REVISED CURRICULUM AND SYLLABI

(With effect from the academic year 2017 – 2018 onwards)

M.Sc Food Science and Nutrition

DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

PONDICHERRY UNIVERSITY

R. Venaktaraman Nagar, Kalapet

Puducherry – 605 014

INDIA

PONDICHERRY UNIVERSITY

M.Sc Food Science and Nutrition

REGULATIONS

The program in Food Science and Nutrition provides students with in-depth study of nutrition science, nutrition education, food and nutrition issues, food regulations and compliance. It prepares professionals for careers in nutrition and wellness, healthcare, education and research, food and nutrition administration, nutrition policy, food production, food safety and regulations, and food and nutrition management. The department is offering M.Sc. and Ph.D programme in Food Science and Nutrition and Food Science and Technology. The specialists in food science and nutrition have unlimited job markets in the most innovative and challenging areas like Therapeutic nutrition sector, Nutraceutical and Nutrigenomics industries and various other related fields.

Aim of the Course

The curriculum integrating several soft courses, besides the core, has been formulated to provide professionally competent manpower for

a. Academic and research activities
b. Food Processing sectors
c. Managerial roles in agencies and institutions – both Government and NGO sector
d. Planning, monitoring and evaluation of nutrition and health programmes
e.. Ensuring food safety and quality for consumers
g. Entrepreneurial ventures
h. Advocacy and consultancy

Eligibility for Admission

Bachelor's degree in Food and Nutrition / Food Technology / Food Science /Clinical Nutrition and Dietetics of Composite / General Home Science / Biochemistry / Biotechnology / Microbiology /Chemistry/ Agriculture /dairy / fisheries at B.Sc. / BAMS/BSMS.

Curriculum - M.Sc Food Science and Nutrition

Semester	Course Code	Title of the Course	Category	Credits
I	FS&N411	Food Chemistry	HC	3
	FS&N412	Food Microbiology	HC	3
	FS&N413	Food Processing and Preservation Technology	HC	3
	FS&N414	Public Health Nutrition	HC	3
	FS&N415	Techniques in Food Analysis	HC	3
	FS&N425	Human Physiology	SC	3
	FS&N426	Food Toxicology	SC	3
	FS&N427	Food Economics and Food Security	SC	3
	LAB			
	FS&N451	Food Chemistry Lab	HC	1
	FS&N452	Food Microbiology Lab	HC	1
	FS&N453	Food Processing and Preservation Technology Lab	HC	1
II	FS&N431	Research Methodology and Biostatistics	HC	3
	FS&N432	Advanced Nutrition	HC	3
	FS&N433	Food Product Development and Quality Evaluation	HC	3
	FS&N434	Nutraceuticals and Functional Foods	HC	3
	FS&N435	Baking and Confectionary technology	SC	3
	FS&N436	Food Ingredients and Processing	SC	3
	FS&N437	Enzymes in Food Processing	SC	3
	LAB			
	FS&N455	Food Product Development and Quality Evaluation lab	HC	1
	FS&N456	Food Ingredients and Processing Lab	SC	1
III	FS&N511	Food Biotechnology and Nanotechnology	HC	3
	FS&N512	Food Packaging	HC	3
	FS&N513	Food Safety and Quality Control	HC	3
	FS&N514	Nutritional Biochemistry	HC	3
	FS&N515	Clinical and Therapeutic Nutrition	HC	3
	FS&N516	Food Additives	SC	3
	LAB			
	FS&N551	Food Safety and Quality Control lab	SC	1
	FS&N552	Nutritional Biochemistry lab	HC	1
IV	FS&N571	Project work	HC	8

PONDICHERRY UNIVERSITY
Department of Food Science and Technology

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	FS&N426	Food Toxicology	SC	3
	FS&N427	Food Economics and Food Security	SC	3
	LAB			
	FS&N451	Food Chemistry Lab	HC	1
	FS&N452	Food Microbiology Lab	HC	1
	FS&N453	Food Processing and Preservation Technology Lab	HC	1

Unit I **8 HOURS**

Water: Water molecule structure, liquid water and ice, water activity, Phase transition of water molecule, WLF equation. Dispersed System: surface chemistry, colloidal interaction, creaming foams and emulsion.

Unit II **9 HOURS**

Amino acids: classification, physical properties, chemical reaction, synthesis of amino acids in food fortification. Peptides: Nomenclature, physical and sensorial properties, individual peptides, Proteins: conformation, physical properties, chemical and enzyme catalyzed reactions in protein processing.

Unit III **9 HOURS**

Monosaccharides: structure and nomenclature, conformation, physical and sensory properties, chemical reaction and derivates. Oligosaccharides: Structure and nomenclature, properties and reaction. Polysaccharides: classification and structure, conformation, properties, Individual Polysaccharide, enzyme degradation of polysaccharides, analysis of Polysaccharides.

Unit IV **10 HOURS**

Fatty acids: Nomenclature and classification, Physical properties and chemical reactions, Biosynthesis of Unsaturated fatty acids. Acylglycerols: Nomenclature and classification, Physical, chemical and melting properties. Classification and properties of Phospho and glycolipids, Lipoproteins, Diol lipids, higher alcohols ,waxes and cutin. Changes in Acyl lipids of foods, Classification and Properties of Unsaponifiable constituents.

Unit V **9 HOURS**

Enzymes: Nomenclature, specificity, structure, isolation and purification. Enzyme cofactor, Theory of Enzyme catalysis, Kinetics of Enzyme catalyzed reaction, Enzyme analysis, Enzyme utilization in food industries. Vitamins, Minerals and Co-factors.

Text books and Reference materials

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

UNIT I **8 HOURS**

History and development of Microbiology-Importance and significance of microorganisms in food science. Factors affecting the growth of micro organisms in food – Intrinsic and Extrinsic parameters

UNIT II **10 HOURS**

Determination of microorganisms 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-Chemical, 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 **9 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 **8 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 **10 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. Drug resistance - phenomena and mechanism.

Text books and reference materials

1. Prescott LM Harley JP and Klein DA (2006). Microbiology (7th edition) McGraw Hill, Newyork.
2. Frazier, W.C. (1988) Food Microbiology, Mc Graw Hill Inc. 4th Edition.
3. Vijaya Ramesh,K. (2007) Food Microbiology. MJP publishers, 2007
4. Yasmine Motarjemi and Martin Adams. (2006) Emerging Food borne pathogen- Wood Head Publishing England.
5. Arun, K Bhunia. (2008) Food borne microbial pathogens: Mechanisms and pathogenesis. Springer.
6. Thomas J. Montville, Karl R. Matthews, Kalmia E. Kniel (2012). Food Microbiology: An Introduction, American Society for Microbiology.
7. Dubey, R.C. and Maheswari, D.K. (2008) Text book of Microbiology. S Chand Publishing.

FS&N413 FOOD PROCESSING AND PRESERVATION TECHNOLOGY CREDIT 3

UNIT I **8 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. 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 **10 HOURS**

Processing and preservation by drying, concentration and evaporation: Drying – water activity, microbial spoilage due to moisture. Dehydration of fruits, vegetables, milk, animal products. 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, sundrying, 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 .Food Concentration- methods of food concentration, freeze concentration, Ultra-filtration, reverse osmosis.

UNIT V **9 HOURS**

Processing and preservation by non-thermal methods: High pressure, pulsed electric field, hurdle technology. GRAS and legal aspects for gamma irradiation. Permissible limits for chemical preservatives. Use and application of enzymes and microorganism in processing and preservation of foods; food fermentations, pickling smoking ; Food additives; Definition, types and functions, permissible limits and safety aspects. Chemical Preservatives- type I and type II.

Text books and Reference materials

1) Rao, Chandra Gopala (2006). Essentials of food process engineering. B.S. Publications.
2) Khatkar, Bhupendra Singh ed (2007). Food science and technology. Daya Publishing House.
3) Singh, N.P (2007). Fruit and vegetable preservation. Oxford Book Company.
4) Ahlluwalia, Vikas (2007). Food processing. Paragon International Publishers.
5) Sivasankar,B (2005). Food processing and preservation. Prentice - Hall of India
6) Paul, Meenakshi (2007). Effects of food processing on bioactive compounds. Gene-Tech Books.
7) Rahman, Shafiur : (2007). 2nd Edn Handbook of food preservation. CRC press.
8) Arthey, David . (2005). 2nd ed Fruit processing. Springer,
9) Fellows.P (2005). 2nd edn Food processing technology. woodhead publishing company.
10) Lewis Michael (2000). Continuous Thermal Processing Of Foods. Aspen.
11) Koutchma, Tatiana (2007). Ultraviolet light in food technology , CRC Press.
12) Sun, Da-Wen (2005). Emerging technologies for food processing. Elesevier Academic Press.
13) Zeuthen, Peter (2005). Food preservation techniques. Woodhead publishing ltd,
14) Berk, Zeri (2009). Food process engineering and technology. Elsevier.
15) Fellows, P (2015). 3rd ed Food processing technology. Elsevier India.
16) Daniel B.-Gagne, Chloe M. (2013). Processed Foods, Jones, Nova Science Publishers, Inc.
17) Sun, Da-Wen (2005). Emerging technologies for food processing. Elesevier Academic Press.
18) Zeuthen, Peter (2005). Food preservation techniques. Woodhead publishing ltd,
19) Berk, Zeri (2009). Food process engineering and technology. Elsevier.
20) Fellows, P (2015). 3rd ed Food processing technology. Elsevier India.
21) Daniel B.-Gagne, Chloe M. (2013). Processed Foods, Jones, Nova Science Publishers, Inc.

UNIT -I **10 HOURS**

Concept and scope of public health nutrition - Health - definition, dimensions, determinants and indicators of health and nutrition (IMR, CBR, Fertility rate, MMR, U5MR), Vital link between health and nutrition - Review - concept of adequate nutrition and malnutrition. Health care facility - role of public nutritionists in the health care delivery system, primary Health Centre - Concept, functions, organization, current status in India and delivery of service, Taluk level hospital, and immunization. Anganwadi - its management, duties of public nutritionist in anganwadis. Demographic profile - population trends in India, density of population, demographic transition, population structure, sex ratio, family size, literacy and education, morbidity rate and life expectancy.

UNIT –II **8 HOURS**

Assessment of nutritional status of individuals and population - Significance of nutritional assessment of community, methods for assessing nutritional status., Direct methods-Anthropometry, biochemical, clinical, dietary and functional methods of assessments. Indirect methods - demography, population dynamics and vital statistics. Nutrition during life span – pregnancy, lactation, infancy, preschool age, school going and adolescents, adults and old age.

UNIT -III **10 HOURS**

Nutritional surveillance system (NSS) - Objectives, initial assessment indicators for use in nutritional surveillance**,** Triple A approach. Nutrition in emergencies and disasters - Natural and manmade disasters resulting in emergency situation., Macro and micronutrient deficiencies and Infection in emergencies. Scope for malnutrition assessment, indicators and simple screening methods. Nutritional relief and rehabilitation - Assessment of food needs, food distribution strategy, targeting food aid, mass and supplementary feeding, special foods/rations for nutritional relief, transportation and storage, feeding centers, sanitation and hygiene and ethical considerations

UNIT -IV **9 HOURS**

Prevalence of malnutrition in India - Common nutritional problems - causes and preventive measures - PEM, VAD, IDA, IDD, VDD, Obesity and fluorosis. Approaches and strategies for improving nutritional status and health – Intervention Programmes - Nutrition policy and

programmes, role of national and international organizations to combat malnutrition. Health based interventions. Food based interventions. Perspectives in food and nutrition security – basic concepts**,** production, distribution, access, availability, losses and consumption, food and nutrition security at national, household and individual levels. Food Security Programmes- Public Distribution System (PDS), Antyodaya Anna Yojana (AAY), Annapurna Scheme, Food for Work Programme.

UNIT -V **8 HOURS**

Information Education Communication approaches to improve health and nutrition: Concepts – Scope- Elements- Models of communication - Communication Process - Approaches and Barriers to communication, Communication for Extension Education and Development - Introduction to IEC Aims and Objectives, Importance of IEC, relevance to programmes - Nutrition education for behaviour change – Rationale, Planning Execution and evaluation of Intervention Programmes - Different Media, their characteristics and use- IEC for different target group

Text books and Reference materials

1.Sheila Chander Vir (2012) Public health nutrition in developing countries. Vol I&II. Woodhead Publishing India Pvt. Ltd.New Delhi.

2. Park K (2011). Park's Textbook of Preventive and Social Medicine, 21st Edition. M/s Banarasidas Bhanot Publishers, Jabalpur, India

3. Bamji MS, Krishnaswamy K and Brahmam GNV (Eds) (2009). Textbook of Human Nutrition, 3rd edition. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi

4. Kaufman and Mildred (2006). Nutrition in promoting the public's health. Jones and Bartlett Publishers. USA.

5. Edelstein and Sari (2006). Nutrition in public health, 2nd edition. Jones and Bartlett Publishers. USA.

6. Michael J. Gibney , Barrie M. Margetts, John M. Kearney and Lenore Arab (2005). Public Health Nutrition. Blackwell Publishing company. USA.

7. Schneider and Mary-jane. Introduction to public health (2006). Jones & Bartlett Publishers. USA.

8. Spark and Arlene (2007). Nutrition in public health. CRC Press. USA

9. Frank and Gail C (2008). Community nutrition, 2nd edition. Jones & Bartlett Publishers. USA.

10. Edelstein, sari and Sharlin (2009). Life cycle nutrition. Jones and Bartlett Publishers. USA.

11. Wadhwa A and Sharma S (2003). Nutrition in the Community - A Textbook. Elite Publishing House Pvt. Ltd. New Delhi.

UNIT I **9 HOURS**

Introduction, Food Regulations and Standards - Sampling methods - Sample preparation for analysis; Statistical evaluation of analytical data - Official Methods of Food Analysis. Moisture in foods - determination by different methods - ash content of foods, wet, dry ashing, microwave ashing methods; Significance of Sulphated Ash, water soluble ash and acid insoluble ash in foods; titratable Acidity in foods, determination of dietary fiber and crude fiber.

UNIT II **10 HOURS**

Determination of Total fat in foods by different methods; Analysis of oils and fats for physical and chemical parameters, Quality standards, and adulterants; different methods of determination of protein and amino acids in foods; determination of total carbohydrates, starch, disaccharides and simple sugars in foods.

UNIT III SPECTROSCOPIC TECHNIQUES **9 HOURS**

Basic Principles- Spectrophotometric analysis of food additives and food Components -IR Spectroscopy in online determination of components in foods; AAS and ICP-AES in mineral elements and toxic metals analysis; use of fluorimeter in vitamin assay- specfic use of Tintometer in vanaspathi analysis.

UNIT IV **9 HOURS**

Chromatographic Techniques- Basic principles and types of:- Paper chromatography, thin layer chromatography, column chromatography, Ion exchange chromatography, HPTLC, HPLC, UHPLC, GC,GC-MS, Types of detectors ,Uses and applications of chromatographic techniques.

UNIT V **8 HOURS**

Basic Principles, application of electrophoresis in food analysis, refractive indices of oils and fats, total soluble solids in fruit juice and honey, specific rotation of sugars, estimation of simple sugars and disaccharides by polarimeter; Immunoassay techniques and its applications in foods.

Text books and Reference materials

1. Fung, D.Y.C. and Matthews, R. (1991): Instrumental Methods for Quality Assurance in Foods, Marcel Dekker, Inc. New York.
2. Skoog, D.A., Holler, F.H. and Nieman (1998): Principles of Instrumental Analysis Saunders College Publishing, Philadelphia.
3. Gruenwedel, D.W.; Whitaker, J.R. (editors) (1984): Food Analysis Principles and techniques, Volumes 1 to 8, Marcel Dekker, Inc., New York.

4. Herschdoerfer, S.M. (ed) (1968 – 1987): Quality Control in the Food Industry, Vols. 1 to 4, Academic Press, London.

5. Pomeranz, Y. and MeLoan, C.E. (1996): Food Analysis: Theory and Practice; 3rd Edition, CBS Publishers and Distributors, New Delhi.

6. Wilson and John Walker ,Principles and Techniques of Biochemistry and Molecular Biology (2010), Keith Wilson and John Walker, Cambridge University Press.

UNIT - I **10 HOURS**

Cell structure and function: Levels of cellular organization and function – organelles, tissues, organs and systems – Brief review - Cell membrane transport across cell, membrane and intercellular communication Regulation of cell multiplication. Musculo-skeletal system: Structure and function of bone, cartilage and connective tissue. Disorders of the skeletal system. Types of muscles structure and function.

UNIT - II **12 hours**

Digestive system: Review of structure and function - Secretory, Digestive and Absorptive functions - Role of liver, pancreas and gall bladder and their dysfunction - Motility and hormones of GIT. Regulation of food intake – role of hunger and satiety centers, effect of nutrients.

UNIT - III **9 HOURS**

Circulatory and Cardio Vascular system: Blood - formation, composition, clotting and haemostasis .Formation and function of plasma proteins. Erythropoesis. Blood groups and histocompatibility. Blood indices - Use of blood for investigation and diagnosis of specific disorders, Structure and function of heart and blood vessels - Regulation of cardiac output and blood pressure, heart failure, hypertension.

Respiratory system: Review of structure and function. Role of lungs in the exchange of gases. Transport of oxygen and Co_2. Role of haemoglobin and buffer systems. Cardio-respiratory response to exercise and physiological effects of training.

UNIT - IV **7 HOURS**

Excretory system :Structure and function of nephron - Urine formation - Role of kidney in maintaining pH of blood -Water, electrolyte and acid base balance – diuretics

Nervous System: Review of structure and function of neuron - conduction of nerve impulse, synapses, and role of neurotransmitters - Organization of central and Peripheral nervous system. Hypothalamus and its role in various body functions-obesity, sleep, memory.

UNIT - V **7 HOURS**

Immune system: Cell mediated and humeral Immunity - Activation of WBC and production of antibodies. Role in inflammation and defense.

Endocrine system :Endocrine glands (Pituitary gland, Thyroid, parathyroid, Islets of Langerhans, Adrenals, Ovary and Testis, Thymus, Pineal gland – structure, function, role of hormones, regulation of hormonal secretion, Disorders of endocrine glands Emphasis on physiology of diabetes and stress hormones.

Text books and Reference materials

1. Ganong, W.F. (1986): Review of Medical Physiology, 12th Edition, Lange Medical Publication.
2. Guyton, A.G. and Hall, J.B. (1996): Text Book of Medical Physiology, 9th Edition, W.B. Sanders Company, Prism Books (Pvt.) Ltd., Bangalore.
3. Wilson, K.J.W and Waugh, A. (1996): Ross and Wilson Anatomy and Physiology in Heath and Illness 8th Edition, Churchill Livingstone.
4. Jain, A.K.: Textbook of Physiology. Vol.I and II. Avichal Publishing Co., New Delhi.
5. McArdle, W.D., Katch, F.I. and Katch V.L(1996): Exercise Physiology. Energy, Nutrition and Human Performance, 4th Edition, Williams and Wilkins, Baltimore.
6. Datta, Chandrani Sanyal (2006): Essentials of human physiology: AITBS.
7. Marieb, Elaine N. (2004): Pearson Human anatomy & physiology, 6th ed.
8. Donnersberger, Anne B.Jones & Bartlett, (2005): 8th ed. Laboratory textbook of anatomy and physiology.

FS&N426 FOOD TOXICOLOGY CREDIT 3

UNIT- I **10 HOURS**

Principles of Toxicology: classification of toxic agents; characteristics of exposure; spectrum of undesirable effects; interaction and tolerance; biotransformation and mechanisms of toxicity. Evaluation of toxicity: risk vs. benefit: experimental design and evaluation: prospective and retrospective studies: Controls :Statistics (descriptive, inferential): animal models as predictors of human toxicity: Legal requirements and specific screening methods as per OECD guidelines *in vitro* and in vivo studies; clinical trials.

UNIT – II **8 HOURS**

Natural toxins in food: natural toxins of importance in food- toxins of plant and animal origin; microbial toxins (e.g., bacterial toxins, fungal toxins and Algal toxins), natural occurrence, toxicity and significance, determination of toxicants in foods and their management.

UNIT – III **9 HOURS**

Food allergies and sensitivities: natural sources and chemistry of food allergens; true/untrue food allergies; handling of food allergies; food sensitivities (anaphylactoid reactions, metabolic food disorders and idiosyncratic reactions); Safety of genetically modified food: potential toxicity and allergenisity of GM foods. Safety of children consumables.

UNIT – IV **9 HOURS**

Environmental contaminants and drug residues in food: fungicide and pesticide residues in foods; heavy metal and their health impacts; use of veterinary drugs (e.g. Malachite green in fish and β-agonists in pork); other contaminants in food, radioactive contamination of food, Food adulteration and potential toxicity of food adulterants. Endocrine disrupters in food.

UNIT – V **9 HOURS**

Food additives and toxicants added or formed during food processing: safety of food additives; toxicological evaluation of food additives; food processing generated toxicants: nitroso-compounds, heterocyclic amines, dietary Supplements and toxicity related to dose: common dietary supplements; relevance of the dose; possible toxic effects.

Text books/ Resources

1. Klaassen, Curtis; Watkins III, John B. (2015), Casarett & Doull's Essentials of Toxicology, Third Edition, McGraw-Hill Medical, ISBN 10: 0071847081 ISBN 13: 9780071847087.
2. Tõnu Püssa (2013), Principles of Food Toxicology, Second Edition, CRC Press, ISBN 9781466504103.
3. S.S. Deshpande Ed (2013), Handbook of Food Toxicology, CRC Press, ISBN 9780824707606.
4. Helferich, W., and Winter, C.K. (2001) Food Toxicology, CRC Press, LLC. Boca Raton, FL
5. Shibamoto, T., and Bjeldanes, L. (2009) Introduction to Food Toxicology, 2nd Ed. Elsevier Inc., Burlington, MA.
6. Watson, D.H. (1998) Natural Toxicants in Food, CRC Press, LLC. Boca Raton, FL
7. Duffus, J.H., and Worth, H.G. J. (2006) Fundamental Toxicology, The Royal Society of Chemistry
8. Stine, K.E., and Brown, T.M. (2006) Principles of Toxicology, 2nd Ed. CRC Press.
9. Tönu, P. (2007) Principles of Food Toxicology. CRC Press, LLC. Boca Raton, FL.

FS&N427 FOOD ECONOMICS AND FOOD SECURITY CREDIT 3

UNIT I **9 HOURS**

Statistical profile of the world food economy. The Structure of the World Food System. Early human food systems and subsistence agriculture. Semi-subsistence food systems and commercial, market-oriented food systems. Global supply-demand balance and projections

UNIT II **10 HOURS**

Statistical profile of the Indian economy Agricultural production and the supply of food. Economic causes and consequences of resource degradation. Components of Indian Food Systems, Food Policies in India **:**Food and agricultural policies, Supply side policies, Agricultural research and development Infrastructure and production policies, Demand side policies, Income support and redistribution Food assistance programs

UNIT III **9 HOURS**

Global Institutions and the WTO, World food systems: food security, food self-sufficiency and the role of trade. Foreign aid, food aid and development. Global sustainability: environmental impacts of the world food system. Hunger, conflict, government failure and international intervention. Globalization of the food system.

UNIT IV **9 HOURS**

Food security: Hunger and malnutrition, Definition and measurement. Food security model, Food availability. Foreign aid, food aid and development. Global sustainability: environmental impacts of the world food system. Hunger, conflict, government failure and international intervention. Globalization of the food system.

UNIT V **8 HOURS**

Food and agricultural policies including Supply side policies, Agricultural research and development, Infrastructure and production policies, Demand side policies, income support and redistribution, Food assistance programs.

Text books and Reference materials

1. Leathers, H.D. and Fosters, P., The World Food Problem: Tackling the Causes of Under nutrition in the Third World, 3rd Edition. Lynne Rienner Publishers, 2004.
2. Southgate, D., Graham, D.H. and Tweeten, L., The World Food Economy, Blackwell Publishing, 2007.

3. Fogel, R. W. 2004. Health, nutrition, and economic growth. Economic Development & Cultural Change 52(3): 643-658.

4. Asbjorn, E. 2007. Freedom from Hunger as a Basic Human Right, in Ethics, Hunger, and Globalization, edited by Per Pinstrup-Andersen and Peter Sandoe. The netherlands:Springer Press.

5. Pinstrup-Andersen, Per and Peter Sandoe, editors. *Ethics, Hunger, and Globalization*. 2007. The Netherlands: Springer Press.

1. Water activity and moisture isotherm
2. Specific gravity and Refractive Index
3. Emulsions and foaming properties of proteins
4. Millard Reaction, qualitative test for protein
5. Quantitative estimation of protein by biuret method, factors affecting protein quality
6. Fehling's test for reducing sugars, Microscopic examination of starch,
7. Starch Gels, Viscosity curves of starch pastes
8. Lipids: Solubility, specific gravity and refractive index of fats,
9. Water absorption and plasticity of fats, Oxidative rancidity

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.

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

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Department of Food Science and Technology

M.Sc Food Science and Nutrition

Semester	Course Code	Title of the Course	Category	Credits
II	FS&N431	Research Methodology and Biostatistics	HC	3
	FS&N432	Advanced Nutrition	HC	3
	FS&N433	Food Product Development and Quality Evaluation	HC	3
	FS&N434	Nutraceuticals and Functional Foods	HC	3
	FS&N435	Baking and Confectionary technology	SC	3
	FS&N436	Food Ingredients and Processing	SC	3
	FS&N437	Enzymes in Food Processing	SC	3
	LAB			
	FS&N455	Food Product Development and Quality Evaluation lab	HC	1
	FS&N456	Food Ingredients and Processing Lab	SC	1

FS&N431 RESEARCH METHODOLOGY AND BIOSTATISTICS CREDIT 3

UNIT I **9 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 **9 HOURS**

Introduction to Bio statistics – Meaning and its scope; Population and Sample. Parameter and Statistics; types of statistical data; Diagrammatic representation data; Mean, Median, Mode, Standard deviations, Coefficient of Variation, Skewness and Kurtosis. Probability – Definition, Axioms of Probability; Addition and Multiplication theorem.

UNIT III **8 HOURS**

Concept of Correlation – Simple, Partial Regression – Simple Methods of Association – Chi square test of association of attributes, Goodness of Fit.

UNIT IV **9 HOURS**

Concepts of Hypothesis _ Null, Alternative Hypothesis, Type I and type II errors, Sampling Distribution Standard error t & F distribution: t test based on single samples, two sample mean, paired samples, F test two sample variances, F test for several mean (One way ANOVA only). Z-test for proportion – One sample, two sample..

UNIT V **10 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. (2002). Intergrating research : A guide for literature reviews (2nd Edition). California: Sage
3. Harman, E & Montages, I. (Eds.) (2007). 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

UNIT - I **10 HOURS**

Homeostatic maintenance - Body water compartments - Body fluids and electrolyte balance Regulation of water balance - disorders of water balance - Body composition. Energy metabolism Basal and resting metabolism (BMR and RMR) – influencing factors. Methods to determine energy requirements and expenditure. Thermogenesis, adaptation to altered energy intake, latest concepts in energy requirements and RDA - ICMR and WHO

UNIT - II **9 HOURS**

Carbohydrates: Occurrence and physiological functions**,** Review of metabolism of carbohydrates. Harmonal regulation of CHO metabolism. Lactose intolerance. Dental caries. Sugar alternatives. Role of dietary fiber in health and disease. Disorders related to carbohydrate metabolism. Glycemic index and Glycemic load of foods and its uses. RDA-ICMR and WHO

UNIT - III **8 HOURS**

Lipids **–** Classification and Functions, Review of metabolism of Lipid, Concepts of visible and invisible fats, EFA, SFA, MUFA, PUFA – sources and physiological functions. Role of lipoproteins (Chylomicrons, VLDL, IDL, LDL and HDL), cholesterol, triglycerides in health and disease.

UNIT - IV **9 HOURS**

Proteins **–** Classification and Functions, Review of metabolism of Protein, Concepts of essential and non-essential amino acids – their role in growth and development. Physiological functions of proteins. Requirements, nitrogen balance concept. Methods of evaluating protein quality. Protein malnutrition., Muscle wasting – clinical features and biochemical changes. RDA-ICMR and WHO.

UNIT - V **9 HOURS**

Regulatory nutrients – Water and Fat Soluble Vitamins. Macro, Micro and Trace minerals- Sources, Digestion, Absorption, Transport, and Storage Functions and Mechanisms of Action, Metabolism and Excretion, RDA, Deficiency and Toxicity. Health and nutrient claims in food and dietary Supplement. Detoxification – Xenobiotics, enzyme systems involved mechanism of detoxification.

Text books and Reference materials

1. Sareen S. Gropper, Jack L.Smith, James L.Groff (2009). Advanced Nutrition and Human Metabolism, 5th Edition, Thomson Wordsworth Publication, USA.

2. Shils, M.E., Olson, J., Shike, M. and Roos, C (2006). Modern Nutrition in Health and Disease, 9th edition Williams and Williams. A Beverly Co. London.

3. Carolyn D. Berdanier, Janos Zempleni (2009). Advanced Nutrition Macronutrients, Micronutrients and metabolism. CRC Press Taylor & Francis Group, LLC.

4. Carroll A. Lutz, Erin E. Mazur and Nancy A. Litch (2015). Nutrition and Diet Therapy. Sixth Edition.F.A.Davis Company, USA.

5. Paul Insol, Don Ross and Kimberley McMohan (2006). Discovering Nutrition, 2nd edition. Jones and Barlett Publishers. USA.

6.Steve and Cui (2005). Food Carbohydrates. Taylor & Francis.UK.

7. Gibney and Michael.J (2003). Nutrition Metabolism. Blackwell Publishing.USA.

8. Bender and David (2008). Introduction to nutrition and metabolism, 4th edition.CRC Press. USA.

9.Geissler and Catherine (2007). Human Nutrition, 11th edition. Elsevier. UK.

10.Mann and Jim (2008). Essentials of Human Nutrition,3rd edition. Oxford University Press.UK.

11.Eastwood and Martin (2003). Principles of Human Nutrition, Blackwell Publishing.USA.

UNIT I **8 HOURS**

FOOD NEEDS & CONSUMER PREFERENCE - Market survey and its importance in; designing a questionnaire to find consumer needs for a product or a concept. Developing a Product to Meet the Requirements. Product life cycle. Creating brand value for the Product. The SWOT analysis

UNIT II **10 HOURS**

DESIGNING NEW PRODUCTS - New Food Product Development (NPD) process and activities, The Stage-Gate model 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; involvement of consumers, chefs and recipe experts; selection of materials/ingredients for specific purposes; modifications for production on large scale, cost effectiveness and return on investment, nutritional needs or uniqueness; use of novel food ingredients and novel processing technologies.

UNIT III **9 HOURS**

STANDARDIZATION & LARGE SCALE PRODUCTION - Process design, equipment needed; establishing process parameters for optimum quality; Sensory Evaluation; Lab requirements; different techniques and tests; statistical analysis; application in product development and comparison of market samples; stages of the integration of market and sensory analysis.

UNIT IV **9 HOURS**

QUALITY, SAFETY & 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 **9 HOURS**

PRODUCT COMMERCIALIZATION, LAUNCH, EVALUATION & CASE STUDIES - Outcomes and activities in product commercialization, Pre-launch trial, Steps in product launch, Evaluation of the Launch, product performance testing, developing test market strategies, Case Studies of some successes and failures, food choice models and new product trends.

REFERENCES

1. Jacqueline H. Beckley, M. Michele Foley Elizabeth J. Topp &_J. C. Huang Witoon Prinyawiwatkul (2007). Accelerating New Food Product Design and Development. Blackwell Publishing Company. IFT Press. USA

2. Howard R. Moskowitz, I. Sam Saguy & Tim Straus (2009). An Integrated Approach to New Food Product Development. Taylor and Francis Group, LLC.USA

3. Mary Earle and Richard Earle (2008). Case studies in food product development Wood head Publishing Limited and CRC Press LLC.USA

4. Creating New Foods. The Product Developer's Guide: Marie D. Earle and Richard L. Earle (2001). Chadwick House Group Ltd. New Zeeland.

5. David H. Lyon, Mariko A. Francombe, Terry A. Hasdell and Ken Lawson (1992). Guidelines for sensory analysis in food product development and quality control.
Chapman & Hall, 2-6 Boundary Row, London.

FS&N434 NUTRACEUTICALS AND FUNCTIONAL FOODS CREDIT 3

UNIT -I **9 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 **9 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 **9 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 **9 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. Synbiotics.

UNIT -V **9 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.

Text Books and Reference materials

1. Wildman, Robert. Nutraceuticals and Functional Foods, second edition. Taylor and Francis Group. 2007.
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.

FS&N435 BAKING AND CONFECTIONARY TECHNOLOGY CREDIT 3

UNIT-I **10 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 **10 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. Preparation pastries and pie – types of pastries – different methods of making pastries – methods of lamination process in pastries.

UNIT-IV **9 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 **8 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, 2005.
3. Pomeranz. Y. "Modern Cereal Science and Technology". MVCH Publications, New York.2003.
4. Samuel A., Matz., " Equipment for Bakers", Pan Tech International Publication, 2009.
5. Manley, Duncan., " Biscuit Doughs Manual 2", Woodhead Publishing Ltd., England. 2009.

FS&N436 FOOD INGREDIETNS AND PROCESSING CREDIT 3

UNIT I **9 HOURS**

Cereals and Legumes: **Cereals** - classification and structure of cereals. Wheat types, dough chemistry, quality of flour and flour treatment. Rice milling, aging of rice. Processing , pearling and matting of barley. Corn wet and dry milling, corn flakes, starch and its derivates syrup, germ oil, preparation of extruded products. **Legumes**-classification, processing pulses, Dhal milling, processing of soy bean and peanut.

UNIT II **9 HOURS**

Vegetables and Fruits: **Vegetables-** Classification of vegetables, post harvest changes and storage. Vegetable products processing: Dehydrated, canned, frozen, pickled and vinegar pickled vegetables. Vegetable juices, pastes and powders. **Fruits-**Classification, post harvest handling and storage of fruits. Fruit Products: Dried, canned, deep frozen, rum fruits, pulp, slurries, marmalades, jams and jellies, plum sauce, thickened fruit syrup, juices, nectars, concentrates and powder.

UNIT III **9 HOURS**

Milk and Milk Products: Sources, processing, standardization, toning, homogenization, pasteurization, sterilization, storage, transport and distribution. Milk products processing- cream, butter oil, cheese, cheese spread, condensed milk, evaporated milk, whole milk ,.skimmed milk powder, ice cream, khoa, channa ,panner, fermented milk products, yogurt, dahi, srikhand similar products. Instantization of milk and milk products.

UNIT IV **10 HOURS**

Meat, fish and poultry products: sources of meat and meat products, effect of feed, breed and management of meat production and quality. Slaughtering of animals and poultry inspection and grading of meat. Factors affecting post mortem changes, properties, shelf life of meat . Meat quality evaluation. Mechanical deboning, meat tenderization, ageing, pickling and smoking of meat. Structure and functional properties of egg. Factors affecting egg quality and measure of egg quality. Types of fish structure, post mortem changes in fish. Storage and processing fish and fish products.

UNIT V **8 HOURS**

Edible Fats and oils and Plantation crops: Edible Fats and oils- classification and Origin of individual fats and oils, production, processing of oils. Shortening-types and preparation. Mimic fats and fat powder. Plantation crops: Varieties, and processing of Tea, coffee and coco. Processing of spices-pepper, turmeric,cardamom, chilli, palm , vanilla and mustard.

Textbooks

1. Potter,N. and Hotchkiss,J.H.(1996).Food Science, Fifth Edition, CBS Publishers and Distributors, New Delhi.
2. Charley,H.(1982).Food Science ,JohnWiley and Sons, New York.
3. Salunke,D.K and Kodam,S.S. (2001).Handbook of vegetable science and Technology, Marcel Dekker,Inc,270,Madison Avenue, New York.
4. Borwankar,R.P and Shoemaker,C.E.(1992).Rheology of Foods.Elsevier Science Publishers Ltd., England.
5. Salunke,D.K and Kodam,S.S . (2001). Handbook of Vegetable Science and Technology, Marcel Dekker,Inc., 270,Madison Avenue, New York,NY,10016

UNIT -I **9 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 **9 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 **9 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 **9 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 **9 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

Survey on types of convenience foods / consumer behavior / analysis of food labeling

Group projects to Develop Food Products at Laboratory scale

Project Identification: Products/Processes Review, Project Feasibility, Design and Product Specification

Project Planning: Identifying Objectives, Identifying Tools/Methods, - Permutation and Combination, Response Surface Methodology, Use of Information/ Communication Technology

Project Execution: Product Trials and Standardization, Evaluation of product- Analysis of Physical and Chemical Properties and Sensory Evaluation

Project Presentation: Documentation and Report, Viva Voice

1. Development of gluten in fermented doughs
2. Effect of cooking on whole and split pulses
3. Factor affecting gelatinization and setting quality of food starches
4. Determination of smoking points of fats and oils
5. Effects of pre preparation techniques on meat tenderization
6. Effect of cooking on the coagulation property of eggs
7. Effect of pH on cooking of vegetables and fruits
8. Determination of subjective evaluation on foods

PONDICHERRY UNIVERSITY
Department of Food Science and Technology

M.Sc Food Science and Nutrition

Semester	Course Code	Title of the Course	Category	Credits
III	FS&N511	Food Biotechnology and Nanotechnology	HC	3
	FS&N512	Food Packaging	HC	3
	FS&N513	Food Safety and Quality Control	HC	3
	FS&N514	Nutritional Biochemistry	HC	3
	FS&N515	Clinical and Therapeutic Nutrition	HC	3
	FS&N516	Food Additives	SC	3
	LAB			
	FS&N551	Food Safety and Quality Control lab	SC	1
	FS&N552	Nutritional Biochemistry lab	HC	1

FS&N511 FOOD BIOTECHNOLOGY AND NANOTECHNOLOGY

CREDIT 3

UNIT -I **9 HOURS**

Basic principles of molecular biology and biotechnology: Introduction to 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. Nutrogenomics - concept, working, significance and relevance. Biosensors and novel tools and their application in food science.

UNIT -II **9 HOURS**

Traditional applications of biotechnology in food - 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. Examples of genetically modified crops- Bt brinjal , Bt maize and golden rice.

UNIT -III **9 HOURS**

Plant and animal culture, transgenic plants, application of genetic engineering in food science and technology. Genetically modified foods – concept, types and application. Regulations concerning Genetically Modified Foods in India and at the International level; Ethical issues concerning GM foods; testing for GMOs; current guidelines for the production, release and movement of GMOs; labeling and traceability; trade related aspects; bio safety; risk assessment and risk management. Public perception of GM foods.IPR.

UNIT -IV **9 HOURS**

Introduction to Nanotechnology: Characteristic scale for quantum phenomena, nanoparticles, nano-clusters, nanotubes, nanowires and nanodots. *Nanobiotechnology*: Nanoparticles and nucleic acid and protein based recognition groups – application in optical detection methods – Nanoparticles as carrier for genetic material - nanobioelectronic devices and polymer nanocontainers – microbial production of inorganic nanoparticles – magnetosomes.

UNIT -V **9 HOURS**

Biological synthesis of nanoparticles: Biosynthesis of Nanoparticles: Biomineralization -Microbial Nanoparticle production. Biofunctionalizaion of gold nanoparticles – phospholipids polymer nanoparticles – magnetic nanoparticles–metallic nanoparticle. Application of nanotechnology in food Science in brief: Nanosensors for microbial, chemical contaminants; Foods incorporated with nanoscale antimicrobial compounds, antioxidants and flavours which would improve shelf-life or sensory characteristics such as flavour, odour.

Text books and reference materials

1. Dubey, R.C. “Textbook of Biotechnology” Chand publishing. 2009.
2. Kalaiselvan, “Bioprocess technology” MJP Publishers, 2007.
3. Glenn R. Gibson and Marcel Roberfroid “Handbook of Prebiotics”, CRC Press, 2008
4. Shanmugham,S. “Nanotechnology” MJP publishers. 2011.

FS&N512 FOOD PACKAGING CREDIT 3

UNIT I **9 HOURS**

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

UNIT II **9 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 **9 HOURS**

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

UNIT IV **9 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 **9 HOURS**

Packaging Design & Environmental Issues in Packaging: Food marketing and role of packaging- bar coding, Migration in food packaging. FSSAI regulations for packaging and food labeling.

Text Books and Reference materials

1 Miquel Angelo P R C, Ricardo Nuno C P, Oscar Leandro D S R, Jose Antonio C T, Antonio Augusto V , 2016, Edible Food Packaging: Materials and Processing Technologies, CRC Press. Taylor & Francis ,Boca Raton , FL

2 Luciano P, Sara L,2016, Food Packaging Materials, Springer cham Heildelberg, New york

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

FS&N513 FOOD SAFETY AND QUALITY CONTROL CREDIT 3

UNIT I **9 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 **9 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 **9 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 **8 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 **10 HOURS**

Food safety regulation in India: An overview of Food Regulation in India; Food Laws and Regulations; Structure, organization and duties of regulatory system; Duties and responsibilities of food business operator; Registration and Licensing process and requirements; Labeling of Food Products; Traceability; Import and Export of Foods; Liability for Defective Products; Food safety management systems and certifications; Regulation of special category Foods: Regulation of Irradiated foods; Regulation of Biotechnology and Genetic Modifications; Regulation of Dietary Supplements, Functional Foods and Nutraceuticals.

Text books and Reference materials

1. Food Safety and standards Act 2006, Rules 2011, Regulations, 2011, 10th Edition, ILBCO India, Indian Law Book Company, 2013.
2. Early, R. (1995): Guide to Quality Management Systems for the Food Industry, Blackie, Academic and professional, London.
3. Gould, W.A and Gould, R.W. (1998). Total Quality Assurance for the Food Industries, CTI Publications Inc. Baltimore.
4. Pomeraz, Y. and MeLoari, C.E. (1996): Food Analyasis: Theory and Practice, CBS publishers and Distributor, New Delhi.
5. 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.
6. Kirk, R.S and Sawyer, R. (1991): Pearson's Composition and Analysis of Foods, Longman Scientific and Technical. 9th Edition, England.
7. FAO (1980): Manuals of Food Quality Control. 2-Additives Contaminants Techniques, Rome.
8. FSSAI, FSIS, EU and FAO website for updates

FS&N514 NUTRITIONAL BIOCHEMISTRY CREDIT 3

UNIT -I **10 HOURS**

Metabolic pathways: Carbohydrates – Aerobic and anaerobic degradation, glycogenesis, glycogenolysis, gluconeogenesis, HMP shunt pathway.Hormonal regulations of blood glucose.Bioenergetics – Principles of bioenergetics, free energy – endergonic and exergonic process, role of high energy compounds in energy storage, formation of ATP- Biological oxidation and electron transport chain - Reduction potentials, anatomical site and components of oxidative phosphorylation, enzymes involved membrane location of electron transport, chemiosmotic theory, inhibitors of respiratory chain.

UNIT -II **9 HOURS**

Protein and amino acids: Protein degradation, fate of nitrotgen (urea cycle), metabolism of aromatic, sulfur containing, BCAA and other amino acid pool. Glutamine and alanine cycle, protein biosynthesis. Nucleic acids- metabolism of nucleic acid components, biosynthesis of nucleotides.

UNIT -III **9 HOURS**

Lipids- Metabolism of triaclyglycerol, β oxidation of fatty acids, cholesterol. Regulation of lipid metabolism and ketone bodies.Oxidative stress and antioxidants – Free radicals – definition, formation in biological systems, defense against free radicals. Role of free radicals and antioxidants in health and disease Determination of free radicals, lipid peroxides and antioxidants

UNIT -IV **8 HOURS**

Regulation of metabolism – Interrelationship of carbohydrate, protein and lipid metabolism, Role of Vitamins and Minerals in Metabolism,metabolic adaptation during starvation, exercise, stress and diabetes mellitus

UNIT -V **9 HOURS**

Significances of enzymes in food metabolism Classification, Chemical nature - Enzyme inhibition, enzyme pattern in disease pattern.Hormones: Classification – synthesis - regulatory functions and mechanism of hormone action - Prostaglandin – structure, biosynthesis, metabolism and biological action and their role in pathology.

Text books and Reference materials

1. Murray, R.K., Graner, D.K., Mayes, P.A. and Rodwell, V.W. (2000): 25th Ed. Harpers Biochemistry Macmillan Worth Publishers.
2. Nelson, D.L., and Cox, M.M. (2000): 3rd Ed. Lehninger's Principles of Biochemistry, Macmillan Worth Publishers.

3. Conn, E.E., Stumpf, P.K., Bruening, G. and Doi, R.H. (2001): 5th Ed. Outlines of Biochemistry, Heinemann Medical Books Ltd.
4. Raghuramulu, N., Madhavan Nair and K. Kalyanasundaram, S. (1983). A Manual of Laboratory Techniques, NIN, ICMR.
5. King, E.J. and Wootton, I.D.P. (1956), Micro-Analysis in Medical Biochemistry, 3rd ed., J. and Chuchill Ltd.

FS&N515 CLINICAL AND THERAPEUTIC NUTRITION CREDIT 3

UNIT I **10 HOURS**

Guidelines for dietary planning - Weights and Measures. Nutritional Assessment. Nutritional care process. Nutritional intervention: Objectives of diet therapy, Therapeutic modification of the normal diet: diet prescription. Routine Hospital diet - regular diets, clear fluid diet, full fluid diet, soft diet, modifications of food and nutrient intake, Enteral nutrition, parenteral nutrition, Refeeding syndrome, Transitional feeding. Medical and nutritional care record types and uses, Format for medical and nutrition charting and documentation record

UNIT II **9 HOURS**

Dietitian and Nutrition counseling: Role of dietitian on hospitalized and outdoor patients and development of nutritional care plan. Specific functions of a therapeutic, administrative and consultant dietitian. Team approach in patient care. Psychological considerations in feeding the patients. Inter personal relationship with patients. Nutrition counseling- concept, components, activities for behavior changes, intervention counseling models, types of counseling session in patients.

UNIT III **8 HOURS**

Weight imbalances, anorexia nervosa and Bulimia nervosa, cardio vascular disorders, Diabetes mellitus-Type I, II, GI Tract Disorders, Liver and gall bladder, Pancreatic disorders, renal disorder, gout, cancer, Musculo -skeletal disorders (Rheumatoid Arthritis, Osteoarthritis, Osteoporosis), Respiratory problems, hyper metabolic conditions- Burns, Sepsis, Surgery.

UNIT IV **10 HOURS**

Neurological disorders attributed to nutritional etiologies (Wernicke-Korsakoff syndrome and Stroke). Neurological disorders attributed to non nutritional etiologies (Parkinson's disease, epilepsy, Huntington's chorea, Amyotrophic lateral sclerosis, multiple sclerosis, myasthenia gravis, Alzheimer's disease and Wilson's disease). Immune – deficiency disorders - Infections and AIDS, Genetic disorders, in born errors of metabolism. Management of diet related health disorders- Food allergy, food poisoning, alcohol, drugs.

UNIT V **8 HOURS**

Food- Drug Interaction: Effect of Food on Drug Therapy. Effect of Drug on Food and Nutrition. Modification of Drug Action by Food and Nutrition. Effect of Drug on Nutritional Status. Excipients and Food-Drug Interaction. Medical nutritional therapy.

Text books and Reference materials

1. Mahan, L.K. and Escott-Stump, S. (2008): Krause's Food Nutrition and Diet-Therapy, 12th Edition, W-13 Saunders Ltd.,Canada.

2. Garrrow J.S, James W. P.T, Ralph A, (2000), Human Nutrition and Dietetics, 10th edition, Churchill Livingston, London.

3. Antia F.P. And Philip Abraham (2001) Clinical Nutrition and Dietetics, Oxford Publishing Company, New Dellhi.

4. Williams, S.R. (2003): Nutrition and Diet Therapy, 7th Edition, Times Mirror/Mosby Collage Publishing

5. Esther A. Winterfeldt,Margret L.Bogle,Lea L.Ebro.(2011).Dietetics: Practice& Future Trends.Third Edition.Jones and Barlet Publishers.UK.

UNIT I **10 HOURS**

Food additives – definitions, classification and function , chemistry, food uses and functions in formulations; toxicological evaluation of food additives. Proteins, starches and lipids as functional ingredient; isolation, modification, specifications, functional properties and applications in foods.

UNIT II **9 HOURS**

Functionality of food additives, regulatory and legal aspects, sensory properties of foods objectives of additives, functional classification of additives, additives of natural origin, synthetic additives, indirect additives. Health and safety aspects of food additives. Present status of various food additives.. Controversial food additives Saccharin, history, function, controversy status, aspartame, nitrite and nitrate compounds, nitrosamines.

UNIT III **9 HOURS**

Additives to improve acceptability, permitted food colors, natural and artificial, food flavours, natural and artificial, sweeteners natural and artificial. acidulents, antimicrobials, aerating agents, ant staling agents, bodying agents, clouding agents, curing agents clarifiers, dietary supplements, dietary fiber , emulsifiers, enzymes, fat replacers, gelling agents, leavening agents, stabilizers, surfactants, tenderizers, texturizers, thickeners, vitamins, nutraceuticals, viscosity modifiers, whipping agents.

UNIT IV **8 HOURS**

Flavor technology; types of flavours, flavours generated during processing – reaction flavours, flavor composites, stability of flavours during food processing , analysis of flavours, extraction techniques of flavours, flavours emulsions; essential oils and oleoresins; authentication of flavours etc.

UNIT V **9 HOURS**

Food adulteration, definition, reasons for food adulteration, methods of adulteration, and methods of detection. Consumer's responsibilities, consumer organizations. The prevention of food adulteration Act, 1954. The consumer protection Act 1986, normal food adulterants in coffee, tea leaves, edible oil, milk, cereals, spice powders.

Text books and Reference materials

1. Branen, A.L., Davidson PM & Salminen S. 2001. Food Additives. 2nd Ed. Marcel Dekker.
2. Gerorge, A.B. 1996. Encyclopedia of Food and Color Additives. Vol. III. CRC Press.
3. Gerorge, A.B. 2004. Fenaroli's Handbook of Flavor Ingredients. 5th Ed. CRC Press.
4. Madhavi, D.L., Deshpande, S.S & Salunkhe, D.K. 1996. Food Antioxidants: Technological, toxicological and Health Perspective. Marcel Dekker
5. Morton, I.D. & Macleod, A.J. 1990. Food Flavours. Part A, BC. Elsevier.

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

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

1. Estimation of blood and urine glucose
2. Estimation of hemoglobin and iron
3. Estimation of total protein , serum albumin and globulin
4. Estimation of phosphorus in urine
5. Estimation of ascorbic acid in urine
6. Estimation of cholesterol
7. Estimation of urea in urine
8. Estimation of creatinine in urine
9. Estimation of nitrogen in urine

PONDICHERRY UNIVERSITY
Department of Food Science and Technology

M.Sc Food Science and Nutrition

Semester	Course Code	Title of the Course	Category	Credits
IV	FS&N571	Project Work	HC	8

FS&N571 **PROJECT WORK** **CREDIT 8**

Students will work on specific project attached to a supervisor and submit a thesis at the end of the semester. The assessment will be based on the midterm evaluation, evaluation of final report and viva-voce examination.