REVISED REGULATION, CURRICULUM AND SYLLABI

(With effect from 2009-2010 onwards)

M.Sc. Food Science and Nutrition

DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

PONDICHERRY UNIVERSITY

R. Venaktaraman Nagar,

Kalapet, Puducherry – 605 014.

PONDICHERRY UNIVERSITY

M.Sc. Food Science and Nutrition

REGULATIONS, CURRICULUM AND SYLLABI

The specialists in Food Science and Nutrition play a vital role in promoting the quality of life of individuals and communities, which contributes significantly to the economic and overall development of the nation. This is achieved through a blend of academics, research training and extension as well as industrial applications. The post graduate programme in this discipline has been designed to provide the students with intensive and extensive theoretical and experiential learning. The programme allows flexibility in the choice of thrust areas, which students can select, based on their career goals. It is envisaged that the current scenario at the regional and national level require trained professionals in areas such as **Nutraceuticals, nutrigenomics, Public Health Nutrition, Clinical and Therapeutic Nutrition, Institutional Food Administration, Food Science, Food Safety, Food Toxicology and Quality Control.** Alternatively a broad-based programme covering several varied aspects in this discipline is also possible.

Aim of the Course

The curriculum integrating several elective 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

Eligibility for Admission

The candidates should have completed 10+2+3 with Food and Nutrition/Food Technology / Food Science and Quality Control / Clinical Nutrition and Dietetics or Composite / General Home Science / Biochemistry / Biotechnology / Zoology / Chemistry / Botany / Microbiology / Agriculture dairy or fisheries or any other allied science subjects under life sciences at B.Sc., level with a minimum of 50% of marks.

Note: 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.

M.Sc Food science and nutrition – Course outline

Semester	Course code	Title of the Course	Category	Credits
I	FSN401	Advanced nutrition I	HC	3
	FSN402	Human physiology	SC	3
	FST401	Food chemistry	HC	3
	FST451	Food chemistry lab	HC	1
	FST402	Food microbiology	HC	3
	FST452	Food microbiology Lab	HC	1
	FST405	Food processing and preservation	HC	3
	FST453	Food processing and preservation lab	HC	1
	FST454	Techniques in food analysis lab	HC	2
II	FSN403	Research methods and statistics	SC	3
	FSN404	Clinical and therapeutic nutrition	HC	3
	FSN451	Clinical and therapeutic nutrition lab	HC	1
	FSN405	Advanced nutrition-II	HC	3
	FSN406	Nutrition and physical fitness*	SC	2
	FST407	Nutrition and biochemistry	HC	3
	FST457	Nutrition and biochemistry lab	HC	1
	FST408	Food product development and quality evaluation	HC	3
	FST458	Food product development and quality evaluation lab	HC	1
	FST411	Nutraceuticals and functional foods	SC	3
	FSN491	Seminar	HC	1
III	FSN501	Food service management	HC	3
	FSN551	Food service management Lab	HC	1
	FSN502	Nutrition in critical conditions and emergencies	HC	3
	FSN552	Nutrition in critical conditions and emergencies lab	HC	1
	FSN503	Public health nutrition	HC	3
	FSN553	Public health nutrition lab	HC	1
	FST501	Food biotechnology	HC	3
	FST502	Food packaging	HC	3
	FST508	Food safety and quality control	HC	2
	FST556	Food safety and quality control Lab	HC	1
	FSN595	Dissertation	HC	3
IV	FSN504	National programmes and policies in nutrition	HC	3
	FSN505	Dietetic techniques and patient counselling	SC	3
	FST509	Environmental issues in food industry	HC	3
	FSN596	Dissertation	HC	5
	FSN555	Internship in food industries	HC	2

* Soft core offered to other departments.

PONDICHERRY UNIVERSITY

Department of Food Science and Technology

M.Sc. Food Science and Nutrition

Semester I

S.No.	Course code	Title of the course	Category	Credits
1.	FSN401	Advanced nutrition I	HC	3
2.	FSN402	Human physiology	SC	3
3.	FST401	Food chemistry	HC	3
4.	FST451	Food chemistry lab	HC	1
5.	FST402	Food microbiology	HC	3
6.	FST452	Food microbiology Lab	HC	1
7.	FST405	Food processing and preservation	HC	3
8.	FST453	Food processing and preservation lab	HC	1
9.	FST454	Techniques in food analysis lab	HC	2

FSN401 ADVANCED NUTRITION – I CREDIT 3

UNIT - I **8 hours**

Basis for computing nutrient requirements - latest concepts in dietary recommendations,: their uses and limitations. Body fluids and water balance - Body water compartments - Regulation of water balance - disorders of water balance - Body composition Methods of study - compositional changes during life cycle - nutritional disorders and their effect body composition.

UNIT - II **6 hours**

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 **8 hours**

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

UNIT - IV **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 and cholesterol, triglycerides in health and disease.

UNIT - V **6 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 – clinical features and biochemical changes. RDA-ICMR and WHO

References

1. Shils, M.E,; Olson, J.-, Shike, M. and Roos, C (1998). Modern Nutrition in Health and Disease, 9" edition Williams and Williams. A Beverly Co. London.
2. Bodwell, C.E.. and Erdman, J.W. (1988) Nutrient Interactions. Marcel Dekker Inc. New York
3. Sareen, S , Jack – James (2005). Advanced Nutrition in Human Metabolism, 4th Edition, Thomson Wordsworth Publication, USA.
4. Indian Council of Medical Research. Nutritive Value of Indian Foods – Latest Publication.
5. Chandra, R.K. (ad) (1992): Nutrition and Immunology, ARTS Biomedical. St. John's Newfoundland.

FSN402 HUMAN PHYSIOLOGY CREDIT 3

UNIT - I **6 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

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 baladder 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.
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.
Musculo-skeletal system: Structure and function of bone, cartilage and connective tissue. Disorders of the skeletal system. Types of muscles structure and function.

UNIT - III **6 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.

UNIT - IV **6 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 **6 hours**

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

References

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.

FST401 FOOD CHEMISTRY CREDIT 3

UNIT - I **8 hours**

Introduction to chemistry of foods: composition and factors affecting the composition of foods, moisture in foods and methods of moisture determination. Flavonoids and tannins. Carbohydrates: occurrence and classification. Principles of structure determination, diagrammatic representation of optical isomers, absolute configurations properties of sugars, sugar derivatives. Caramelisation. Chemistry of fibre fractions and their constituents. Starch enzymes. Properties of starch, Pectic substances, their occurrence, structure, properties and use in foods. Plant acids and their functions.

UNIT - II **8 hours**

Chemistry of amino acids and proteins. Classification of proteins, chemical and physical properties of proteins, structure of proteins and techniques used in elucidation of protein structure. Protein conformation, functional properties of proteins in foods, enzymatic and non enzymatic browning, hydrolysis of proteins, major food proteins and their sources. Changes in proteins during processing.

UNIT - III **8 hours**

Oils and fats their chemistry, occurrence, classification, composition. Physical and chemical properties of fats, rancidity and flavour reversion, oil sources, extraction, refining, hydrogenation and interesterification.

UNIT - IV **6 hours**

Vitamins classification, properties and chemistry,changes during processing. Emulsions: Definition, classification and functional properties. Essential oils, chemistry occurrence and extraction. Terpeneless oils and their use in foods.

UNIT - V **6 hours**

Principles of Colorimetry, spectrophotometry, fluorimetry, atomic absorption spectroscopy and chromatographic methods

References

1. Belitz HD.2005. *Food Chemistry*. Springer Verlag.
2. Owen R. Fennema ,2006,Food Chemistry , Academic Press.
3. Meyer LH. 1987. *Food Chemistry*. CBS.
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.

FST451 FOOD CHEMISTRY LAB CREDIT 1

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

FST402 FOOD MICROBIOLOGY CREDIT 3

UNIT - I **6 hours**

Micro-organisms importance in food - Factors affecting the growth of micro organisms in food - Intrinsic and Extrinsic parameters that affect microbial growth. Role of microbes in fermented foods and genetically modified foods**.**

UNIT - II **8 hours**

Spoilage of different groups of foods: Cereal and cereal products, vegetables and fruits, meat and meat products, eggs and poultry, fish and other sea foods, milk and milk products, canned food.

UNIT -III **8 hours**

Methods of Isolation and detection of micro organisms or their products in food
Conventional methods - Rapid methods (Newer techniques) - Immunological methods: Fluorescent, antibody, Radio immunoassay, principles of ELISA. - Chemical methods, Thermostable nuclear, ATP measurement and PCR (Polymerised chain reactions).

UNIT - IV **6 hours**

Indicators of water and food safety and quality: Microbiological criteria of foods and their Significance. The HACCP system and food safety used in controlling microbiological hazards.

UNIT - V **8 hours**

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

References

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

FST452 FOOD MICROBIOLOGY LAB CREDIT 1

1. Preparation of common laboratory media and special media
2. Staining of Bacteria: 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 air
5. Microbiology of water
6. Microbiology of soil
7. Microbiological analysis of processed food
8. Microbiological analysis of unprocessed food
9. Isolation of specific culture

FST405 FOOD PROCESSING AND PRESERVATION CREDIT 3

UNIT - I **9 hours**

Principles of Fresh Food Storage: Nature of harvested crop, plant and animal; Product storage; Effect of cold storage and quality- storage of grains; Principles of refrigerated gas storage of food- Gas packed refrigerated foods; Sub atmospheric storage; gas atmospheric storage of foods. Principles of freezing of food product, processes and equipment for freezing of fresh and processed foods. IQF of marine products. Frozen and cold storage. Changes during freezing and storage. Microbial aspects of frozen foods.

UNIT - II **9 hours**

Principles of thermal processing of food. Pasteurization, sterilization and canning. Spoilage of canned foods, storage of canned foods; Influence of canning on the quality of food; improvement in canning technology. Calculation of process time temperature-schedules. Retort processing of Ready to eat (RTE) products.Drying – Water activity, microbial spoilage due to moisture. Dehydration of fruits, vegetables, milk, animal products etc. Types of dryers. Osmotic dehydration.
Newer methods of thermal processing- batch and continuous; application of infra-red microwaves; ohmic heating.Intermediate moisture foods.

UNIT - III **6 hours**

Preservation by Concentration of liquid foods :Control of water activity; preservation by concentration; reverse osmosis and membrane filtration with reference to fruit juice and milk. Freeze drying and freeze concentration.

UNIT - IV **6 hours**

Other non-thermal methods, **c**hemical preservatives, irradiation, high hydrostatic pressure, smoking. Application of Hurdle technology and minimal processing. GRAS and permissible limits for chemical preservatives and legal aspects for gamma irradiation.

UNIT - V **6 hours**

Use of enzymes and microorganisms in processing and preservation of foods. Lactic acid fermentation, alcoholic fermentation, pickling, smoking.

References

1. Arsdel WB, Copley MJ & Morgan AI. 1973. *Food Dehydration*. 2nd Ed. Vols. I, II. AVI Publ.
2. Desrosier NW & James N.1977. *Technology of Food Preservation*. 4th Ed. AVI. Publ.
3. Fellows PJ. 2005. *Food Processing Technology: Principle and Practice*. 2nd Ed. CRC.
4. Jelen P. 1985. *Introduction to Food Processing*. Prentice Hall.

FST453	FOOD PROCESSING AND PRESERVATION LAB	CREDIT 1

1. Blanching and browning control
2. Preparation of fruit preserves (jam, jelly).
3. Preparation of vegetable preserves (pickle)
4. Dehydrated products – vegetables dices tray drying, osmotic dehydration of seasonal fruit.
5. Tomato processing
6. Fruit pulping / juice / beverage preparation
7. Preparation and standardization of traditional Indian fermented food (idli udid and rice, dhokla – horse gram, dahi – milk) --- lactic acid fermentations. – solid state – rise in batter, softness on cooking, weight gain / loss – bulk density)
8. Bread making - texture.
9. Confectionery
10. Visit to food processing and preservation unit.

FST454 TECHNIQUES IN FOOD ANALYSIS LAB CREDIT 2

1. Estimation of calorific value of food
2. Estimation of moisture content
3. Estimation of ash content
4. Estimation of protein
5. Estimation of fat
6. Estimation of crude fibre
7. Estimation of Dietary fiber
8. Estimation of Calcium
9. Estimation of Phosphorus
10. Estimation of iron
11. Estimation of Vitamin C
12. Estimation of Thiamine
13. Estimation of Riboflavin
14. Estimation of Vitamin A and β carotene
15. Estimation of cholesterol
16. Estimation of antioxidants
17. Estimation of sugars
18. Estimation of iodine number
19. Estimation of saponification number

PONDICHERRY UNIVERSITY

Department of Food Science and Technology

M.Sc. Food Science and Nutrition

Semester II

S. No.	Course code	Title of the Course	Category	Credits
1	FSN403	Research methods and statistics	SC	3
2	FSN404	Clinical and therapeutic nutrition	HC	3
3	FSN451	Clinical and therapeutic nutrition lab	HC	1
4	FSN405	Advanced nutrition-II	HC	3
5	FSN406	Nutrition and physical fitness*	SC	2
6	FST407	Nutrition and biochemistry	HC	3
7	FST457	Nutrition and biochemistry lab	HC	1
8	FST408	Food product development and quality evaluation	HC	3
9	FST458	Food product development and quality evaluation lab	HC	1
10	FST411	Nutraceuticals and functional foods	SC	3
11	FSN491	Seminar	HC	1

*Soft core offered to other departments.

FSN403 RESEARCH METHODS AND STATISTICS — CREDIT 2

UNIT -I **4 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 **5 hours**

Research design: Meaning and needs, Features of a good design, important concepts relating to research design, variables, experimental and control groups. Different research designs exploratory, descriptive and diagnostic, Hypothesis testing research. Sampling design – Population and sample, Steps in sampling design, Criteria for selecting a sampling procedure, Different types of sampling techniques – probability sampling and non-probability sampling. Methods of data collection – Schedules and questionnaires; Interview, Case study, Home visits, scaling methods, Reliability and validity of measuring instruments

UNIT -III **6 hours**

Analysis of data : Graphical and diagrammatic presentation, Measures of central tendencies (Mean, median and mode), Measure of dispersion (Range, Mean deviation and standard deviation) and their relative measures- Qualitative methods of data analysis. Concepts and characteristics of a normal probability curve. Simple linear correlation and Regression Analysis - chi – squire test for comparing variance. Analysis of variance, Co variances and Multivariate techniques: Concept of ANOVA, one – way and Two – way ANOVA- analysis of Co-variance, Uses of computers in statistical analysis: The computer system and technology, important characteristics of computer applications in research.

UNIT -IV **5 hours**

Interpretation: Meaning of interpretation, Technique of interpretation, Precaution in interpretation – Interpretation of tables and figures. Scientific Writing: Significance of report writing, Different steps in writing report- Introduction, Review of literature, Methods, Results and discussion, Summary and abstract, References Ask questions related to: content, continuity, clarity, validity internal consistency and objectivity during writing each of the above parts. Mechanics of writing reports - Drafting titles, Sub titles, tables, illustrations. Types of reports – Thesis, Article, Abstract, Project, Synopsis Precautions to be taken while writing research reports.

UNIT -V **4 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

References

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

FSN404 CLINICAL AND THERAPEUTIC NUTRITION — CREDIT 3

UNIT -I **6 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. Enteral and parenteral feeding – Formulations – Commercial supplements and hospital based methods of administration and monitoring. Correction of fluid balance.

UNIT -II **12 hours**

Etiology, metabolic and clinical complications, prevention and recent advances in the medical nutritional management on: Weight imbalances – over weight and obesity – Cardio vascular disorders – Diabetes mellitus – GI Tract Disorders – Liver and gall bladder, Pancreatic disorders – Renal disorders –Gout – Cancer – Neurological disorders (Parkinson's disease, Huntington's chorea, Amyotrophic lateral sclerosis, Multiple sclerosis, Myasthenia Gravis, Alzheimer's disease, Wilson's disease, stroke) – Musculo-skeletal disorders (Rheumatoid Arthritis, Osteoarthritis, Osteoporosis) – Immuno-deficiency disorders- Genetic disorders- Infections and AIDS – Respiratory problems – In born errors of metabolism.

UNIT -III **6 hours**

Development of nutritional care plan- Identification of high risk patients - Assessment of patient needs based on interpretation of patient data - Assessment Components- dietary, clinical, biological, somatic, behaviour methods - Data analysis and interpretation. Medical records-types and uses.

UNIT -IV **6 hours**

Nutritional Counselling**:** Nutritional counselling – concept, recipient and counselling environment, the problem solving counselling method. Nutrition counselling strategies-verbal and non-verbal communication, counselling models, empowerment, interpersonal skills. Nutritional counselling components-planning, implementation and evaluation.

UNIT -V **6 hours**

Recent trends in concepts of medical nutrition therapy: Delivery of nutritional care and dietary counselling – Nutritional support Recent advances in techniques and feeding substrates – management of diet related health disorders- alcohol, drugs, food poisoning, allergy, anorexia etc.

References

1. Mahan, L.K. and Escott-Stump, S. (2000): Krause's Food Nutrition and Diet-Therapy, 10th Edition, W-13 Saunders Ltd.
2. Shills, M.E., Olson, J.A, Shike, M and Ross, A.C. (1999): Modern Nutrition in Health and Disease, 9th Edition, A. vaiiiams and Willdns..
3. Williams, S.R. (1993): Nutrition and Diet Therapy, 7th Edition, Times Mirror/Mosby Collage Publishing.

FSN 451 **CLINICAL AND THERAPEUTIC NUTRITION LAB** **CREDIT 1**

1. Planning and preparation of rehabilitation diets
2. Planning and preparation of diet for obesity and under weight conditions
3. Planning and preparation of diet for insulin and non insulin dependent diabetes mellitus
4. Planning and preparation of diet for gastrointestinal disorders
5. Planning and preparation of diet for cardiovascular disorders
6. Planning and preparation of diet for hepatic disorders
7. Planning and preparation of diet for pancreatic disorders
8. Planning and preparation of diet for renal disorders
9. Preparation of diet counseling aids for common disorders.

FSN405 ADVANCED NUTRITION – II CREDIT 3

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 nutriture and analysis in food material.

UNIT -I **6 hours**

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

UNIT -II **10 hours**

Micro minerals: Iron, zinc, copper, selenium, chromium, iodine, manganese, Molybdenum and fluoride. Ultra trace minerals: arsenic, boron, nickel, silicon, vanadium and cobalt.

UNIT -III **6 hours**

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

UNIT -IV **8 hours**

Water soluble vitamins**:** vitamin C, thiamine, riboflavin, niacin, pantothenic acid, biotin, folic acid, vitamin B_{12}, vitamin B_{6}.

UNIT -V **6 hours**

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

References

1. Shils, M.E.; Olson, J. Shike, M. and Roos, C (1998). Modern Nutrition in Health and Disease, 9th edition Williams and Williams. A Beverly Co. London.
2. Bodwell, C.E.. and Erdman, J.W. (1988) Nutrient Interactions. Marcel Dekker Inc. New York
3. Sareen, S , Jack – James (2005). Advanced Nutrition in Human Metabolism, 4th Edition, Thomson Wordsworth Publication, USA.

FSN 406 NUTRITION AND PHYSICAL FITNESS CREDIT 2

UNIT -I **6 hours**

Basic Nutrition – Relation between foods and nutrition Nutrients. Macro nutrients-their functions, food sources digestion, absorption Deficiency symptoms and toxicity. Micro nutrients functions, food sources digestions and absorption, deficiency and toxicity. Non nutrient components of foods and their association to health. Fluid balance – Water compartments in human body, fluid regulation water intake in different conditions, dehydration and water intoxication. Recommended dietary allowances and balanced diet.

UNIT - II **4 hours**

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 **5 hours**

Approaches to the management of fitness and health.

a. Diet and exercise – Effect of specific nutrients on work performance and physical fitness.
b. Fuel and other nutrients that support physical activity (metabolic pathways) Mobilization of fuel stores during exercise. Importance of carbohydrate loads.
c. Nutrition, exercise, physical fitness and health – their inter relation ship.

UNIT -IV **4 hours**

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 **5 hours**

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.

References

1. Mahan, L.K. & Ecott-Stump, S. (2000): Krause's Food, Nutrition and Diet Therapy, 10th Edition, W.B. Saunders Ltd.
2. Sizer, F & Whitney, E. (2000): Nutrition – Concepts and Controversies, 8th Edition, Wadsworth Thomson Learning.
3. Whitney, E.N. & Rolfes, S.R. (1999): Understanding Nutrition, 8th Edition, WestWadsworth, An International Thomson Publishing Co.
4. Ira Wolinsky (Ed) (1998): Nutrition in Exercise and Sports, 3rd Edition, CRC Press
5. Parizkova, J. Nutrition, physical activity and health in early life, Ed. Wolinsky, I. CRC Press.
6. Shils, M.E., Olson, J.A. Shike, N and Ross, A.C. (Ed) (1999): Modern Nutirtion in Health and Disease,9th Edition, Williams & Wilkins.
7. McArdle, W. Katch, G. and Katch, V. (1996) Exercise Physiology, Energy, Nutrition and Human Performance, 4th Edition, Williams and Wilkins, Philadelphia.

FST407 NUTRITION AND 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 **8 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 **6 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 **6hours**

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 **6 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.

References

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), 3rd ed. Micro-Analysis in Medical Biochemistry. J. and Chuchill Ltd.

FST 457 NUTRITION AND BIOCHEMISTRY LAB CREDIT 1

1. Estimation of blood and urine glucose
2. Haematological analysis
3. Estimation of serum albumin and globulin
4. Estimation of serum retinol
5. Estimation of serum ferritin
6. Estimation of lipid profile
7. Estimation of urea.
8. Estimation of creatinine.
9. Estimation of immunoglobulin

FST408 FOOD PRODUCT DEVELOPMENT AND QUALITY EVALUATION — CREDIT 3

UNIT-I **8 hours**

Method of Food Product Development, product design, food innovation case studies, Recipe development; advance technological applications for traditional recipe recent development in food ingredients/additives, flavorings, colourings, emulsifiers, stabilizer and sweeteners. Selection of materials / ingredients for specific purposes; modifications for production on large scale, cost effectiveness, nutritional needs or uniqueness; use of novel food ingredients and novel processing technologies.

UNIT -II **8 hours**

Stability of products; evaluation of shelf life; changes in quality attributes- sensory nutritional technological, microbial , statistical and packaging. Food regulation Act .

UNIT -III **8 hours**

Food sampling method: Sampling and sample preparation: samplers, storage materials, preservatives, product analysis.

UNIT -IV **6hours**

Introduction to sensory evaluation - Types of sensory tests: Detection, threshold and dilution tests – different tests for sensory evaluation – discrimination, descriptive, affective; flavour profile and tests – ranking tests – methods of sensory evaluation of different food products. Sensory and instrumental methods.

UNIT -V **6 hours**

Selection of sensory panelists –general testing conditions - factors influencing sensory measurements – sensory quality parameters – size and shape, texture, aroma, taste, colour and gloss; designing of questionnaire and/or evaluation scorecard; consumer acceptability using sensory evaluation.

References

1. Lyon, D.H.; Francombe, M.A.; Hasdell, T.A.; Lawson, K. (eds) (1992): Guidelines for Sensory Analysis in Food Products Development and Quality Control. Chepman and Hall, London.
2. Lawless, H.T. and Klein, B.P. (1991): Sensory Science Theory and Applications in Foods. Marcel Dekker Inc. New York.
3. Piggott, J.R. (ed) (1988): Sensory Analysis of Foods. Elservier Applied Science, London.
4. Ranganna

FST458 FOOD PRODUCT DEVELOPMENT AND QUALITY EVALUATION LAB — CREDIT 1

Product development

1. Permutation combination method
2. Response surface methodogy

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

FST 411 NUTRACEUTICALS AND FUNCTIONAL FOODS CREDIT 3

UNIT -I **4 hours**

Nutraceuticals and phytochemicals: definition. Traditional health sciences including Ayurveda,Unani and Chinese. Nutraceuticals in controlling diseases.

UNIT -II **8 hours**

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

UNIT -III **8 hours**

Prebiotics and probiotics: Usefulness of probiotics and prebiotics in gastro intestinal health and other benefits. Beneficiary microbes; prebiotic ingredients in foods; types of prebiotics and their effects on gut microbes.

UNIT -IV **8 hours**

Isolation of photochemical 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.

UNIT -V **8 hours**

Definition, development of functional foods, use of bioactive compound in appropriate form with protective substances and activators; Effect of environmental condition in 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 in functional foods.

Reference

1. Brigelius-Flohé, J & Joost *HG. 2006. Nutritional* Genomics: Impact on Health and Disease. Wiley VCH.
2. Cupp J & Tracy TS. 2003. *Dietary Supplements: Toxicology and Clinical Pharmacology*. Humana Press.
3. Gibson GR & William CM. 2000. *Functional Foods - Concept to Product.*
4. Goldberg I. 1994. *Functional Foods: Designer Foods, Pharma Foods*.
5. Losso JN. 2007. *Angi-angiogenic Functional and Medicinal Foods*. CRC Press.

FSN491 **SEMINAR** **CREDIT 1**

Seminar on any Topic related to Food Science/Nutrition/Dietetics.

Note:

Internal evaluation only	-	50 Marks
Duration of Seminar	-	20 minutes

PONDICHERRY UNIVERSITY

Department of Food Science and Technology

M.Sc. Food Science and Nutrition

Semester III

S. No.	Course code	Title of the Course	Category	Credits
1	FSN501	Food service management	HC	3
2	FSN551	Food service management Lab	HC	1
3	FSN502	Nutrition in critical conditions and emergencies	HC	3
4	FSN552	Nutrition in critical conditions and emergencies lab	HC	1
5	FSN503	Public health nutrition	HC	3
6	FSN553	Public health nutrition lab	HC	1
7	FST501	Food biotechnology	HC	3
8	FST502	Food packaging	HC	3
9	FST508	Food safety and quality control	HC	2
10	FST556	Food safety and quality control Lab	HC	1
11	FSN595	Dissertation	HC	3

FSN501 FOOD SERVICE MANAGEMENT CREDIT 3

UNIT -I **6 hours**

Definition and importance, various types of commercial and non- commercial food service institutions. Theories and approaches to food service management.

UNIT -II **6 hours**

Menu planning: writing menus, types of menu, menu display. Food production: production system, process, large quantity cooking techniques.

UNIT -III **10 hours**

Managerial roles and responsibilities, managerial styles and leadership quality. Tools of management – organization chart, types, structure, function, work improvement techniques. Management of resources: personnel management - material management - financial management –time and energy – physical layout and equipment

UNIT -IV **8 hours**

Hygiene and sanitation in preparation and serving area – personal hygiene, types and sources of contamination, prevention and safety measures. Methods of controlling infestation Methods of dish washing. Quality assurance - Food quality - Total Quality Management

UNIT -V **6 hours**

Marketing and Sales management - Marketing Strategies - Sales analysis - Market promotion

References

1. West, B Bessie & Wood, Levelle (1988) Food Service in Institutions 6th Edition. Revised by Harger FV, Shuggart SG&Palgne-Palacio June Macmillian Publication company New York.
2. Sethi Mohini (1993) Catering Management An integrated Approach 2nd Edition Wiley Publication.
3. Desseler, Gary (1987) Personnel Management Modern Concepts and Techniques, Prentice Hall New Jersey.
4. Desseler, Gary (1987) Personnel Management Modern Concepts and Techniques, Prentice Hall New Jersey.
5. Kumar, H.L. (1986): Personnel Management in Hotel and Catering Industries,
6. Keiser, J. & Kalio, E. (1974): Controlling and Analysis of Cost in Food Service Operations Wiley and Sons New York.

FSN551 FOOD SERVICE MANAGEMENT LAB CREDIT 1

1. Allocation of Managerial roles and responsibilities to individual students
2. Menu planning for conducting various cuisines
3. Selection, buying and storage of ingredients
4. Standardization of recipes for various cuisines
5. Scaling upto 10 portions
6. Budgeting and pricing of prepared food products.
7. Maintenance of storage and kitchen records
8. Planning of layout design for conducting various cuisines
9. Sales analysis and suggestions for future improvement.

FSN502 NUTRITION IN CRITICAL CONDITIONS AND EMERGENCIES — CREDIT 3

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, immuno suppressants and special diets. Complications of nutritional support systems including re-feeding syndrome, palliative care, rehabilitation diets.

UNIT -II **8 hours**

Enteral and parental feeding-Basis, principles, designer and commercial feeds, techniques, applications and limitations.

UNIT -III **8 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 **4 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 **6 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

1. Goyet, fish.. V.; Seaman, J. and Geijer, u-(1978): The Management of Nutritional Emergencies in Large Populations, World Health Organisation, Geneva
2. Refugee Nutrition Information System (ANIS): Newsletters UN ACCISCN Sub-committee on Nutrition.
3. Field Exchange, Newsletters by Emergency Nutrition Network, Dept. of Community Health and General Practice, Ireland.

FSN 552 NUTRITION IN CRITICAL CONDITIONS AND EMERGENCIES LAB **CREDIT 1**

Internship in hospitals for 10 – 15 days and submission of a report for evaluation

FSN503 PUBLIC HEALTH NUTRITION CREDIT 3

UNIT -I **7 hours**

Concept of public nutrition - Relationship between health and nutrition, role of public nutritionists in the health care delivery system. Population dynamics - Demographic transition, population structure, population policy, fertility behaviour, , nutrition and quality of life inter-relationship. Nutritional status -methods for assessing nutritional status – Indirect methods – demography, population dynamics and vital events and their health implications, indicators of health an nutrition (IMR, TMR, MMR) - Direct – anthropometry, biochemical, clinical, dietary and functional methods of assessments.

UNIT -II **6 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 **6 hours**

Approaches and strategies for improving nutritional status and health - Programmatic options – their advantages and demerits. Intervention Programmes – Health based interventions, Food –based interventions including fortification and genetic improvement of foods, supplementary feeding. Malnutrition and Health economics - Its impact on productivity and national development. Cost management.

UNIT -V **7 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 - Intervention Programmes – Health based interventions, Food –based interventions including fortification and genetic improvement of foods, supplementary feeding- Different Media, their characteristics and use- IEC for different target groups.

Reference

1. Owen, A.Y. and Frackle, R.T., (1996): Nutrition in the Community. The Art of Delivering Services, 2nd Edition Times Mirror/Mosby.
2. Part, K. (2000): Part's Textbook of Preventive and Social Medicine, 18th Edition, M/s. Banarasidas Bhanot, Jablpur.
3. Beaton, G.H. and Bengoa, J.M. (Eds) (1996): Textbook of Human Nutrition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Bamji, M.S., Rao, P.N., Reddy, V (Eds) (1996): Textbook of Human Nutrition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

FSN 553 PUBLIC HEALTH NUTRITION LAB CREDIT 1

1. Planning and conducting diet survey in
    a. Rural/urban area different age groups and socio economic status may be included.
    b. Planning and organizing nutrition education programs in the community.
    c. Processing of the data-data entry using statistical package and formulation of tables. Application of statistical methods if any.
    d. Interpretation of results and preparation of reports using different graphical and tabular presentation.

2.Development of a plan for nutrition intervention project in the community (The target group (s) needs to be specified). Development of low cost nutritive recipes suitable for various vulnerable groups at micro, and macro levels.

Submission of report for evaluation

FST501 FOOD BIOTECHNOLOGY CREDIT-3

UNIT -I **8 hours**

Traditional applications of food biotechnology - Fermented foods: eg dairy products, oriental fermentations, alcoholic beverages, and food ingredients. The role of biotechnology in fermented food products (dairy, meat, vegetable). Starter culture development, process development. · Enzymes in the dairy industry: cheese making and whey processing, impact of enzyme technology. · Enzymic processing of fruit juices. Role of enzymes in baking, meat and meat processing.

UNIT -II **6 hours**

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

UNIT -III **6 hours**

Cell and tissue culture, Micro-propagation. Nutrogenomics and nutraceuticals. Pre and probiotics.

UNIT -IV **8 hours**

Genetic engineering in microbial cell. Concept of molecular cloning. Plant and animal culture, transgenic plants, application of genetic enginerring.Biological role of DNA in cell metabolism, molecular genetics – fundaments of molecular biology with special reference to chemistry and biology and DNA(primary , secondary and tertiary) structure. Application to produce genetically modified foods.

UNIT -V **8 hours**

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

References:

1. Bains W.1993.Biotechnology from A to Z. Oxford Unuiv.Press.
2. Joshi VK and Pandey A. 1999.Biotechnology: Food Fermentaion. Vols.I,II.Education Publ.
3. Knorr D.1982.Food Biotechnology.Marcel Dekker.
4. Lee BH.1996. Fundamentals of Food Biotechnology.VCH.
5. Perlman D.1977-1979. Annual Reports of Fermentation Processes.
6. Percott SC and Dunn CG.1959.Industrial Microbiology.McGraw Hill.
7. Ward. OP.1989.Fermentaion Biotechnology.Prentice Hall.

FST 502 FOOD PACKAGING CREDIT-3

UNIT -I **8 hours**

Introduction to packaging. Packaging Media & Materials : Primary packaging media , Properties and application manufacturing and applications of textiles and wood, paper and paperboard, metal, glass, plastics; combined package systems; Identification methods used for plastic food packaging materials; Shaping and manufacturing processes used for the production of moulded plastic food containers; Edible films and coatings used in the food packaging industry; Labels, caps and closures and adhesives, inks and lacquers, cushioning materials, reinforcements.

UNIT -II **8 hours**

Packaging systems and methods : Vacuum packaging, gas flush packaging, Tamper-evident packaging; aseptic packaging; modified atmosphere packaging (MAP), Controlled atmosphere packaging (CAP) & aseptic & retort pouch technology, box in box; microwave packaging; active packaging; bio-degradable packages, edible packages; Use of smart packaging by the food industry; Use of sensor technology within the food packaging industry; Industrial packaging: unitizing, palletizing, containerizing, stacking and materials handling; distribution systems for packaged foods including prevention of shock damage to articles during transportation; Rigid and semi-rigid containers; flexible containers; form-fill-seal systems; Testing & evaluation of packaging media – retail packs & transport packages.

UNIT -III **8 hours**

Packaging Fresh and Processed Food : Packaging requirements for different foods and processing methods- General classification and packaging types, varieties and trends; Protective packaging of foods; packaging of food products sensitive to oxygen, light, moisture; special problems in canned foods; packaging of convenience foods; Packaging of Food products-; fruits and vegetables; packaging requirements of fresh fruits and vegetables; packaging of fruit juices; fats and oils; packaging of spices; packaging of meat and poultry; packaging and transportation of fish and other sea-foods; criteria for selection of proper packaging based on the shelf life desired; diary products; beverage products; cakes and snack foods; different packaging requirements for thermal- processed, dehydrated, frozen, irradiated and other specially processed foods.

UNIT -IV **6 Hours**

Status of current packaging; critical review of the existing knowledge in packaging of products. Special needs: Packaging for gamma irradiation, packaging for HHP processing. Active packaging. Edible packaging. Recent developments in packaging.

UNIT -V **6 hours**

Packaging Design & Environmental Issues in Packaging : Food marketing and role of packaging- Packaging aesthetic and graphic design; Coding and marking including bar coding; Consumer attitudes to food packaging materials; Packaging – Laws and regulations, safety aspects of packaging materials; sources of toxic materials and migration of toxins into

food materials; Packaging material residues in food products; Environmental & Economic issues, recycling and waste disposal.

References

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

FST508 FOOD SAFETY AND QUALITY CONTROL CREDIT 3

UNIT -I **4 hours**

Hazards – microbiological, nutritional, environmental, natural toxicants, pesticide residues and food additives.

UNIT -II **6 hours**

Sanitary and hygienic practices; HACCP; Quality manuals, documentation and audits; Indian and international quality systems and standards like ISO and Food Codcex; export, import policy, export documentation, laboratory quality procedures and assessment of laboratory performance; applications in different food industries; food adulteration and food safety. IPR and patent.

UNIT -III **8hours**

Introduction to quality control and quality assurance. Food safety measures. Current concepts of quality control.

UNIT -IV **10hours**

Quality assurance programme: Quality plan, documentation of records, product standards product and purchase specifications, process control, hygiene and housekeeping, corrective action.

UNIT -V **8 hours**

Concepts of quality management: objectives, importance and functions of quality control; quality management systems in India; sampling procedures and plans; Food safety and Standards Act 2006; domestic regulations; global food safety initiative; various organization dealing with inspections, traceability and authentication, certification and quality assurance (PFA,FPO,MMPO,MPO,AGMARK,BIS), labeling issues, international scenario , international food standards.

References

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

FST 556 **FOOD SAFETY AND QUALITY CONTROL LAB** **CREDIT-1**

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

FSN595 DISSERTATION CREDIT 3

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

Department of Food Science and Technology

M.Sc. Food Science and Nutrition

Semester IV

S.No.	Course code	Title of the Course	Category	Credits
1.	FSN504	National programmes and policies in nutrition	HC	3
2.	FSN505	Dietetic techniques and patient counselling	SC	3
3.	FST509	Environmental issues in food industry	HC	3
4.	FSN596	Dissertation	HC	5
5.	FSN555	Internship in food industries	HC	2

FSN504 NATIONAL PROGRAMMES AND POLICIES IN NUTRITION CREDITS 3

UNIT -I **8 hours**

Global, national and regional nutritional concerns-situations of vulnerable group, Food , nutrition and health security.

UNIT -II **6 hours**

Currently major nutrition supplementation programs in India : Integrated Child Development Services Scheme (ICDS), Mid-day meal Programs (MDM), Special Nutrition Programs (SNP), Wheat Based Nutrition Programs (WNP); Applied Nutrition Programs (ANP); Balwadi Nutrition Programs (BNP); National Nutritional Anaemia Prophylaxis Program (NNAPP); National Program for Prevention of Blindness due to Vitamin A Deficiency; and National Goiter Control Program (NGCP).

UNIT -III **8 hours**

National nutrition policies: need for nutrition policy, current nutritional status and five year plan, nutrition and national development, vital statistics.Existing policy instrument: direct and indirect, PDS, and reforms , health and family welfare, nutritional surveillance, appraisal of the programmes: merits, demerits, objectives and goals.

UNIT -IV **6 hours**

Scaling up of the programme: centralization and decentralization, finance management, administration and monitoring and implementation.

UNIT -V **8 hours**

Management Information System: State and central Government regulations, budget, continuous process improvement, clinical assessment, nutritional education and community.

Reference

1. Owen, A.Y. and Frackle, R.T., (1996): Nutrition in the Community. The Art of Delivering Services, 2nd Edition Times Mirror/Mosby.
2. Part, K. (2000): Part's Textbook of Preventive and Social Medicine, 18th Edition, M/s. Banarasidas Bhanot, Jablpur.
3. Beaton, G.H. and Bengoa, J.M. (Eds) (1996): Textbook of Human Nutrition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Bamji, M.S., Rao, P.N., Reddy, V (Eds) (1996): Textbook of Human Nutrition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

FSN 505 DIETETIC TECHNIQUES AND PATIENT COUNSELLING CREDIT 3

UNIT -I **6 hours**

Dietician as part of the medical team and out reach services. Role of dietician .Essential qualities

UNIT -II **8 hours**

Medical history , assessment techniques for obtaining relevant information from patients profile.

UNIT -III **8 hours**

Dietary diagnosis and tests for nutritional status –correlating clinical and dietary information.

UNIT -IV **7 hours**

Patient counseling – Assessment of patient needs, establishing rapport and counseling relationship, resources and aids to counseling relationship, resources and aids to counseling.

UNIT -V **7 hours**

Aesthetic attributes- Nutritional significance of diet for different clinical conditions. Follow visit and patients education.

Reference:

1. Goyet, fish.. V.; Seaman, J. and Geijer, u-(1978): The Management of Nutritional Emergencies in Large Populations, World Health Organisation, Geneva
2. Refugee Nutrition Information System (ANIS): Newsletters UN ACCISCN Sub-committee on Nutrition.
3. Field Exchange, Newsletters by Emergency Nutrition Network, Dept. of Community Health and General Practice, Ireland.

FST509 **ENVIRONMENTAL ISSUES IN FOOD INDUSTRY** **CREDIT 3**

UNIT -I **7 hours**

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

UNIT -II **6 hours**

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

UNIT -III **7 hours**

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

UNIT -IV **6 hours**

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

UNIT -V **10 hours**

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

Reference

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

FSN596 DISSERTATION CREDIT 5

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

FSN555 INTERNSHIP IN FOOD INDUSTRIES CREDIT 2

1. 10-15 days on job training in different departments of a food processing industry. Preparation and presentation of report for evaluation.