M.SC. FOOD SCIENCE AND NUTRITION

SYLLABUS & REGULATIONS

2012-13 onwards.
REVISED REGULATION, CURRICULUM AND SYLLABI
(With effect from the academic year 2012 – 2013 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 department of Food Science and Technology was established in 2007. The major objectives of the department is to provide interdisciplinary high quality education in order to deepen their understanding of food science, clinical nutrition and dietetic, food process techniques, product development, food quality control. The department is offering M.Sc. and Ph.D programme in Food Science and Nutrition and Food Science and Technology. The subjects food science and technology have tremendous scope and significance in the national and international scenario. The specialists in food science and nutrition have unlimited job markets in the most innovative and challenging areas like Space nutrition, Therapeutic nutrition, Nutraceutical and Nutrigenomics industries and various other related fields. The specialized in food science and technology have unlimited job potential in food industry, food quality control lab and various other related things.

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. Hospitals, food service institutions and industries
c. Managerial roles in agencies and institutions – both Government and NGO sector
d. Planning, monitoring and evaluation of nutrition and health programmes
e. Training and IEC activities of regional and national programmes
f. Ensuring food safety and quality for consumers
g. Entrepreneurial ventures
h. Advocacy and consultancy
A total of 72 credits have to be taken by the students to complete the programme. If the number of credits exceeds 72, it permissible, but the calculation of the grade point average will be done on the basis of 72 credits only. Internship/On Job Training is an integral part of the programme of study. This can be arranged during the course of study or after the completion of the programme. It can be arranged in one single assignment or two. Total duration of Internship/On Job Training shall be 4 – 6 weeks.

**Eligibility for Admission**

Bachelor’s degree in Food and Nutrition / Food Technology / Food Science and Quality Control / Clinical Nutrition and Dietetics of Composite / General Home Science / Biochemistry / Biotechnology / Chemistry / Microbiology / Agriculture dairy or fisheries or any other allied science subjects under life sciences at B.Sc. level with a minimum of 55% of marks.
# Curriculum - M.Sc Food Science and Nutrition

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# M.Sc Food Science and Nutrition

## Semester I

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UNIT - I 10 hours

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

UNIT - II 9 hours

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

UNIT - III 9 hours

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

UNIT - IV 10 hours

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

UNIT - V 10 hours

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

Text books and Reference materials

UNIT I  9 hours
Importance and significance of microorganisms in food science. Micro-organisms importance in food - Factors affecting the growth of micro organisms in food - Intrinsic and Extrinsic parameters that affect microbial growth.

UNIT II  10 hours
Determination of micro organisms and their products in food: Sampling, sample collection, transport and storage, sample preparation for analysis. Microscopic and culture dependent methods- Direct microscopic observation, culture, enumeration and isolation methods; Chemical and Physical methods-Chenical, immunological and nucleic acid based methods; Culture independent techniques – PCR Based, DGGE, Metagenomics, etc.; Analytical methods for microbial metabolites- microbial toxins and metabolites.

UNIT III  10 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  9 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

Text books and reference materials

UNIT I  9 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  10 hours
Processing and preservation by heat: Blanching, pasteurization, sterilization and UHT processing, canning, extrusion cooking, dielectric heating, microwave heating, baking, roasting and frying. Retort processing of Ready to eat (RTE) products. Drying – water activity, microbial spoilage due to moisture. Dehydration of fruits, vegetables, milk, animal products Newer methods of thermal processing – batch and continuous

UNIT III  9 hours
Processing and preservation by low Temperature – refrigeration, freezing, CA, MA, and dehydro-freezing. Food irradiation, history and mechanism, the electro-magnetic spectrum, forms of radiant energy. Principles of using electromagnetic radiation in food processing, ionizing radiations and non ionizing radiations, advantages and disadvantages. Controlling undesirable changes in food during irradiation.

UNIT IV  10 hours
Processing and preservation by drying, concentration and evaporation: Various methods employed in production of dehydrated commercial products, selection of methods based on characteristics of foods to be produced, advantages and disadvantages of different methods, sun-drying, tray or tunnel drying, spray drying, drum drying, freeze drying, fluidized bed drying. Physical and chemical changes during drying control of chemical changes, desirable and undesirable changes. Packaging and storage of dehydrated products. Ultra-filtration, reverse osmosis, Freeze drying and freeze concentration.

UNIT V  10 hours
Processing and preservation by non-thermal methods: High pressure, pulsed electric field, hurdle technology. GRAS and permissible limits for chemical preservatives and legal aspects for gamma irradiation. Use and application of enzymes and microorganism in processing and preservation of foods; food fermentations, pickling smoking etc; Food additives; Definition, types and functions, permissible limits and safety aspects.

Text books and Reference materials

UNIT - I  
10 hours

UNIT - II  
9 hours
Nutrition during life span – pregnancy, lactation, infancy, preschool age, school going and adolescents, adults and old age.

UNIT - III  
10 hours
Assessment and surveillance of nutritional status in emergency affected populations- Scope for malnutrition assessment, indicators and simple screening methods. Organization for nutritional surveillance. Nutritional relief and rehabilitation-Assessment of food needs, food distribution strategy, targeting food aid, mass and supplementary feeding, special foods/rations for nutritional relief, organization for mass feeding/food distribution, transportation and storage, feeding centers, sanitation and hygiene and public nutrition approach to tackle nutritional and health problems in emergencies, ethical considerations.

UNIT - IV  
9 hours

UNIT - V  
10 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 groups.

Textbooks and Reference materials

UNIT - I  
9 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

Review of the following systems

**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.

**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.

**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.


UNIT - III  
9 hours


UNIT - IV  
9 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
UNIT - V

9 hours

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

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: LD50 and TD50: In vitro and in vitro 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. Algal toxins, bacterial toxins and fungal toxins). Natural occurrence, toxicity and significance. Food poisoning; Mycotoxicoses of 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 allergenesisity of GM foods. Safety of toys and 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 adultration and potential toxicity of food adultrants.

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: nitrosocompounds, heterocyclic amines, Dietary Supplements and Toxicity related to Dose: Common dietary supplements; relevance of the dose; possible toxic effects.

Text Books and Reference material
1. Helferich, W., and Winter, C.K. Food Toxicology CRC Press 2001
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  10 hours

UNIT IV  10 hours

UNIT V  9 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. Determination of boiling point and freezing point of water
2. Estimation of sugars
3. Stages of sugar cookery
4. Estimation of gluten content
5. Estimation of polyphenols
6. Determination of acidity
7. Determination of gelatinization
8. Determination of natural pigments in foods
9. Fat acidity in foods-flour
10. Determination of refractive index of fats
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
10. Visit to food processing and preservation unit.
1. Estimation of moisture content
2. Estimation of soluble and insoluble ash content
3. Estimation of sugars
4. Estimation of fat
5. Estimation of free fatty acids
6. Estimation of Iodine number
7. Estimation of Peroxide value
8. Estimation of protein
9. Estimation of crude fibre
10. Estimation of ascorbic acid
11. Estimation of calcium
12. Estimation of Total Antioxidants
13. Estimation of thiamine
14. Estimation of Riboflavin
15. Estimation of Vitamin A
16. Estimation of β carotene
17. Estimation of cholesterol
18. Estimation of calorific value
PONDICHERRY UNIVERSITY
Department of Food Science and Technology
M.Sc Food Science and Nutrition

Semester II

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FS&N431  RESEARCH METHODOLOGY AND BIOSTATISTICS  CREDIT 3

UNIT I  10 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  9 hours

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

UNIT IV  10 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. MS- excel support for above procedures.

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


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UNIT - II
Energy metabolism Basal and resting metabolism – influencing factors. Methods to determine energy requirements and expenditure. Thermo genesis, adaptation to altered energy intake, latest concepts in energy requirements and RDA-ICMR and WHO

UNIT - III

UNIT - IV

UNIT - V

**Text books and Reference materials**

UNIT I  9 hours
Food needs and consumer preference: market survey and its importance in; designing a questionnaire to find consumer needs for a product or a concept; advantages of processed foods in urbanized modern society; why people buy processed foods. Developing a product to meet the requirements

UNIT II  10 hours
Designing new products new food product development (NPD) process and activities, NPD success factors, new product design, food innovation case studies, market-oriented NPD methodologies, organization for successful NPD; recipe development; use of traditional recipe and modification; recent development in food ingredients/additives flavorings, colourings, emulsifiers, stabilizer and sweeteners; Involvement of consumers, chefs and recipe experts; selection of materials/ingredients for specific purposes; modifications for production on large Scale, cost effectiveness, nutritional needs or uniqueness

UNIT III  10 hours
Standardization & large scale production: process design, equipment needed and design; establishing process parameters for optimum quality; sensory evaluation; lab requirements; different techniques and test; statistical analysis; application in product development and comparison of market samples; stages of the integration of market and sensory analysis.

UNIT IV  9 hours
Quality, safety and regulatory aspects: product stability; evaluation of shelf life; changes in sensory attributes and effects of environmental conditions; accelerated shelf life determination; developing packaging systems for maximum stability and cost effectiveness; interaction of package with food; regulatory aspects; whether standard product and conformation to standards; approval for proprietary product.

UNIT V  10 hours
Advertisement, marketing and case studies; product performance testing; market positioning, marketing; developing test market strategies; various tools and methodologies to evaluate consumer attitudes, preferences and market acceptance factors; case studies of some successes and failures – factors that influence NPD success, innovation case studies to highlight best practice in terms of the integration of technological and marketing approaches to NPD; food choice models and new product trends.
Text books and Reference materials


UNIT -I


UNIT -II

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

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 destruction of active material; stability studies. Recent developments in the isolation, purification and delivery of phytochemicals.

UNIT -IV

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

UNIT -V

Functional foods - Definition, development of functional foods, use of bioactive compounds in appropriate form with protective substances and activators; Effect of environmental condition and food matrix; Effects of processing conditions and storage; Development of biomarkers to indicate efficacy of functional ingredients; Research frontiers in functional foods; delivery of immunomodulators /vaccines through functional foods. Nutrigenomics- concept of personalized medicine. Use of anotechnology in functional food industry.
Text Books and Reference materials


UNIT I  9 hours
Guidelines for dietary planning: Weights and Measures, Determining nutritional needs, Basic Guidelines for diet planning, Nutritional status of Indians, Cultural aspects of dietary planning.

UNIT II  9 hours
Nutritional assessment: Anthropometrics, Laboratory and Biochemical Assessment, Clinical Assessment. Nutritional imbalance and Nutritional screening.

UNIT III  10 hours

UNIT IV  10 hours
Nutrition counseling: Nutritional counseling—concept, recipient and counseling environment, the problem solving counseling method. Activities for behavior changes, intervention counseling models, types of counseling session in patients. Empowerment, interpersonal skills. Nutritional counseling components—planning, implementation and evaluation.

UNIT V  10 hours
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 patient care. Inter personal relationship with patients. Objectives of diet therapy—regular diet and rationale for modifications in energy and other nutrients, texture-fluid, soft diets etc.

Text books and Reference materials

UNIT I 9 hours

UNIT II 10 hours
Fats and Oils: Effect of processing on chemical structure and physical properties- Precursors of aroma compounds. Functional properties of fat and uses in food preparation, inter- esterification of fats. Hydrogenated fat, Lipid- protein complexes, emulsion, fat deterioration and fat substitutes.

UNIT III 9 hours

UNIT IV 10 hours

UNIT V 10 hours

Textbooks
UNIT I  
Food additives – definitions, classification and function, preservatives, antioxidants, colours and flavours, emulsifiers, sequesterants, humectants, hydrocolloids, sweeteners, acidulents, buffering salts, anticaking agents, etc. – chemistry, food uses and functions in formulations, indirect food additives; 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
UNIT -I

UNIT - II
Factors influencing dietary intake: Food habits, food fads and fallacies, their influence on health and wellbeing. Gender and health. Nutritional status: Definition methods to assess nutritional status – (Relevant to maintenance of fitness), specific fitness and health.

UNIT -III

UNIT -IV
Nutrition in sports – Sports specific requirements diet manipulation pre game and post game means, Use of different nutragenic aids and commercial supplements. Sports drinks, Diets for persons with high energy requirements stress, fracture and injury

UNIT 5
Significance of physical fitness and nutrition in prevention and management of weight control diabetes mellitus, CVD, bone health and cancer. Awareness about the alternative systems for health and fitness, like ayurveda, yoga, meditation vegetarianism and traditional diets.

Text books and Reference materials
Product development

1. Permutation combination method
2. Response surface methodology

Evaluation of product

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

Sensory evaluation

5. Selection of panel
6. Threshold test

Collection and analysis of sensory data

7. Statistical analysis
8. Interpretation
9. Reporting
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
### Semester III

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<td>Food Biotechnology</td>
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<td>Food Packaging</td>
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<tr>
<td>FS&amp;N513</td>
<td>Food Safety and Quality Control</td>
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<tr>
<td>FS&amp;N514</td>
<td>Nutritional Biochemistry</td>
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<td>FS&amp;N515</td>
<td>Advanced Nutrition II</td>
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<td>FS&amp;N516</td>
<td>Clinical and Therapeutic Nutrition II</td>
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<td>Minor project and Seminar</td>
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<td>FS&amp;N528</td>
<td>Nutrition in Critical Conditions and Emergencies</td>
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<td>Nutritional Biochemistry lab</td>
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UNIT -I

UNIT -II

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

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

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

Text books and reference materials
UNIT I

9 hours


UNIT II

10 hours


UNIT 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, Edible packaging, Shrink and stretch packaging.

UNIT IV

10 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

10 hours

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

Text Books and Reference materials

3. Ahvenainen, R. (Ed.) 2003 Novel Food Packaging Techniques, CRC Press,
4. Han, J.H. (Ed.) 2005 Innovations in Food Packaging, Elsevier Academic Press,
5. 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 10 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 9 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 11 hours
Food Safety regulations and management systems: National and international food quality regulations, Quality systems- Introduction to the legal system, principles in the general food law, principles of self control, risk analysis on food, international food trade, Codex Alimentarius, traceability, EU-regulations on the hygiene of foodstuffs, and EU-regulations on the official food control. Food quality standard: IPM, GAP, Organic farming, GMP, Standard of food quality and food quality analysis, Environmental risk assessment in food safety aspect, Food hygiene and surveillance system, Standard of food quality and control system, Food industries and quality
assurance in food production, ISO certifications. Indian Food regulations – History of Indian Food Regulations: BIS, ISI, FPO, PFA and FDA. Food Safety and Standards Act 2006

Text books and Reference materials

5. FSSAI, FSIS, EU and FAO website for updates
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 nitrogen (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  
**10 hours**
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  
**9 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  
**10 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


Note: All the nutrients will be dealt with Digestion, absorption and transport and excretion, functions, interaction with other nutrients (if any), RDA, deficiency and toxicity, major sources, Assessment of nutritive and analysis in food material.

UNIT -I __________________________  9 hours

Macro minerals: Calcium, phosphorus magnesium, sodium, potassium, chlorine.

UNIT -II __________________________ 12 hours


UNIT -III __________________________ 9 hours

Fat soluble vitamins: Vitamin A, D, E& K.

UNIT -IV __________________________ 9 hours

Water soluble vitamins: vitamin C, thiamine, riboflavin, niacin, pantothenic acid, biotin, folic acid, vitamin B₁₂, vitamin B₆.

UNIT -V __________________________ 9 hours

Detoxication –Definition, xenobiotics, enzyme systems involved mechanism of detoxification.

Text books and Reference materials

UNIT I  
Enteral and Parenteral nutritional support: Enteral nutrition, parenteral nutritional, Transitional feeding, Nutrition support in long-term and home care.

Disease etiology, Metabolic and clinical complications, Disease process and medical treatment, Biochemical and nutritional issues, nutritional assessment, Diagnostics, lab indices, Dietary history and recalls, Nutrition prescription, Feed, food and fluid issues, Adequacy of nutrition therapy, Efficacy of nutrition therapy, Goals of nutrition therapy, follow ups. (Unit II and Unit II)

UNIT II  
Weight imbalances-overweight and obesity, anorexia nervosa and Bulimia nervosa-cardio vascular disorders-Diabetes mellitus-Type I, II, neurological disorders (Parkinson’s disease, Huntington’s chorea, Amyotrophic lateral sclerosis, multiple sclerosis, myasthenia gravis, Alzheimer’s disease, Wilson’s disease, stroke)

UNIT III  

UNIT IV  

UNIT V  
Recent trends in concepts of medical nutrition therapy: delivery of nutritional care and dietary counseling-nutritional support recent advances in techniques and feeding substrates-management of diet related health disorders-alcohol, drugs, food poisoning, allergy, anorexia etc.

Text books and Reference materials


A minor project work would be modulated for the students for hands-on experience and the findings of the projects would be presented as seminar and report will be submitted.
UNIT – I  
10 hours  
Nutritional screening and nutritional status, assessment of the critically ill. Preparation of nutritional care plan. Nutritional support systems. Monitoring nutrient intake and providing nutrition support service, role of immuno enhancers, conditionally essential nutrients, immune suppressants and special diets. Complications of nutritional support systems including refeeding syndrome, palliative care, rehabilitation diets.

UNIT -II  
10 hours  
Enteral and parental feeding-Basis, principles, designer and commercial feed techniques, applications and limitations.

UNIT -III  
9 hours  
Medical nutrition therapy (including pathophysiological, clinical and metabolic aspects) in the following conditions- Gastro intestinal and cardiovascular complications, renal failure, hepatic failure, cancer, AIDS, general surgery, neuro surgery and fractures.

UNIT -IV  
9 hours  
Medical nutrition therapy (including pathophysiological, clinical and metabolic aspects) in the following conditions: burns, multiple organ failure and other conditions of stress, trauma and sepsis.

UNIT –V  
10 hours  
Nutritional problem in Natural/man made disasters and communicable diseases -Famine, drought, flood, earthquake, cyclone and war. Factors contributing to the rise and development of emergency situations (Use illustrations from Indian case studies.) Diet in communicable diseases-causes, major deficiencies.

References  
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
### Semester IV

<table>
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<td>HC</td>
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The Dissertation work continues in IV Semester. Preparation of Thesis report and Thesis Viva-voce are to be done in IV Semester.