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

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Unit I  
8 HOURS  

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  

Unit V  
9 HOURS  

Text books and Reference materials
UNIT I

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

UNIT II

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

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

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

Text books and reference materials
UNIT I

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

UNIT II

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

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

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

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


5) Sivasankar,B (2005). Food processing and preservation. Prentice - Hall of India


8) Arthey, David . (2005). 2nd ed Fruit processing. Springer,


13) Zeuthen, Peter (2005). Food preservation techniques. Woodhead publishing ltd,


18) Zeuthen, Peter (2005). Food preservation techniques. Woodhead publishing ltd,


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

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

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

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

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- specific use of Tintometer in vanaspathi analysis.

UNIT IV

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

UNIT V

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


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

UNIT - IV
7 HOURS

UNIT - V
7 HOURS
Text books and Reference materials

UNIT- I

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

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

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 allergeniscy of GM foods. Safety of children consumables.

UNIT – IV

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

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
UNIT I 9 HOURS

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

UNIT IV 9 HOURS

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. 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)
5. Tomato processing
6. Fruit pulping / juice / beverage preparation
7. Preparation and standardization of traditional Indian fermented foods
9. Confectionery
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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  

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

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
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**

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
   Publishing Company. IFT Press. USA

   Food Product Development. Taylor and Francis Group, LLC. USA

   Publishing Limited and CRC Press LLC. USA


UNIT -I  
9 HOURS  

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


UNIT-II
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

UNIT-IV
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


Text Books and Reference materials

UNIT I 9 HOURS


UNIT II 9 HOURS


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


UNIT V 8 HOURS

Textbooks

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

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; xylanases 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
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
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<td>FS&amp;N512</td>
<td>Food Packaging</td>
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<td>Food Safety and Quality Control</td>
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UNIT -I 9 HOURS

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

UNIT -V 9 HOURS
Biological synthesis of nanoparticles: Biosynthesis of Nanoparticles: Biomineralization -Microbial Nanoparticle production. Biofunctionalization 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
UNIT I 9 HOURS


UNIT II 9 HOURS


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

5. Ahvenainen, R. (Ed.) 2003 Novel Food Packaging Techniques, CRC Press,
6. Han, J.H. (Ed.) 2005 Innovations in Food Packaging, Elsevier Academic Press,
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


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

8. FSSAI, FSIS, EU and FAO website for updates
UNIT -I
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
Protein and amino acids: Protein degradation, fate of nitrogren (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
Lipids- Metabolism of triacylglycerol, 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
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
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

UNIT I 10 HOURS

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. Interpersonal 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
UNIT V

8 HOURS


Text books and Reference materials


UNIT I
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

UNIT III
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
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
Text books and Reference materials
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

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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.