation of meat: Chilling and freezing of meat, Canning, cooking, drying, pickling, curing and smoking; prepared meat products like sausages, kebabs, etc.. Intermediate moisture and dried meat products, Packaging of meat products.

UNIT IV **7 hours**

Poultry: methods of slaughtering, Slaughtering equipment and operations, dressing, handling, storage and preservation of poultry meat . Spoilage and its control. Freezing and chilling of poultry. Whole sale and retail cuts.

Eggs: Composition , handling , candeling, washing, coating, packaging and storage. Egg processing (Egg powder manufacturing, pasteurization, etc., Spoilage and its control.

UNIT V **8 hours**

Commercially important marine products from India, Proximate composition, Post mortem changes in fish muscle . Handling, Preservation and transportation of fish. Indices of fish quality, Microbiology of fish and shell fish , Freezing of fish and shell fish.

Text books and References

1. Legarreta,I.G. (2010). *Handbook of Poultry Science and Technology* (Volume I and Volume II), John Wiley & Sons, Inc., Hoboken, New Jersey. U.S
2. Sam, A.R (2001) *Poultry meat processing* CRC Press Taylor & Francis Group
3. Forrest JC. (1975). *Principles of Meat Science*. Freeman.
4. Govindan TK. (1985). *Fish Processing Technology*. Oxford & IBH.
5. Hui YH. (2001). *Meat Science and Applications*. Marcel Dekker.
6. Kerry, J. (2002). *Meat Processing*. Woodhead Publ. CRC Press.
7. Levie A. (1984). *Meat Hand Book*. 4th Ed. AVI Publ.

8. Mead M. 2004. *Poultry Meat Processing and Quality*. Woodhead Publ.
9. Mead, G.C. (1989). *Processing of Poultry*. Elsevier.
10. Pearson, A.M. & Gillett, T.A. 1996. *Processed Meat*. 3rd Ed. Chapman & Hall.
11. Lawrie, R.A. 2006. Meat Science 7th Edn. Woodhead publishers .UK.

1. Slaughtering and dressing of meat animals; study of post-mortem changes; meat cutting and handling;
2. Evaluation of meat quality; estimation of meat: bone ratios.
3. Preservation by dehydration, freezing, curing,
4. Evaluation of quality of eggs
5. Preservation of shell eggs
6. Preparation of meat products
7. Vacuum Packaging of meat and marine products
8. Preparation of fish based products
9. Evaluation of fish and other marine products
10. Visit to a meat processing industry

FT504 TECHNOLOGY OF FRUIT AND VEGETABLES CREDIT 3

UNIT -I **6 hours**

Indian and global scenario on production and processing of fruits and Vegetable. Pre-processing: Fresh fruits and vegetables – Handling, grading, cleaning, pretreatments, transportation, pre cooling, chilling, modified atmosphere packaging, Controlled atmosphere storage, packaging, transportation, quality assurance.

UNIT -II **5 hours**

Freezing of Fruits and Vegetables: Different freezing methods and equipments, problems associated with specific fruits and vegetables;

UNIT -III **8 hours**

Dehydration of Fruits and Vegetables: dehydration – different methods of drying including sun, tray, cabinet, drum, spray, vacuum, tunnel, spray, low temperature drying process, process calculations ,osmotic dehydration and other modern methods, choice of suitable methods, preserving the colour, flavour and nutrient content of the products

UNIT - IV **9 hours**

Canning, Juices & Concentrates:Different UNIT operations involved in fruit and vegetable Pulp/juice extraction, concentration, Bulk aseptic packaging of fruit and vegetable pulps, juices and concentrates; aseptic packaging of fruit drinks, juices and other products

Bottling, canning - essential principles, different types of cans, UNIT operations in canning

blanching, exhausting, processing conditions. Fruit Juice / pulp/ Nectar/Drinks, concentrates – General and specific processing, different packing including aseptic; Vegetable Purees/pastes - processing of Tomato and tomato products

UNIT -V **8 hours**

Fruit and Vegetable Products & Standards: Ready to eat vegetable products, Jams/Marmalades, Squashes/cordials, Ketchup/sauces, Chutneys, Fruit Bar, Soup powders, Candied Fruits, Natural colors, Fruit and Vegetable Fibres - specific processing, different packing including aseptic, Product specifications and standards; food regulations with respect to fruit and vegetable products

Reference

1. Potter, N.N. and Hotchkiss, J.H. “Food science”, 5th Edition, CBS, 1996.
2. Vaclavik, V.A. and Christian, E.W. “Essentials of Food Science”, 2nd Edition, Springer, 2005.

3. Salunkhe, D.K. and Kadam, S.S. “Handbook of Fruit Science and Technology : Production, Composition, Storage, and Processing”, Marcel Dekker, 2005.

4. “Agro – Food Processing : Technology Vision 2020 Fruits & Vegetables Current Status and Vision”, TIFAC, 1996.

5. Alzamora, S.M., Tapia, M.S. and Lopez – Malo, A. “Minimally Processed Fruits and Vegetables: Fundamental Aspects and Applications”, Springer, 2005.

FT552 TECHNOLOGY OF FRUIT AND VEGETABLES LAB CREDIT 1

1. Evaluation of pectin content
2. Canning of fruits and vegetables
3. Quality evaluation of fruits
4. Fruit preserve and candy
5. RTs products
6. Dehydrated products of fruits
7. Dehydrated products of vegetables
8. Preparation of pickles
9. Wafers from vegetables and fruits

FT505 TECHNOLOGY OF CEREALS, LEGUMES AND OILSEEDS CREDIT 3

UNIT -I **5 hours**

General introduction and production and utilization trends; Structure and composition of common cereals, legumes and oilseeds.

UNIT -II **7 hours**

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. Production of starch and vital wheat gluten.

UNIT -III **8 hours**

Rice: Classification, physicochemical characteristics; cooking quality; rice milling technology; by- products of rice milling and their utilization; Rice bran stabilization, oil extraction and refining, parboiling methods of rice criteria of quality of rice: aging of rice – quality changes; processed products based on rice.

UNIT -IV **8 hours**

Corn: Types and nutritive value; dry and wet milling, processing of corn in breakfast cereals, snacks, tortilla etc., production of glucose syrups, dextrose, high fructose corn syrups, modified starches.

Barley: composition, milling, malting of barley, chemical and enzymatic changes during malting, uses of malt.

Oat: composition, processing of oat, byproducts of oatmeal milling.

UNIT -V **8 hours**

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. Oil extraction process – mechanism, solvent, SCE, oil refining, utilization of biproducts of oil milling.

Reference

1. Chakrabarthy, M.M. (2003). Chemistry and Technology of Oils and Fats.Prentice Hall.
2. Dendy, D.A.V., & Dobraszczyk, B.J. (2001). Cereal and Cereal Products. Aspen.

3. Hamilton, R.J., & Bhati, A. (1980). Fats and Oils - Chemistry and Technology.App. Sci. Publ.
4. Hoseney, R.S. (1994). Principles of Cereal Science and Technology. 2nd Ed.AACC.
5. Kay, D.E. (1979). Food Legumes. Tropical Products Institute.
6. Kent, N.L. (1983). Technology of Cereals. 4th Ed. Pergamon Press.

FT553 TECHNOLOGY OF CEREALS, LEGUMES AND OILSEEDS LAB CREDIT 1

1. Physical-tests on wheat and rice
2. Physicochemical and rheological properties;
3. Determination of gluten content in wheat flour;
4. Conditioning of wheat; Milling of wheat and rice by laboratory mill;
5. Parboiling of rice;
6. Quality tests of rice: Amylose content determination in rice;
7. Malting, puffing and popping of grains;
8. Preparation of protein concentrates and isolates and their evaluation for protein content and solubility;
9. Extraction of oil using expeller and solvent extraction methods
10. Visit to related processing industries.

FT506 TECHNOLOGY OF SPICES AND PLANTATION PRODUCTS CREDIT 3

UNIT -I **6 hours**

Coffee: Occurrence, chemical constituents; harvesting, fermentation of coffee beans; changes taking place during fermentation; drying; roasting; process flow sheet for the manufacture of coffee powder; instant coffee technology; chicory chemistry; quality grading of coffee.

UNIT -II **8 hours**

Tea: Occurrence, chemistry of constituents; harvesting; types of tea – green, oolong and CTC; chemistry and technology of CTC tea; manufacturing process for green tea and black tea manufacture; instant tea manufacture; quality evaluation and grading of tea.

UNIT -III **7 hours**

Cocoa: Occurrence, chemistry of the cocoa bean; changes taking place during fermentation of cocoa bean; processing of cocoa bean; cocoa powder; cocoa liquor manufacture; chocolates–types, chemistry and technology of chocolate manufacture; quality control of chocolates.

UNIT -IV **7 hours**

Major spices: Pepper, cardamom, ginger, chili and turmeric–Oleoresins and essential oils; method of manufacture; chemistry of the volatiles; enzymatic synthesis of flavour identicals; quality control; fumigation and irradiation of spices.

UNIT -V **8 hours**

Other plantation crops processing: vanilla, coconut, cashew, Oil palm. arecanut, palmera.

Text Books and Reference Materials

1. Banerjee B. 2002. *Tea Production and Processing*. Oxford Univ. Press.
2. Minifie BW. 1999. *Chocolate, Cocoa and Confectionery Technology*. 3rd Ed. Aspen Publ.
3. NIIR. 2004. *Handbook on Spices*. National Institute of Industrial Research Board, Asia Pacific Business Press Inc.
4. Sivetz M & Foote HE. 1963. *Coffee Processing Technology*. AVI Publ.

1. Estimation of extractives, caffeine in tea and coffee; the aflavin and thearubigens of tea and total solids;
2. Estimation of Moisture and volatile oil content of spices;
3. Estimation of Aromatic compounds in spices;
4. Estimation of capsaicin content , Scoville Heat UNITs in chilies,
5. Curcumin content of turmeric;
6. Storage and packaging of spices;
7. Detection of microbial quality and adulteration in spices;
8. Visit to Coffee and tea processing centers
9. Visit to other spice processing UNITs.

FT507 FOOD SAFETY AND QUALITY CONTROL CREDIT 3

UNIT I **8 hours**

Food safety concept - Importance of food safety in the food processing industry Risk classification, National and international food regulatory agencies, General food laws and food safety regulations, Nutritional labeling regulation (mandatory and optional nutrients, nutritional descriptors and approved health claims); Microbial contamination (including cross-contamination/indirect contamination) Chemical contamination, Physical contamination, Allergen contamination

UNIT II **6 hours**

Food Safety Programs: Definitions and importance, Good Manufacturing Practices (GMPs), Pest Control Program, Facility Maintenance, Personal Hygiene, Supplier Control, Sanitary Design of Equipment and Infrastructure, Procedures for Raw Material Reception, Storage and Finished Product Loading, Sanitation Program. (Sanitation Standard Operating Procedures (SSOPs)., Product Identification, Tracking and Recalling Program, Preventive Equipment Maintenance Program, Education and Training Program

UNIT III **6 hours**

Hazard Analysis and Risk Assessment: Physical hazards (metals, glass, etc), Chemical hazards (food additive toxicology, natural toxins, pesticides, antibiotics, hormones, heavy metals and packaging components), Biological hazards (epidemiology of biological pathogens: virus, bacteria and fungi), Evaluation of the severity of a hazard Controlling Food Hazards . Hazard Analysis Critical Control Point (HACCP) system.

UNIT IV **6 hours**

Food Hygiene Programs: Personal hygiene, Training programs, Infrastructure, Personal habits, Hygiene verification, Water in the food industry, Water sources, Water uses, Water quality, Treatments, Cleaning and sanitation, Cleaning agents, Sanitizing agents, Equipment and systems, Evaluation of sanitation efficacy,. Pest Control, Pest Classification (insects, rodents and birds), Prevention and control

UNIT V **8 hours**

Food Safety regulations and management systems: National and international food quality regulations, Quality systems- Introduction to the legal system, principles in the general food law, principles of self control, risk analysis on food, international food trade,

Codex Alimentarius, traceability, EU-regulations on the hygiene of foodstuffs, and EU-regulations on the official food control. Food quality standard: IPM, GAP, Organic farming, GMP, Standard of food quality and food quality analysis, Environmental risk assessment in food safety aspect, Food hygiene and surveillance system, Standard of food quality and control system, Food industries and quality assurance in food production, ISO certifications. Indian Food regulations – History of Indian Food Regulations: BIS, ISI, FPO, PFA and FDA. Food Safety and Standards Act 2006

Text books and Reference materials

1. Early, R. (1995): Guide to Quality Management Systems for the Food Industry, Blackie, Academic and professional, London.
2. Gould, W.A and Gould, R.W. (1998). Total Quality Assurance for the Food Industries, CTI Publications Inc. Baltimore.
3. Pomeraz, Y. and MeLoari, C.E. (1996): Food Analyasis: Theory and Practice, CBS publishers and Distributor, New Delhi.
4. Bryan, F.L. (1992): Hazard Analysis Critical Control Point Evaluations A Guide to Identifying Hazards and Assessing Risks Associated with Food Preparation and Storage. World Health Organisation, Geneva.
5. Kirk, R.S and Sawyer, R. (1991): Pearson's Composition and Analysis of Foods, Longman Scientific and Technical. 9th Edition, England.
6. FAO (1980): Manuals of Food Quality Control. 2-Additives Contaminants Techniques, Rome.
7. FSSAI, FSIS, EU and FAO website for updates

Market sample evaluation and statistical application of:

1. Qualitative tests for detection of adulterants
2. Test for assessment of purity of water
3. Test for assessment of quality of milk and milk products
4. Test for assessment of quality of cereals/millets
5. Test for assessment of quality of pulses
6. Test for assessment of quality of fats and oils
7. Test for assessment of quality of meat/fish products
8. Test for assessment of quality of canned/bottle fruits and vegetables
9. Test for assessment of quality of baked foods

FT508 FOOD PLANT ORGANIZATION AND MANAGEMENT CREDIT 3

UNIT -I **6 hours**

Operation Research , definition and scope, techniques in operation research. Food plant management . Factors bearing on location and layout of food plants. Regulatory requirements of food industries.

UNIT -II **9 hours**

Structure and operation of food plants. Executive design making in a food plant. Decision protocols. Evolution and role of management planning , organising and controlling. Decision processed for raising efficiency, productivity and quality in food plant operation. System analysis, its need and methodology.

UNIT -III **7 hours**

Model building- deterministic and probabilistic models. Management decision making, problems of productions, production intending, marketing-sales forecasting, inventory , finance-Break down maintenance, inventory, finance replacement and maintenance , inventory, finance replacement and maintenance .

UNIT -IV **6 hours**

Network models.. Computer applications, database operating systems, networking project management, spread sheeting and Statistical Quality Control (SQC).

UNIT -V **8 hours**

Industrial cost accounting, purchase procedure, stores procedure, material accounting, overhead costing, budget and budgetary control, process costing,. Cost factor in fixation of prices, job costing and product costing.

Text Books and Reference Materials

1. Sivarethinamohan, R. Operations Research. Tata McGraw_Hill Pub. Co. Ltd., 2005

2. Metha, P.L. 1999. Managerical Economics- Analysis, Problems and cases, Sultan Chand and Sons, New Delhi.
3. Sherilaker, 1985. Marketting management. Himalaya Publishing Company.

FT509 FOOD LAWS AND REGULATIONS CREDIT 3

UNIT -I **6 hours**

Historical Perspectives including necessity of Food Laws.Establishment of US Pure Food Law in early 1900s and of Food & Drug Administration to enforce safety of food products; Urbanisation of population and necessity of processed and preserved foods and the necessity of ensuring quality of food to prevent adulteration

UNIT -II **10 hours**

Food Quality, Safety & Testing:Quality of Foods and Quality Standards like BIS; Agmark and other optional standards; the difference between mandatory and optional standards; enforcement of optional standards; Food Safety Systems: Quality systems standards including ISO; Auditing; Good Manufacturing Practice and HACCP.Various ways of testing the safety of foods; Detection of harmful chemicals and microbes in foods; Testing of ingredients and additives; using animals for evaluating safety; Clinical studies. Responsibility of agriculture, food industry & food supply sector;Standards of Weights & Measures, British Regulatory Consortium(BRC),American Institute of Bakers(AIB) and some provisions under these regarding food products such as requirements of labelling and giving information therein, size of packages etc. Important Issues of GM Foods, Fortification, Nutrition Information on Label, Organic Foods, Safety of Additives, Processes etc. affecting consumers and industry.

UNIT -III **9 hours**

Food Laws & Implementing Agencies-National:Prevention of Food Adulteration Act 1954 & Rules 1955 established in India to enforce safety and purity of food products; Various aspects of defining adulteration, taking samples of food for analysis by public analyst, prosecution for adulteration and punishment; Standards of various food products; FPO; Infant Milk Substitute Act; Laws relating to vegetable oils; Use of permitted additives like colours, preservatives, emulsifiers, stabilisers, antioxidants.Food Safety & Standards Act 2006 and the provisions therein; Integrated Food Law - Multi departmental - multilevel to single window control system, consumer protection Act

UNIT -IV **7 hours**

International Scenario in Food Regulation USFDA, EFSA, UK, Canada, A & NZ, Japan, Malaysia, Singapore; Consumer Movements; Intellectual Property Rights and Trade Marks: Protection of investment and efforts in research and development by patenting; Criteria of patentability; National and international patent; Terms of patents; Copyright.

UNIT -V **4 hours**

International Agencies in Food Regulation:Food Codex Alimentarius: The necessity of harmonised Food Standards for international trade; various aspects and relation with domestic laws; Codex Nodal agency, FAO, WHO, WTO, TUV ,Consumer protection forums.

References

1. Rajesh, M., and George, J. (2005) “Food Safety Regulations, Concerns and Trade : The Developing Country Perspective”, Macmillan.
2. “The Prevention of Food Adulteration Act, 1954”, Commercial Law Publishers (India) Pvt. Ltd.
3. Naomi, R., and Watson, D. (2000) “International Standards for Food Safety”, Aspen Publication.
4. Newslow, D.L. “The ISO 9000 Quality System: Applications in Food and Technology”, John Wiley & Sons, 2001.
5. Hubbard, Merton R. “Statistical Quality Control for the Food Industry”, 3rd Edition, Springer, 2003.

The Review of Literature and plan of work must be completed in this semester. This would be evaluated internally.

PONDICHERRY UNIVERSITY

Department of Food Science and Technology

M.Sc Food Science and Technology

Semester IV

Course Code	Title of the Course	Credits	Category
FT511	Dissertation	6	HC

FT511 DISSERTATION CREDIT 6

The Dissertation work continues in IV Semester. Preparation of Thesis report and Thesis Viva-voce are to be done in IV Semester