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**THE AMERICAN COLLEGE, MADURAI**

*(An Autonomous Institution Affiliated to Madurai Kamaraj University)*
**Re-accredited (2nd cycle) with Grade 'A' CGPA 3.46 on a 4 point scale**

**Department of Food Science & Nutrition**

# M.Sc. FOOD SCIENCE & NUTRITION

Program Course descriptions & Syllabi

(2021 - 2022 onwards)

**Board of Studies Meeting**

**July 2021**

**DEPARTMENT OF FOOD SCIENCE & NUTRITION**

**Choice Based Credit System**

**Program for M.Sc. – Food Science & Nutrition (2021 - 2022 onwards)**

**POSTGRADUATE DEPARTMENT OF FOOD SCIENCE & NUTRITION**

**(w.e.f. 2021-2022)**

| Semester | Course Code | Course Title | Hours | Credits | Marks |
|---|---|---|---|---|---|
| I | PFN 4401 | Advanced Food Science | 5+1 | 4 | 80 |
| | PFN 4403 | Food Chemistry | 5+1 | 4 | 80 |
| | PFN 4305 | Applied Physiology | 4+1 | 3 | 60 |
| | PFN 4407 | Advanced Food Microbiology | 5+1 | 4 | 80 |
| | PFN 4309 | Lab in Advanced Food Science | 3 | 3 | 60 |
| | XXX 0000 | Elective | 4 | 3 | 60 |
| | | **Total** | **30** | **21** | **420** |
| II | PFN 4402 | Nutrition Through Life Cycle | 5+1 | 4 | 80 |
| | PFN 4404 | Advanced Nutritional Biochemistry | 5+1 | 4 | 80 |
| | PFN 4406 | Food Investigation Techniques | 5+1 | 4 | 80 |
| | PFN 4308 | Research Methodology and Biostatistics | 4+1 | 3 | 60 |
| | PFN 4310 | Lab in Food Analysis | 3 | 3 | 60 |
| | XXX0000 | Elective | 4 | 3 | 60 |
| | | **Total** | **30** | **21** | **420** |
| | | Summer Internship | | | |
| III | PFN 5501 | Drug- Nutrient Interactions | 5+1 | 5 | 100 |
| | PFN 5503 | Food Packaging | 5+1 | 5 | 100 |
| | PFN 5405 | Functional Foods and Nutraceuticals | 5+1 | 4 | 80 |
| | PFN 5407 | Food Biotechnology | 5+1 | 4 | 80 |
| | PFN 5309 | Lab in Food Biotechnology | 3 | 3 | 60 |
| | PFN 5311 | Lab in Food Microbiology | 3 | 3 | 60 |
| | | **Total** | **30** | **24** | **480** |
| IV | PFN 5504 | Clinical Nutrition and Diet Therapy | 5+1 | 5 | 100 |
| | PFN 5302 | Lab in Clinical Nutrition and Diet Therapy | 4 | 3 | 60 |
| | PFN 5304 | Food Processing and Preservation | 4 | 3 | 60 |
| | PFN 5506 | Industrial visit and Report | 5+1 | 5 | 100 |
| | PFN 5810 | Project | 10 | 8 | 160 |
| | | **Total** | **30** | **24** | **480** |

**Courses offered by the Department of Food sciences to Non-Major Students:**

**Elective Courses**

| SEM | Course No. | Course Title | Hrs. | Cr | Marks |
|---|---|---|---|---|---|
| I | PFN 4311 | Exercise and Sports Nutrition | 4 | 3 | 60 |
| | PFN 4313 | Food Service Management | 4 | 3 | 60 |
| II | PFN 4314 | Obstetrics and Neo Natal Nutrition | 4 | 3 | 60 |
| | PFN 4316 | Nutrition in mental health | 4 | 3 | 60 |
| | PFN 4318 | Tamil Traditional Foods | 4 | 3 | 60 |
| **Total** | | | **8** | **6** | **120** |

(Any two electives per year)

**Certificate Courses offered by the Department of Food sciences & Nutrition:**

**Value Added Courses**

| SEM | Course No. | Course Title | Hrs/ wk | Cr |
|---|---|---|---|---|
| I | PFN 421V | Value added products from millets | 2 | 2 |
| I I | PFN 422V | Good Manufacturing Practices in Food Industry | 2 | 2 |
| III | PFN521V | Nutrition Counseling | 2 | 2 |
| IV | PFN522V | Nutrition and Immunity | 2 | 2 |
| **Total** | | | **8** | **8** |

## Programme Outcomes (Pos) for Postgraduates

Postgraduate programmes are expected to have developed in postgraduates the following graduate attributes:

i. Academic Excellence: Being a member of the academic community with advanced discipline-specific knowledge and professional skills in the relevant field with the prowess to communicate complex ideas and to engage in current critical debates with all sensitivity and fairness.
ii. Higher Order Thinking Skills: Ability to critically think, analyse, evaluate, and create new knowledge and skills both in the chosen discipline and across other fields.
iii. Subscription to Quality Research: Ability to design and carry out independent research, to update oneself with current research trends and contemporary inputs in the discipline, and to evaluate research contributions.
iv. Lifelong Learning: Ability to learn, unlearn, and relearn knowledge and skills in the emerging areas of the field of specialization.
v. ICT Literacy: Ability to be digital natives so that they can access a wide range of technologies for personal, academic and professional use and to be members of online communities enjoying the unlimited access blending transparency with accountability and fair practices.
vi. Good Communication: Ability to participate in public discourse on varied themes and topics in one's mother tongue as well as in English as a global link language.
vii. Individuals as Assets: To be academically honest, intellectually curious, ethically responsible, professionally competent, and spiritually inspiring citizens.
viii. Civic and Social Responsibility: Ability to function as matured democratic citizens with participation in issues of equity, gender equality, social justice, sustainable development, and poverty alleviation.
ix. Continuous Professional Development: Ability to continuously develop oneself professionally and to critically improve one's self with a view to taking appropriate decisions in diverse professional and real life environments.
x. Global Citizenship: Ability to work effectively and to live responsibly in a global context of cross-cultural life and capability, to value human diversity and lead life of timeless learning and endless opportunities.

**Program Specific Outcomes (PSO)**

At the end of the PG Food Science & Nutrition program, the student will be able to:

i. Apply the basic principles in food processing, food preservation, food chemistry, food microbiology and foodbiotechnology.

ii. Critically evaluate the issues in food processing, food quality and food safety

iii. Explain the importance of nutraceuticals, food safety and food laws.

iv. Contribute in creating nutritional awareness in making policies for government.

v. Extend the knowledge on various food processing technologies by further research.

vi. Design project in formulation, standardization of new products and clinical supplementation for starting Small Scale Industries (SSI) or Medium Scale Industries (MSI).

vii. Gain proficiency to become dieticians, food analyst and to be employed in government and private sectors.

viii. Develop strategies to apply theoretical concepts in clinical interventions, nutritional assessment, diet planning and for health promotion.

ix. Solve complex problems and acquire analytical skills using latest techniques and tools to find out the solution for food, environmental safety.

x. Articulate legal and cultural impacts of policy making.

**Mapping of Programme Specific Outcomes (PSOs) with**

**Programme Outcomes (POs)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **PSO 1** | √ | | | | | √ | | | √ | |
| **PSO 2** | √ | | √ | | √ | | | √ | | |
| **PSO 3** | √ | | | | | | | | | |
| **PSO 4** | √ | √ | | | √ | | | √ | | √ |
| **PSO 5** | √ | | √ | | | | | | | |
| **PSO 6** | √ | | √ | √ | | | | | √ | √ |
| **PSO 7** | √ | | | √ | | | √ | √ | √ | |
| **PSO 8** | | √ | | √ | | | | | √ | √ |
| **PSO 9** | √ | √ | √ | | √ | | √ | | √ | |
| **PSO 10** | √ | | | | | | √ | √ | √ | |

## Mapping of Courses with Programme Specific Outcomes

| Course Title | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 | PSO 7 | PSO 8 | PSO 9 | PSO 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **PFN 4401** | √ | √ | | | √ | √ | √ | √ | √ | |
| **PFN 4403** | √ | | | | √ | √ | √ | | | |
| **PFN 4305** | | | √ | √ | | √ | √ | √ | | |
| **PFN 4407** | √ | √ | | √ | √ | √ | √ | √ | √ | √ |
| **PFN 4309** | √ | | | | | √ | √ | √ | √ | |
| **PFN 4402** | | | √ | √ | | √ | √ | √ | | |
| **PFN 4404** | √ | √ | | | √ | √ | √ | √ | √ | √ |
| **PFN 4406** | √ | √ | √ | | √ | √ | √ | | √ | |
| **PFN 4308** | | √ | | √ | | √ | | √ | √ | √ |
| **PFN 4310** | √ | | | | √ | | | √ | √ | √ |
| **PFN 5501** | | | √ | √ | | √ | √ | | | √ |
| **PFN 5503** | √ | √ | √ | | √ | | | | | √ |
| **PFN 5405** | √ | √ | | | √ | √ | √ | √ | | |
| **PFN 5407** | | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **PFN 5309** | √ | | | √ | √ | | | √ | √ | √ |
| **PFN 5311** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **PFN 5504** | | | √ | √ | √ | √ | √ | | | √ |
| **PFN 5302** | | | √ | √ | √ | √ | √ | | | √ |
| **PFN 5304** | √ | √ | √ | | | √ | √ | | | √ |
| **PFN 5506** | | | √ | | | √ | √ | | √ | √ |
| **PFN 5810** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **PFN4311** | | | √ | √ | | √ | √ | √ | | |
| **PFN4313** | | | √ | | | √ | √ | √ | | √ |
| **PFN4314** | | | √ | √ | | √ | √ | | | √ |
| **PFN 4316** | | √ | √ | | √ | √ | √ | | | |
| **PFN4318** | | √ | √ | | √ | √ | | √ | √ | |

**PFN 4401 Advanced Food Science 6hrs/4cr**

The course aim at introduce the effect of food processing on bioactive compounds in various aspects and also helps to implement strategies of food waste management and pollution control in industrial basis.

**Course outcomes**

i. Identify the foods with its nutritional properties and the scope in future foods.
ii. Analyze thescience of starches and sweetener.
iii. Revise the properties of food especially sensory characteristics.
iv. Select appropriate method for the formulation of value added food products.
v. Evaluate the applications and strategies of food waste management.

**Unit 1: (12 hrs)**

**Basic food groups & Specific foods** – Composition and nutritive value of Cereals, pulses, nuts & oilseeds, fruits & vegetables, fats & oils, Milk & meat products. Specific foods: Bee products: honey, bee pollen, royal jelly, propolis. Spirulina, Blue-Green algae, Marine phytoplankton, Aloe vera, Hempseed, Coconuts, Camu camu berry, Chlorella, Kelp, Noni, Yacon.

**Unit 2: (17 hrs)**

**Science of starches and sweetener-** Modified food starches, Structure and characteristics of polysaccharides-Non starch Polysaccharides- cellulose, hemicellulose, pectin, gums, animal polysaccharides.

Chemistry of sweetener- Sweetening agents- Colligative properties, Textural contribution, Fermentation, Structural relationship to sweetness perceptions.

**Unit 3: (17 hrs)**

**Sensory Science**- Nutritional Value of Food, Sensory Properties of Food and evaluation methods, Recent Development in sensory science - Introduction to sensory science - Panel selection methods in sensory analysis, Instrumentation - Recent Development in sensory science - Colour and texture of foods **-** Colour measuring systems- CIE system, tintometers - Physical characteristics of foods **-** Texture measurement- instrumental methods - Texture profile analysis - Rheology of foods **-** Flow behaviour of fluid foods - Viscosity measurement- consistometers and viscometers - On-line viscosity measurement.

**Unit 4: (15 hrs)**

**Value added products -** Extrusion - cold and hot extrusion, production of pasta, principles-extrusion cooking, applications, - value addition by Flaking, Puffing, Parching. Encapsulation – micro and nano level process and methods, selection of core and wall materials, quality of encapsulated products. Coating – coating materials and equipment, battering and breading, seasoning. Foods for future- Space foods.

**Unit 5: (14 hrs)**

**Food waste management**- Quantities of lost and wasted food and impact on food and nutrition security, Prospects, Origin of food waste and food loss, Management and valorization strategies, Treatment of food waste, Recovery and applications of enzymes from food wastes. Energy auditing and pollution control in food industries, Policy recommendations, Regulations on pollution control.

**Text Book:**

1. Visakh. P. M, Laura B. Iturriaga, and Pablo Daniel Ribotta, (2014) Advances in Food Science and Nutrition, Copyright by Scrivener Publishing

**References:**

1. Stanier R Y (1986). General Microbiology, Macmillan, India.
2. Frazier and Westhoff. (1978). Food Microbiology.3rd Ed. Tata McGraw Hill,
3. Fellows, P. (1988). Food Processing Technology. Ellis Horwood International Publishers, Cambridge.
4. Marcus Karel Owen R. Fennema and Daryl B.Lund. (1975). Principles of Food science Part II, Physical principles of Food Preservation, Marcel Dekker, Inc. Newyork.
5. Charis Galanakis, Food Waste Recovery 1st Edition, Processing Technologies and Industrial Techniques, Hardcover ISBN: 9780128003510.
6. Srilakshmi B (2005) Dietetics. New Age International Publishers, New Delhi.
7. David Wolfe, Superfoods: The Food and Medicine of the Futu… (Kindle Edition)

**Mapping of Course Outcomes with Bloom's Taxonomy**

| Bloom's Taxonomy | K1 | K2 | K3 | K4 | K5 | K6 |
|---|---|---|---|---|---|---|
| CO 1 | | 2 | | 4 | | |
| CO 2 | | 2 | | 4 | 5 | |
| CO 3 | | | 3 | 4 | | 6 |
| CO 4 | | | 3 | 4 | 5 | 6 |
| CO 5 | | | 3 | 4 | 5 | 6 |

**Mean- 4.1**

**PFN 4403 Food Chemistry (5+1=6hrs/wk) (4cr)**

The course aims at introduction, methods of analysis, chemistry of carbohydrates, amino acids, proteins, lipids, plant pigments and essential oils.

**Course Outcomes**

Upon completion of this course, the student will be able to:

i. Understand the factors affecting the composition of foods
ii. Explain the Structure and properties ofcarbohydrates
iii. Discuss the classification and properties of aminoacid and proteins
iv. Demonstrate the chemistry various lipids and plant pigments
v. Utilize the enzymes in food industries

**Unit 1: (16 hrs)**

**Introduction to chemistry of foods:** Food chemistry-History, Approach to the study of food chemistry, Functions of food, Composition and factors affecting the composition of foods-Raw materials, Processed foods, Changes occurring in food due to processing, Proximate Composition of Foods.

**Unit 2: (15 hrs)**

**Carbohydrates:** Occurrence and classification; structure determination, diagrammatic representation of isomers, sugar derivatives; caramelization; Chemistry of cellulose, starches and other polysaccharides; starch degrading enzymes; commercial sources gel formation and starch retrogradation; pectic substances: their occurrence, structure, properties and use in foods; gums, mucilages and their commercial sources.

**Unit 3: (15 hrs)**

**Amino acids and proteins:** Classification of proteins, chemical and physical properties of proteins, structure of proteins and techniques used in elucidation of protein structure; denaturation of proteins; forces involved in protein conformation, functional properties of proteins in foods, hydrolysis of proteins, major food proteins and their sources; changes in proteins during processing.

**Unit 4: (15 hrs)**

**Lipids and plant pigments:** Chemistry, occurrence, classification and composition; physical and chemical properties of fats. Emulsions-types of emulsions, emulsifying agents. Plant pigments: their occurrence, chemistry, functions and changes during processing, Plant acids, acid and taste relationship; Essential oils: Chemistry, occurrence and extraction; Terpeneless oils and their use in foods.

**Unit 5: (14 hrs)**

**Enzymes:** Classification, nomenclature, general properties, mechanisms of enzyme action, regulation of enzyme activity. Role of coenzymes and cofactors in enzyme activity, Factors affecting enzyme activity. Enzyme inhibition, Isoenzymes, immobilized enzymes, clinical significance of enzyme assays.

**Text Book:**

1. Owen R. Fennema (2008) Food Chemistry Fourth Edition, CRC Press, London, New York.

**References:**

1. H.D.Belitz, W.Grosch, P.Schieberle (2009) Food Chemistry 4th revised and extended edition, Springer publishers.
2. Potter, N.N. and Hotchikiss, J.H. (2006), Food Sciences, Fifth edition, CBS publishers and Distributors, New Delhi.
3. Fennema, O.R, 2006, Food Chemistry, Academic Press.
4. Meyer, L.H. 1987. Food Chemistry. CBS publishers and Distributors, New Delhi.

**Mapping of Course Outcomes with Bloom's Taxonomy**

| Bloom's Taxonomy | K1 | K2 | K3 | K4 | K5 | K6 |
|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | 3 | 4 | | |
| CO 2 | 1 | 2 | | 4 | 5 | |
| CO 3 | | 2 | 3 | 4 | 5 | 6 |
| CO 4 | 1 | 2 | 3 | | 5 | 6 |
| CO 5 | 1 | 2 | 3 | 4 | 5 | 6 |

**Mean = 3.3**

**PFN 4305 Applied Physiology (5hrs/wk) (3cr)**

The course aimed at the students to understand the structure and basic physiology of various organs of the body. The students will obtain better understanding of the principles of Foods and Nutrition through the study of physiology.

**Course Outcomes**

Upon completion of this course, the student will be able to:

I. Compare the digestive and excretory system and infer the mechanisms of digestion and excretion in human beings.
II. Explain the functions of circulatory system.
III. Communicate the structure and functions of respiratory system in man.
IV. Analyze the relationship between nervous system and sense organs
V. Discuss the role of hormones and functions of human reproductive system.

**Unit 1: (15 hrs)**

**Cell:** General Character, Structure, Cell Membrane, Cytoplasm, Lysosome, Peroxisomes, Mitochondria, Ribosomes, Nucleus, Deoxyribonucleic Acid, Ribonucleic Acid

**Muscle physiology**: Muscle, Skeletal Muscle, Changes during Muscular Contraction, Neuromuscular Junction, Smooth Muscle

**Unit 2: (12 hrs)**

**Digestive system**: Digestive system, Enzymes and hormones, Salivary Secretion, Gastric Secretion, Pancreatic Secretion, Liver and Bilary System, Functions and Secretion of Small Intestine and Large Intestine.

**Renal physiology:** Function of Kidney, Nephron, Renal Circulation, Urine Formation, Renal Function Test, Role of kidney in maintaining pH of blood. Water, electrolyte and acid base balance, diuretics.

**Unit 3: (16 hrs)**

**Blood and body fluids –** Body Fluids, Blood, Plasma Protein, RBC, erythropoiesis, Haemoglobin, WBC, Platelets, Blood Coagulation, Blood Groups, Blood Transfusion, Use of blood for investigation and diagnosis of specific disorders.

**Cardiovascular system**: Heart, Properties of Cardiac Muscle, Cardiac Cycle, Heart Sound, ECG, Cardiac impulse, coronary circulation, pulmonary circulation, cerebral circulation, hepatic circulation, renal circulation, cutaneous circulation and skeletal muscle circulation.

**Unit 4: (16 hrs)**

**Endocrinology:** Endocrine System, Hormones, Pituitary Gland, Thyroid Gland, Parathyroid Gland, Pancrease - Islets of Langerhans and Insulin, Adrenal Gland, Emphasis on physiology of Diabetes and stress hormones.

**Respiratory system**: Types of Respiration, Pulmonary Circulation, Respiratory Movement, Pulmonary Function Test, Lung Volume, Lung Capacity, Respiratory Gases, pulmonary function tests, Cardio – respiratory response to exercise and physiological effects of training.

**Unit 5: (16 hrs)**

**Nervous system**: Neuron, Nerve Fibrosis, EEG, CSF, ANS, properties, myelin sheath, nerve endings, synapse, neuro transmitters, The role of Hypothalamus in various body functions – obesity, sleep, memory, Blood Brain Barrier

**Sense organ**: sensation of vision, hearing, taste and smell.

**Text Book:**

1. Ahuja (2001). Textbook of Physiology, CBS Publishers.

**References:**

1. Chatterjee C C (1988). Text Book of Medical Physiology. W B Sounder's Co. London.
2. Elaine N and Marie R N (1997) Human Anatomy and Physiology. Addison Wesley Longman, Inc., UK
3. Ganong (1995). Review of Medical physiology. Prentice Hall international, London.
4. Guyton, A. C, (2009). Function of the Humanbody, 4th Edition, W .B. Sanders Company, Philadephia.
5. Guyton, A. C, and Hall., J. B. (2010). Text Book of Medical Physiology, 9th Edition, W. B. Sanders company, Prime Books (Pvt.) Ltd., Bangalore

| **Bloom's Taxonomy** | **K1** | **K2** | **K3** | **K4** | **K5** | **K6** |
|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 3 | 4 | | 6 |
| CO2 | 1 | 2 | 3 | 4 | 5 | |
| CO3 | 1 | | 3 | 4 | | 6 |
| CO4 | 1 | 2 | 3 | 4 | 5 | |
| CO5 | 1 | 2 | 3 | | 5 | 6 |

**Mean = 3.2**

**PFN 4407 Advanced Food Microbiology (5+1=6h/wk) (4cr)**

The course aims at providing information on basic microbiology, food spoilage and preservation, food borne bacterial and viral diseases and food borne parasitic diseases. It also provides information on use of microorganisms in food preparation.

**Course Outcomes**

Upon completion of this course, the student will be able to:

i. Outline the importance of microorganisms and the factors responsible for their growth
ii. Discuss the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage
iii. Identify the conditions for the growth of food borne bacterial and viral diseases
iv. Compile the conditions for prevalence of food borne and parasitic diseases.
v. Explain the beneficial role of microorganisms in fermented foods and in food processing.

**Unit 1: (12 hrs)**

**Overview of Basic Microbiology:** Importance and significance of microorganisms in food science. Introduction to Microbiology – Scope of microbiology - Ancient Microbiology - Refutation of a biogenesis: discovery of penicillin: discovery of vaccination: proposal of one gene one enzyme hypothesis - Major contribution of scientists– Leeuwenhoeck, Edward Jenner, Alexander - Flemming, Joshep Lister, Robert Koch, Louis Pasteur, Hargobind Khorana. Modern Microbiology - Landmark achievements in 20th century - Microbial Taxonomy - Definition and systematics, Nomenclatural rules and identification. Haeckel's three kingdom classification, Whittaker's five kingdom approach - Woese domain system. Major characteristics used in taxonomy – morphological, physiological and metabolic, genetic and molecular taxonomy. Bergey's Classification of bacteria.

**Unit 2: (16 hrs)**

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

**Unit 3: (15 hrs)**

**Biology of Microorganisms:** Differences between prokaryotic and eukaryotic cell. Biology of bacteria - cell structure, size, shape, arrangement membrane, cell wall, cytoplasmic inclusions, mesosomes, flagella and motility, slime, capsule, pili, chemotaxis, endospore - biology of fungi, structure, physiology and classification – biology of yeast – reproduction - virus (bacteriophages) structure, life cycle (lytic and lysogenic) – biology of algae – Mycoplasma – prions.

**Unit 4: (16 hrs)**

**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, Cryptosporidiosis. Cysticercosis/Taeniasis. Roundworm – Trichinosis, Anisakiasis. Mycotoxins: Aflatoxicosis, Deoxyni valenol Mycotoxicosis, Ergotism

**Unit 5: (16 hrs)**

**Microorganisms and Food Preparation** Fermentation process-kinetics of fermentation process. Prebiotics-Probiotics and single cell proteins. Dairy products (cheese and yoghurt) and traditional Indian fermented foods and their health benefits. Fermented Beverages- wine, beer, toddy and vodka. 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; Mycotoxicosis of significance. Determination of toxicants in foods and their management.

**Text Book:**

1. Frazier Food Microbiology 4$^{th}$edi. Tata McGraw-Hill Education

**References:**

1. James Jay, Loessner, Martin J., Golden, David A., Modern Food Microbiology - Springer publishers
2. Bibek Ray &Arun Bhunia Fundamental Food Microbiology, Fifth Edition CRC Press
3. M. R. Adams, M. O. Moss Food Microbiology Royal Society of Chemistry

**Mapping of Course Outcomes with Bloom's Taxonomy**

| Bloom's Taxonomy | K1 | K2 | K3 | K4 | K5 | K6 |
|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | 3 | 4 | 5 | |
| CO2 | | 2 | | 4 | | 6 |
| CO 3 | 1 | | 3 | 4 | 5 | |
| CO 4 | | | | 4 | | 6 |
| CO 5 | 1 | 2 | 3 | | 5 | 6 |

**Mean = 3.4**

**PFN 4309 Laboratory in Advanced Food Science (3h/wk) (3cr)**

The course aims at relies on the sensory evaluation to determine the quality characteristics of foods by means of sense organs and objective methods. These sensory attributes can also be easily correlated with the physical characteristics of the food material.

**Course Outcomes**

Upon completion of this course, the student will be able:

i. To evaluate different types of food using five basic senses.
ii. To evaluate sensory analysis by subjective and objective methods
iii. To identify the texture profile of fresh and processed foods.
iv. To demonstrate the chemical and biochemical oxygen demand for different waste products.
v. Summarize food analysis experiments, analyzing data and reporting their findings.

**Laboratory Experiments**

1) Sensory Evaluation and interpretation of data (Preference test, Difference test and Descriptive test)
2) Color measurement
3) Textural Profile Analysis (TPA) of fresh and processed foods
4) Viscosity measurement
5) Value added product using extrusion technology and quality assessment.
6) Dissolved oxygen (DO), Biochemical oxygen demand (BOD) and Chemical oxygen demand (COD) analysis of waste water.
7) Visit to a modern food industry.

**Text Book:**

1. Potter,N.N., Joseph,H., Hotchkiss. (1997). Food Science. CBS Publishers and Distributors. New Delhi.

**References**

1. Balasubramanian, P. (2013) Energy Auditing made Simple, Consultancy Services Publishers, India.
2. Fellows, P. (1988). Food Processing Technology. Ellis Horwood International Publishers, Cambridge.

| Bloom's Taxonomy | K1 | K2 | K3 | K4 | K5 | K6 |
|---|---|---|---|---|---|---|
| CO 1 | | 2 | 3 | | | |
| CO2 | | | 3 | 4 | 5 | |
| CO 3 | | | 3 | 4 | 5 | 6 |
| CO 4 | | 2 | 3 | 4 | 5 | 6 |
| CO 5 | | | | 4 | 5 | 6 |

**Mean = 4.11**

**PFN 4402 Nutrition Through Life Cycle (5+1=6hrs/wk) (4cr)**

The course aims at helping the students to provide a detailed view of the nutritional foundations necessary for human growth, development, reproduction, health and well-being in each stage of the human life cycle.

**Course Outcomes**

Upon completion of this course, the student will be able to:

i. Apply knowledge of the science of nutrition to human health across the lifespan
ii. Retrieve, critically evaluate and apply scientific evidence to a contemporary nutritional requirement and health issue during pregnancy and lactation
iii. Assess nutritional requirements relative to infants.
iv. Discuss about the nutrition during preschool and school going
v. Know about the changes in growth pattern during nutrition in adolescence and oldage.

**Unit 1: (15 hrs)**

**Introduction about food:** Definition - Nutrition, Malnutrition, Undernutrition, Overnutrition, Nutrient, Health, Guidelines of good health, recommended dietary intake, Factors affecting RDA, Uses of RDA, Sources of nutrients in food, Functions of nutrients in food, Balanced diet, Nutrition deficiency disorder.

**Unit 2: (15 hrs)**

**Nutrition in pregnancy:** Physiological changes in pregnancy, developmental stages of the embryo, complications in pregnancy, hormonal changes during pregnancy, nutrient requirements, RDA.

**Nutrition in lactation:** Physiological adjustments during lactation, Diet of lactating women, nutrient requirements, RDA.

**Unit 3: (18 hrs)**

**Nutrition during infancy:** Physiological development, Nutrition during infancy, composition of human milk and cow milk, formula preparation, weaning, supplementary and complementary feeding, growth monitoring, and premature infants, nutrient requirements, RDA.

**Unit 4:**

**Nutrition during preschool and school going :** Eating habits and behaviour, growth, packed lunch, Children growth and development during preschool, nutrient requirements, RDA.

**Unit 5: (15 hrs)**

**Nutrition in adolescence**: Changes in growth pattern, puberty, menarche, changes in food habits, nutritional disorders, psychological and peer group pressure on eating habits, factors influencing food intake, nutritional concerns – anorexia and bulimia, nutrient requirements RDA.

**Nutrition in adult hood and old age:** Factors influencing nutritional influence**,** physical activity and energy relationship, theories of aging, physiologic changes, Nutritient requirements, RDA

**Text book:**

1. Srilakshmi B. (2018) Dietetics, New Age International (P) Ltd, Publishers.

**References:**

1. Swaminathan M (1985) Advanced Text Book on Food and Nutrition. Vol.II. No.88, Mysore Road, Bangalore.
2. Whiteny EN and Cataldo CB (1983)Understanding normaland clinical Nutrition. West Publishing Company, NewYork.
3. Krause M V and Mohan L K (1984) Food, Nutrition and Diet Therapy. W. B. Saunders company, Philadelphia.
4. Passmore R and East Wood M A (1987) Human Nutrition and Dietetics. English Language Book Society/ Chruchill, Livingstone.
5. Robinson C H, Lawber M R, Chenoweth W L and Garwick A E (1986) Normal and Therapeutic Nutrition. Seventh Edition, Mc Millan Publishing company, NewYork.

| **Bloom's Taxonomy** | **K1** | **K2** | **K3** | **K4** | **K5** | **K6** |
|---|---|---|---|---|---|---|
| CO1 | | 2 | | 4 | 5 | 6 |
| CO2 | | 2 | 3 | 4 | | |
| CO3 | 1 | 2 | | 4 | 5 | 6 |
| CO4 | 1 | 2 | 3 | 4 | | |
| CO5 | | 2 | 3 | | 5 | 6 |

**Mean=3.33**

**PFN4404 Advanced Nutritional Biochemistry (5+1=6hrs/wk) (4cr)**

The course deals with the metabolism and biochemistry of the carbohydrates, lipids, proteins and other related compounds. It enables an understanding of the physiological mechanisms of action of various nutrition related processes.

**Course Outcomes**

Upon completion of this course, the student will be able to:

i. Understand the basic knowledge of the regulation of integrated metabolic pathways within cells and tissues and about bioenergetics.
ii. Discuss the metabolism of proteins and biosynthesis of nucleotides.
iii. Explain about the lipid metabolism and oxidative stress.
iv. Summarize the regulation of metabolism.
v. Impart knowledge on enzymes and hormones and their role in pathology.

**Unit 1: (15 hrs)**

**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.

**Unit 2: (16 hrs)**

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

**Unit 3: (16 hrs)**

**Lipids:** Metabolism of triaclyglycerol, 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 4: (12 hrs)**

**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 5: (16 hrs)**

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

**Text Book:**

1. Vasudevan, DM, Textbook of Biochemistry for medical students, (2013): 7th Ed. Jaypee Brothers Medical Publishers Ltd.

**References:**

1. Nelson, D.L., and Cox, M.M. (2000): 3rd Ed. Lehninger's Principles of Biochemistry, Macmillan Worth Publishers.
2. Conn, E.E., Stumpf, P.K., Bruening, G. and Doi, R.H. (2001): 5th Ed. Outlines of Biochemistry, Heinemann Medical Books Ltd.

| **Bloom's Taxonomy** | **K1** | **K2** | **K3** | **K4** | **K5** | **K6** |
|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | | 4 | | |
| CO 2 | | 2 | | 4 | 5 | |
| CO 3 | | 2 | 3 | | 5 | |
| CO 4 | | 2 | | | 5 | |
| CO 5 | 1 | 2 | 3 | 4 | | 6 |

**Mean = 3.2**

**PFN4406 Food Investigation Techniques (5+1=6hrs/wk) (4cr)**

Food analysis is a diverse and interdisciplinary field of research that has a significant health, societal and economic impact. It aims to characterize food products in terms of chemical composition, traceability, safety, quality, sensory perception and nutritional value. Food analysis approaches are used by industry, government/control agencies and academia.

**Course outcomes**

Upon completion of this course, the student will be able to:

i. Apply statistically valid sampling techniques to food materials having widely diverse properties and volumes.
ii. Evaluate the principles and methods for the physical and rheological analyses of foods. Evaluation of test methods.
iii. Analyze the basic principles and method for the proximate analysis of food.
iv. Demonstrate competency in the use of standard techniques of food analysis and the treatment of experimental data.
v. Identify modern instrumental methods to analyze chemical and physical properties of foods.

**Unit 1: (15 hrs)**

**Food Sampling and evaluation.** Concepts of food analysis; **S**ampling, purpose, Types of sampling, factors considering for sampling, Sampling as per FSSA 2006 and sampling procedures for liquid, powdered and granular materials.

**Unit 2: (20 hrs)**

**Physical and rheological properties of food analysis**: Determination of pH, titrable acidity, bulk density; total dissolved solids using refractometer; viscosity of food using viscometer; texture analysis and different types of texture analyzing equipments.

**Unit 3: (20 hrs)**

**Proximate analysis of food**: Different methods of determination of moisture; ash content of food- wet and dry ashing, protein and amino acids in foods; determination of total fat in food; determination of total carbohydrates, starch, dietary fiber and simple sugars in foods.

**Unit 4: (20 hrs)**

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

**Unit 5: (15 hrs)**

**Separation techniques:** Basic Principles, application of electrophoresis, chromatography, immunoassay techniques in food analysis and other separation techniques.

**Textbook:**

1. Fung, D.Y.C. and Matthews, R. (1991): Instrumental Methods for Quality Assurance in Foods, Marcel Dekker, Inc. New York.

**References:**

1. Skoog, D.A., Holler, F.H. and Nieman (1998): Principles of Instrumental Analysis Saunders College Publishing, Philadelphia.
2. Gruenwedel, D.W.; Whitaker, J.R. (editors) (1984): Food Analysis Principles and techniques, Volumes 1 to 8, Marcel Dekker, Inc., New York.
3. Herschdoerfer, S.M. (ed) (1968 – 1987): Quality Control in the Food Industry, Vols. 1 to 4, Academic Press, London.
4. Pomeranz, Y. and MeLoan, C.E. (1996): Food Analysis: Theory and Practice; 3rd Edition, CBS Publishers and Distributors, New Delhi.
5. Wilson and John Walker, Principles and Techniques of Biochemistry and Molecular Biology (2010), Keith Wilson and John Walker, Cambridge University Press.

| **Bloom's Taxonomy** | **K1** | **K2** | **K3** | **K4** | **K5** | **K6** |
|---|---|---|---|---|---|---|
| CO 1 | 1 | | 3 | | | 6 |
| CO 2 | | | | 4 | 5 | |
| CO 3 | 1 | 2 | | | | |
| CO 4 | | | 3 | | | |
| CO 5 | | | 3 | 4 | | 6 |

Mean=3.5

**PFN 4308 Research Methodology and Biostatistics (4+1=5h/wk) (3cr)**

This course has two parts. First part deals with research methodology, research problem and methods of data collection. The second part deals with statistics and data analysis using statistical tools.

**Course Outcomes**

Upon completion of this course, the student will be able to:

i. outline various kinds of research, objectives of doing research, research process, research designs and sampling
ii. demonstrate qualitative, quantitative and mixed methods research, as well as relevant ethical and philosophical considerations
iii. apply measurement & scaling techniques as well as the quantitative data analysis in research
iv. analyse the criteria that can be used to select an appropriate statistical test to answer a research question or hypothesis
v. discuss the link between quantitative research questions and data collection and how research questions are operationalized in educational practice

**Unit 1: Research Problem (12 hrs)**

Meaning of Research, Objectives Types of Research, Research Approaches - Significance of Research- Research and Scientific Method - Importance of Research - Research Process - Criteria of Good Research - Research Problem: Selecting the Problem - Defining the Problem - Technique Involved in Defining a Problem - Justification, theory, hypothesis, basic assumptions, limitations and delimitations of the problem

**Unit 2: Report Writing and Quality Parameters (12 hrs)**

Interpretation and report writing- meaning of interpretation technique, precautions, format of research report, types, steps and stages, mechanism and style, essential of good report - Synopsis, Research paper, Review article, Poster preparation, Oral presentations. Plagiarism: Avoiding Plagiarism during documents, thesis, manuscripts, scientific writing. Bibliographic index and research quality parameters: citation index, impact factor, h- index, i10 index, etc

**Unit 3: Introduction of Biostatistics (10 hrs)**

Meaning and its scope; Population and Sample. Parameter and Statistics; types of statistical data; Diagrammatic & Graphic representation of data; Methods of collecting primary data- Questionnaire, preparation of schedules, interview method, case- study method, Experimentation method,

**Unit 4: Data Analysis (12 hrs)**

Sources of Secondary data, precautions while using secondary data. Editing and coding the data, Organization of data, classification- meaning and objectives, types of classification, formation of discrete and continuous frequency distribution, Tabulation – role, parts of a table, general rules of tabulation, types of tables. Mean, Median, Mode, Standard deviations, Coefficient of Variation, Skewness and Kurtosis. Probability – Definition, Addition and Multiplication theorem.

**Unit 5: Parametric Tests** **(14 hrs)**

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). MS- excel & SPSS in data analysis.

**Textbook:**

1. Kothari C.R. (2014) Research Methodology Methods & Techniques, New age international publisher.

**References:**

1. Myra L. Samuels, Jeffrey A. Witmer, Andrew Schaffner. (2012). Statistics for the Life Sciences, 4th edition. Prentice Hall.
2. John A. Rice. (2010). Mathematical Statistics and Data Analysis, Duxbury Press.
3. John M. Lachin. (2010). Biostatistical Methods: The Assessment of Relative Risks, 2nd Edition, Wiley-Blackwell Pub.
4. Snedecor, George, W.Cochran and William, G. (1967). Statistical Methods, Sixth edition, Oxford and IBH Publishing Co., Oxford.

| **Bloom's Taxonomy** | **K1** | **K2** | **K3** | **K4** | **K5** | **K6** |
|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | 3 | 4 | | |
| CO 2 | 1 | 2 | 3 | 4 | | |
| CO 3 | | | | 4 | 5 | 6 |
| CO 4 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO 5 | | 2 | 3 | 4 | 5 | 6 |

**Mean = 3.45**

**PFN 4310 Laboratory in Food Analysis (3h/wk) (3cr)**

The course aims at relies on scientific analysis to identify problems with food products. It provides analytical data on the quality of a product or production process to support quality control in the HACCP system. The objective of quality control is to identify contaminants in raw material, or contamination after a product is produced and before it is placed on the market.

**Course Outcomes**

Upon completion of this course, the students will be able to:

i. Summarize food analysis experiments, analyzing data and reporting their findings.
ii. Understand basic principles of food analytical procedures
iii. Estimate the chemical composition, structural and physical properties of native and processed food materials.
iv. Evaluate the standard experimental techniques.
v. Choose the appropriate and accurate methods for various food quality characteristics.

**Laboratory Experiments**

1. Preparation of Primary and Secondary solutions
2. Proximate analysis of marketed food products (Moisture, Ash, Crude Fat, Crude Protein and Crude Fiber)
3. Vitamin estimation (Ascorbic acid, Beta carotene, thiamine and riboflavin)
4. Mineral estimation (Zinc, Calcium, Phosphorus, Iron)
5. Determination of PH, TA, TSS, RS, Non-RS, Total sugar, Total phenolic compounds
6. Identification of antinutritional factors found in food sample

**Text Book:**

1. Raghuramulu,N.Nair,K.A.AndKalyanasundraram, A.(1983) A manual of Laboratory Techniques, National, Institure of Nutrition, Silver Prints, Hyderabad.

**References:**

1. Oser, B.L.,(1954) Hawke's Physiological Chemistry, XIV Edition, Tata MC Graw Hill Publishing Company Ltd, Mumbai.
2. Jayaram.J.(1996), Laboratory Manual In Biochemistry, New Age International Ltd, Publishers, New Delhi, Fifth Reprint.
3. The Food Chemistry Laboratory: A Manual for Experimental Foods, Dietetics, and Food Scientists, Second Edition-Connie M. Weaver, James R. Daniel
4. Food Chemistry: A Laboratory Manual -Dennis D. Miller
5. Hand Book of Food Analysis by Nollet&Toldra, CRC publishing ltd.

| Bloom's Taxonomy | K1 | K2 | K3 | K4 | K5 | K6 |
|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO 2 | | 2 | 3 | 4 | 5 | |
| CO 3 | 1 | 2 | | 4 | 5 | 6 |
| CO 4 | 1 | 2 | 3 | 4 | 5 | |
| CO 5 | 1 | | 3 | | 5 | 6 |

**Mean = 3.45**

**PFN 5501 Drug -Nutrient Interactions (5+1=6hrs/wk) (5cr)**

The course aims at overview of drug nutrient interactions, pharmacology, nutrigenomics, drug nutrient interactions in specific conditions in order to optimize drug efficacy.

**Course Outcomes**

Upon completion of this course, the student will be able to:

1. Discuss the significance of food and drug interactions in the present clinical scenario.
2. Apply this knowledge in prescribing individualized dietary regimen for various therapeutic conditions in order to optimize drug efficacy.
3. Analyze clinically possible interactions between drugs and nutrients in patients who are on enteral and parenteral nutrition.
4. Explain the importance of nutritional genomics in improving health outcomes.
5. Compile knowledge of pharmacology, gene- nutrient and drug- nutrient interactions into the nutrition care process.

**Unit 1: (15 hrs)**

**Overview of drug nutrient interactions:** Drug- definition, Dosage forms (powders, capsulses, tablets, liquids, rectal dosage forms, topical agents, injections), routes for drug delivery (enteral, parenteral and topical). Basic concepts of Pharmacokinetics - absorption, Factors affecting absorption, distribution, metabolism and elimination; Pharmacodynamics- mechanism of drug action, combined effect of drugs (synergism and antagonism), Factors modifying drug action; Pharmacogenomics.

**Unit 2: (18 hrs)**

**Influence of nutritional status on drug disposition and effect**: Effect of malnutrition on drug disposition. Influence of food or nutrients on drug disposition and effect. Interactions of frequently used drugs with nutrients- Analgesics, antibiotics, hypoglycemic agents, cardiovascular agents (diuretics, anticoagulants, antihypertensives, antihyperlipidemics), antacids, respiratory agents (bronchodilators, corticosteroids), immunosuppressants, psychotropic agents.

**Unit 3: (15 hrs)**

**Drug nutrient interaction by life stage:** Drug–Nutrient Interactions in Infancy and Childhood, Drug–Nutrient Interaction considerations in Pregnancy and Lactation, Drug–Nutrient Interactions in the elderly. Drug–Nutrient Interactions in Nutrition support - (Enteral and parenteral Nutrition)

**Unit 4: (15 hrs)**

**Nutrigenomics:** Basics of Nutrigenomics, Tools of Nutrigenomics- Genomics, Transcriptomics, Proteomics, Metabolomics. Interaction between nutrient and gene- direct interactions, epigenetic interactions, genetic variations. Chronic disease and nutritional genomics. Role of nutrigenomics in coronary heart disease.

**Unit 5: (12 hrs)**

**Drug nutrient interactions in specific conditions:** HIV/AIDS, organ transplantation, impact on mineral status and cancer. Diet counseling to prevent food and drug interactions, Computers in Nutrient- Drug Interaction management.

**Text Book:**

1. Joseph I. Boullata, Vincent T. Armenti, (2004), Handbook of Drug-Nutrient Interactions, Humana Press, Totowa. ISBN: 978-1-4757-5359-2 (Print) 978-1-59259781-9 (Online).

**References:**

1. Beverly J. McCabe, Eric H. Frankel and Jonathan J. Wolfe, (2003) Hand book of food and drug interactions, CRC press, Boca Raton (online).
2. Tripathi K.D, (2003), Essentials of medical Pharmacology, Ed 5, Jaypeebrothers , Medical publishers Pvt., Ltd., New Delhi.
3. Srilakshmi B, Nutrition Science, Ed 5, New Age International (P) Ltd., New Delhi.
4. Sumathi R. Mudambi, M.V. Rajagopal. Fundamentals of food, nutrition and diet therapy, Ed. 6, New Age International (P) Ltd., New Delhi.

| **Bloom's Taxonomy** | **K1** | **K2** | **K3** | **K4** | **K5** | **K6** |
|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO2 | 1 | 2 | 3 | 4 | | |
| CO 3 | | 2 | 3 | 4 | 5 | 6 |
| CO 4 | 1 | 2 | 3 | 4 | 5 | |
| CO 5 | 1 | | 3 | | 5 | 6 |

**Mean = 3.4**

**PFN 5503 Food Packaging (5+1=6hrs/wk) (5cr)**

The course aims at Food packaging includes introduction, packaging materials and their properties, packaging systems and methods, packaging aspects of fresh and processed foods and packaging design and environmental issues in packaging.

**Course Outcomes**

Upon completion of this course, the student will be able to:

i. Outline the functions of packaging along with the influence of various factors on food
ii. Compile about the different packaging materials like cans, bottles, flexible films etc.
iii. Discuss about the various methods of packaging and the equipment's used for packaging.
iv. Outline about the different metal container like tin, aluminium, physical testing of polymer packaging materials.
v. Explain about the dairy products like bakery, beverages, frozen foods etc.

**Unit 1: (12 hrs)**

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

**Unit 2: (18 hrs)**

**Packaging material and their properties:** Glass, Paper and paper board, Corrugated fiber board (CFB), Metal containers: Tin and Aluminum, Composite containers, Collapsible tubes, Laminations, Metalized films, Co extruded films, physical testing of polymeric packaging materials. Food Packaging Polymers (Polyethylene, PET, PVC, Polypropylene, Polystyrene & Nylon).

**Unit 3: (12 hrs)**

**Packaging Systems and methods:** Canning-Vacuum Packaging, controlled atmospheric packaging, modified atmospheric packaging, Aseptic Packaging, Retort processing, Active Packaging, intelligent packaging, shrink and stretch packaging-cling.

**Unit 4: (15 hrs)**

**Packaging aspects 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 5: (18 hrs)**

**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 Book:**

1. Gardon L. Robertson (2012) Food Packaging: Principles and Practice, Third Edition, CRC Press, India.

**References:**

1. Richard Coles, Derek McDowell,.Mark J. Kirwan.(2003).Food Packaging Technology, Blackwell Publishers.
2. Aaron L. Brody, E. P. Strupinsky, Lauri R (2001). Active Packaging for Food Applications, CRC Press, U.S.A.
3. Ahvenainen, R. (Ed.) 2003 Novel Food Packaging Techniques, CRC Press,.
   Han, J.H. (Ed.) 2005 Innovations in Food Packaging, Elsevier Academic Press

| **Bloom's Taxonomy** | **K1** | **K2** | **K3** | **K4** | **K5** | **K6** |
|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | | 4 | 5 | |
| CO 2 | | 2 | 3 | 4 | 5 | 6 |
| CO 3 | | 2 | 3 | 4 | 5 | 6 |
| CO 4 | | 2 | 3 | 4 | | 6 |
| CO 5 | 1 | 2 | | | 5 | |

**Mean = 3.6**

**PFN 5405 Functional Foods and Nutraceuticals (5+1=6hrs /wk) (4cr)**

The course aims at enables to gain knowledge on sources of functional foods and nutraceuticals. It also helps to understand the role of functional foods, nutraceuticals and dietary supplements in health and disease.

**Course outcomes**

i. To enable students understand the relation between Functional Foods, Nutraceuticals to Food and Drugs along the regulatory aspects
ii. To introduce them to various functional food groups of plant origin
iii. To enable students understand the functional component of animal origin
iv. Discuss the role of prebiotic and probiotics in gut health
v. Study about the herbs and flowers as a source of bio active compounds in treating certain diseases

**Unit 1: (15 hrs)**

**Introduction to Functional Foods and Nutraceuticals:** Functional foods and Nutraceuticals –definition and history. Teleology–definition, primary and secondary metabolites. Organisational Models for Nutraceuticals- a) Food Sources b) Mechanism of Action: c) Chemical Nature. Consumer Marketing- Factors for marketing functional foods and nutraceuticals.

**Unit 2: (18 hrs)**

**Functional Components from Plant Sources:** i) Nutrient Molecules: (Phospholipids, Vitamin K, Carbohydrate Derivatives- Dietary fiber - Types and sources, Physical and Physiological properties. Minerals – Zinc, Selenium. ii) Non Nutrient Molecules: Phenolic compounds (Phytoestrogens - Isoflavones, Lignans. Flavonoids – Quercetin, kempferol, Flavones – limonene. Flavols – Catechin), Phenolic acid – Ellagic acid, Caffeic acid), Phytosterols and phytostenols, Saponins, Tannins, Carotenoids (Lycopene, Beta-carotene, Lutein and zeaxanthin). iii) Hypocholesterolemic and antidiabetic components.

**Unit 3: (15 hrs)**

**Functional Components from Animal Sources:** Major and minor components in cow's Milk and Human Milk. Proteins – lactalbumin, lactoglobulin, lactoferrin, immunoglobulins, Derived peptides – casein phospho peptides, glycomacro peptides, Lactose, Fat. Mineral – zinc, selenium, Calcium. Dietary lipids **-** Conjugated Linolenic Acid, linoleic acid, oleic acid, GLA. Omega 3 and Omega 6 Fatty Acids. Structured Lipids

**Unit 4: (12 hrs)**

**Microbes as Functional Foods:** General Functions of Intestinal Microflora. Prebiotics - Definition, role of prebiotic as functional ingredient, examples. Probiotics - Definition, role of probiotic as functional ingredient, examples. Symbiotics - Definition, functions, examples.

**Unit 5: (15 hrs)**

**Herbs and Flowers as Functional Foods:** Action of Herbs and Efficacy on**:** i)Nervous System-Ginseng, St.John's wort, Ginkgo biloba. ii) Heart and Circulatory System-Hawthorn plant**.** iii) Immune System –Echinacea**.** iv) Digestive System-Ginger valerian root fennel**.** v) Respiratory System-Licorice root, kava kava**.** vi) Urinary System-Cranberry, Saw palmetto**.** vii) Musculoskeletal System-Fever few.

Flowers - Medicinal values, nutritional importance, culinary uses, effect of cooking of Edible flowers – Drumstick, Neem, Agathi, Plantain. Ornamental edible flowers – Hibiscus, lotus, rose

**Text Book:**

1. Mary K Schmidl and Theodore P.Labuza, Essentials of Functional Foods, Culinary and Hospitality Industry Publications Services 2000.

**References:**

1. G.Mazza Functional Foods Biochemical Processing Aspects, Culinary and Hospitality Industry Publications 1998.
2. Israel Goldberg Functional Foods Designer Foods Pharma Food, Nutraceuticals, Culinary and Hospitality Industry Publications 2001.
3. Robert E C Wildman Handbook of Nutraceuticals and Functional Foods, Culinary and Hospitality Industry Publications 2001.
4. David H Watson Performance Functional Foods ,Culinary and Hospitality Industry Publications 2001.

| **Bloom's Taxonomy** | **K1** | **K2** | **K3** | **K4** | **K5** | **K6** |
|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | | 4 | 5 | |
| CO 2 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO 3 | 1 | 2 | 3 | | | |
| CO 4 | | | 3 | 4 | 5 | 6 |
| CO 5 | 1 | 2 | 3 | 4 | 5 | 6 |

**Mean = 3.4**

**PFN 5407 Food Biotechnology (5+1=6hrs/wk) (4cr)**

The course aims at Food Biotechnology deals with use of genetic engineering, cloning and cell culture in Food Biotechnology, prospects, traditional applications, xenobiotics and its elimination and role of Biotechnology in food industries.

**Course Outcomes**

Upon completion of this course, the student will be able to:

i. Apply the techniques of molecular biology, biotechnology and r-DNA for the development of food products
ii. Discuss the role of genetically modified plants and animal cells to produce desired food components
iii. Explain the role of nanomaterials for the development of food packaging
iv. Identify different types of food toxicants including xenobiotics
v. Utilize the wastes released from the food industries

**Unit 1: (12 hrs)**

**Prospects of Biotechnology:** Definition, scope and applications. Application of biotechnology in food. Basic principles of molecular biology and biotechnology: Recombinant DNA Technology.

**Unit 2: (18 hrs)**

**Genetic Engineering, cloning and cell culture:** Fundaments of molecular biology and genetics. Central dogma. Concept of genetic engineering and molecular cloning. Plant and animal culture, transgenic plants, application of genetic engineering in food science and technology. Genetically modified foods – concept, types and application.

**Unit 3: (15 hrs)**

**Food Nanotechnology:** Nanomaterials - Definition - History – Properties. Food Nanotechnology: Current developments and future prospects; Nanotechnology and applications in food safety; Nanotechnology for food: delivery system; Nanostructured encapsulation systems: food antimicrobials. Barrier Packaging – Antimicrobial Packaging- Antimycotic Packaging- Bio-based Packaging- Bio-degradable Packaging- Active Packaging – Smart Packaging. Safety of Nanomaterials in Food

**Unit 4: (15 hrs)**

**Xenobiotics:** Definition, components, drug adverse reactions, nutrient drug interactions, industrial chemicals, Bio- dynamics of xenobiotics, overall metabolic fate of xenobiotic in the body Naturally occurring food toxicants and its elimination: Sources, toxicity, elimination- protease inhibitors, goitrogens, haemagglutinins, glucosinolates, cyanogens, saponins, gossypols, lathyrogens, favism and carcinogens.

**Unit 5: (15 hrs)**

**Role of Biotechnology in Food Industries:** Production of organic acids**,** vitamins, amino acids**-** downstream processing-Food additives, synthesis, sweeteners – glucose syrup and High Fructose Corn Syrup (HFCS): thickeners and gelling agents, xanthan gums. Food industry solid waste management – utilization and disposal, effluent treatment: resource recovery, recycle, reuse, treatment and disposal.

**Text Book:**

1. Green P.J (2002), Introduction to Food Biotechnology, CRC press, U.S.A

**References:**

1. Mansi, EMT, Bryce, CFA, Demain,A.L and Allman, R (2003) Fermentation Microbiology and Biotechnology, Taylor and Francis, NewYork,.
2. Primrose, S.B (2001), Molecular Biotechnology, second edition, Panima Publishing Corporation, New Delhi.
3. Satyanarayana, U, (2007). Biotechnology, Books and Allied (P) Ltd., Kolkata.
4. Fischer, A and F. Kampers (2011). Nanotechnology in the Agri-Food Sector: Implications for the Future - Wiley-VCH.

| Bloom's Taxonomy | K1 | K2 | K3 | K4 | K5 | K6 |
|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | 3 | 4 | | |
| CO 2 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO 3 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO 4 | | 2 | 3 | | 5 | 6 |
| CO 5 | 1 | | 3 | 4 | 5 | |

**Mean = 3.4**

**PFN 5309 Laboratory in Food Biotechnology (3hrs/wk) (3cr)**

Laboratory course on food biotechnology deals with isolation, purification, quantification of DNA and PCR applications. It also deals with fermentation and enzyme immobilization techniques. It covers wide range of topics from molecular biology to industrial applications for the improvement of food & food products.

**Course Outcomes**

Upon completion of this course, the student will be able to:

i. Understand the isolation and purification of DNA from food samples.
ii. Demonstrate on genetic analysis techniques.
iii. Ability to apply knowledge in determining the total proteins in foods.
iv. Evaluate on fermentation and enzyme immobilization techniques on foods.
v. Gain knowledge by relating the theoretical knowledge to practical implications.

## Laboratory Experiments:

1. Genomic DNA extraction and purification from food samples
2. DNA quantification using spectrophotometric method
3. Separation of DNA by Agarose gel electrophoresis
4. Polymerase chain reaction (PCR) application in genetically modified foods
5. Quantitative determination of total proteins in foods by Bradford method
6. Enzyme immobilization techniques
7. Fermentation of yeast and sugar
8. Visit to a food biotechnology laboratory/institute

**Text Book:**

1. Sambrook, J., & Russell, D. W. (2001). Molecular cloning: a laboratory manual.

**References:**

1. Iranpur, V.M., Esmailizadeh, A.K., 2002. Rapid Extraction of High Quality DNA from Whole Blood Stored at 4°C for Long Period, Department of Animal Science, Faculty of Agriculture, Shahrekord University, Shahrekord, Iran (Protocol online).

2. Panda, S. K. and Ravindran, B. (2013). Isolation of Human PBMCs. *Bio-protocol* 3(3): e323. DOI: 10.21769/BioProtoc.323.

3. Benzie, I. F., & Strain, J. J. (1996). The ferric reducing ability of plasma (FRAP) as a measure of "antioxidant power": the FRAP assay. *Analytical biochemistry*, *239*(1), 70-76.
4. Nollet, L. Marcel Dekke (2004). Handbook of food analysis: Methods and instruments in applied food analysis, New Delhi.

| **Bloom's Taxonomy** | **K1** | **K2** | **K3** | **K4** | **K5** | **K6** |
|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | 3 | 4 | | |
| CO 2 | 1 | 2 | 3 | 4 | | 6 |
| CO 3 | | 2 | 3 | 4 | 5 | 6 |
| CO 4 | 1 | | 3 | 4 | 5 | |
| CO 5 | 1 | 2 | 3 | 4 | 5 | 6 |

**Mean = 3.3**

**PFN 5311 LABORATORY IN FOOD MICROBIOLOGY (3h/wk) (3cr)**

The laboratory course focuses on microbiology of food, to detect the food borne pathogens. It also enables to analyse the microbiology of milk, processed and unprocessed foods.

**Course Outcomes**

Upon completion of this course, the student will be able to:

i. Evaluate the physical and chemical properties of Food Pathogens.
ii. Demonstrate the microbiology of water and milk.
iii. Apply methods to detect pathogens in foods.
iv. Demonstrate the isolation of specific cultures from foods.
v. Analyse the Processed and Unprocessed food.

**Laboratory Experiments**

1. Microbial isolation techniques. Isolation of bacteria and fungi

2. Establishment of pure cultures - streak, pour and spread plating techniques

3. Identification of microbes- Simple, differential, negative staining and spore staining methods.

4. Establishment of bacterial growth curve

5. Screening of microbes for the production of enzymes and hormones

6. Phylogenetic analysis of microbes

7. Microbial preservation techniques- patch plate, slant, water stock, glycerol stock and lyophilization.

8. Microbiology of Water

9. Microbiology of Milk

10. Microbiological analysis of typical processed food and unprocessed food.

**Text Book:**

**1.** Prescott, Harley and Klein- Microbiology-5 th edition; Publisher: McGraw Hill science 2002.

**Reference:**

**1.** John G. Holt, Bergey's Manual of Determinative Bacteriology. Lippincott Williams & Wilkins, 1993.

| **Bloom's Taxonomy** | **K1 Remembering** | **K2 Understanding** | **K3 Applying** | **K4 Analyzing** | **K5 Evaluating** | **K6 Creating** |
|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | 3 | 4 | 5 | |
| CO 2 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO 3 | 1 | 2 | | | 5 | 6 |
| CO 4 | | 2 | 3 | 4 | | |
| CO 5 | 1 | | 3 | 4 | 5 | 6 |

**Mean = 3.39**

**PFN 5504 CLINICAL NUTRITION AND DIET THERAPY (5+1=6h/wk) (5cr)**

This course provides knowledge on the importance of diet and their modifications along with the insights of nutrient and drug interactions.

**Course Outcomes:**

Upon successful completion of the project the students will be able to

Explain the physiological and metabolic role of various nutrients and their interactions in human nutrition

Discuss the principles of diet and nutrient modifications for cancer and AIDS

Plan the diet for Surgery, convalescence, burns and trauma patients

Compile diet management for eating disorders

Select or alter diet for the management of allergy, nervous system disorders and bone health disorders.

**1.Introduction to dietetics and dietary management in critically ill patients:** Definition and history of dietetics - Dietitian -Nutritional status assessment of the critically ill patients - Recent advances in techniques and feeding substrates - Enteral Nutrition support - Site, Different tube sizes, Different types of feeds, Composition and Delivery methods and its complications. Parenteral Nutrition - Type of access, Parenteral nutrition solutions/composition - Administration methods, Monitoring & complications; Code of ethics.

**2. Dietary management of cancer& AIDS:** Types, Etiology, Signs and symptoms, and diagnosis of cancers - Cancer therapy and its complications - Chemotherapy, Radiation therapy and Surgery. Dietary management for cancer patients.

Definition, Etiology, metabolic aberrations, signs and symptoms, phases of HIV, dietary modification, nutritional problems and its management through diet.

**3. Dietary management in Surgery:** Nutrition in wound healing - Stage of Convalescence - Dietary management for pre and post- surgical diets.

**Dietary management in Burns:** Classification and Complications - Metabolic changes in protein and electrolytes - Dietary management & mode of nutrition support for burns and wound management of burns.

**Dietary management in Trauma:** Physiological, metabolic and hormonal response to injury - Dietary management in trauma Dietary management in Sepsis - Definition and Dietary management of Sepsis with or without Multiple Organ Dysfunction Syndrome (MODS)

**4. Dietary management in Eating disorders:** Definition- Signs and symptoms and Complications/health risks - Diagnostic criteria and nutrition management in Anorexia Nervosa and Bulimia Nervosa.

**Dietary management in GI tract disorders:** Crohn's disease & Irritable Bowel Syndrome-etiology, symptoms and Complications, Medical and nutritional therapy.

**Dietary management in COVID 19:** Pathophysiology, symptoms, complications, diagnostic criteria and medical and nutritional therapy.

**5. Dietary Management in Nervous System Disorders** Etiology and Clinical features and Dietary management for – Parkinson's disease and Alzheimer's disease

**Dietary Management in Bone Health disorders** Prevalence, Types and Etiology and Role of Calcium, Phosphate & Vitamin D in Osteoporosis and Osteomalacia - Measurement of Bone Mass Using Bone Mineral Density (BMD) and Peak Bone Mass (PBM).

**Text Book:**

1. Swaminathan S. Advanced Textbook On Food & Nutrition Vol. 1 & N (2nd Ed. Revised _Enlarged) Bapp Co. 1985.

**References:**

1. Mahan L.K., Sylvia Escott-Stump (2000): Krause‟s Food Nutrition and Diet Therapy 10th Edition, W.B. Saunders Company London.

2. B. Srilakshmi, (2007): Dietetics, published by K.K. Gupta For New age International Pvt. Ltd. New Delhi.

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

4. Gopalan C., Ram Sastri B.V. And BalSubramaniam S.C., (2006) Nutritive Value of Indian Foods, Hydrabad, National Institute of Nutrition, Indian Council of Medical Research.

5. Passmore P. And M.A. East Wood: Human Nutrition And Dietetics, Churchill Living Stone.

| **Bloom's Taxonomy** | **K1 Remembering** | **K2 Understanding** | **K3 Applying** | **K4 Analyzing** | **K5 Evaluating** | **K6 Creating** |
|---|---|---|---|---|---|---|
| CO1 | | 2 | | 4 | | |
| CO2 | | | | 4 | 5 | 6 |
| CO3 | | 2 | | 4 | | |
| CO4 | | | 3 | | 5 | |
| CO5 | 1 | | | | 5 | |

**Mean = 3.72**

**PFN 5302 LABORATORY IN CLINICAL NUTRITION AND DIET THERAPY (4h/wk) (3cr)**

**Course Outcomes:**

Upon successful completion of the project the students will be able to

Demonstrate the method to plan and prepare diet for various diseases.

Design the principles of meal planning, diet therapy, therapeutic diets and nutrition support.

Create skill development in planning therapeutic diets using food exchange lists.

Evaluate the concept of food groups and exchanges for planning and preparing a balanced diet for various age groups and physiological conditions.

Make appropriate dietary modifications for various disease conditions based on the path physiology.

**Laboratory Experiments**

1. Planning and preparation of routine hospital diet: Clear fluid diet, Full fluid diet, Soft diet, High calorie and low-calorie diet, High residue and low residue diet.
2. Planning and preparation of diet for cancer.
3. Planning and preparation of diet for HIV.
4. Planning and preparation of diet for surgery.
5. Planning and preparation of diet for burns.
6. Planning and preparation of diet for eating disorders.
7. Planning and preparation of diet for Crohn's disease.
8. Planning and preparation of diet for IBS.
9. Planning and preparation of diet for Covid-19.
10. Planning and preparation of diet for Parkinson's disease.
11. Planning and preparation of diet for Alzheimer's disease.
12. Planning and preparation of diet for Osteoporosis.

**Text Book:**

1. Joshi, S. A (1998) Nutrition and Dietetics, 4th edition, Tata McGraw Hill Publications, New Delhi.

**References:**

Bhala S.M.L, Bhatia N, Gopinath (1983). Diet Manual for heart patient, CTC, AHMS, New Delhi.

Gibney M.J, Elia, M Ljingquist. O (2005), Clinical Nutrition, Blackwell Science Publishing Co. USA.

Robinson. C.H. et.al., (1986) Normal and Therapeutic Nutrition, 17thedition,MacMilian Publishing Co.

Raheena, B (2009) A Textbook of Food, Nutrition and Dietetics, Sterling Publishers, New Delhi.

| Bloom's | K1 | K2 | K3 | K4 | K5 | K6 |
|---|---|---|---|---|---|---|

| Taxonomy | Remembering | Understanding | Applying | Analyzing | Evaluating | Creating |
|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | 3 | 4 | 5 | |
| CO 2 | 1 | 2 | 3 | | 5 | 6 |
| CO 3 | | | 3 | 4 | | 6 |
| CO 4 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO 5 | 1 | 2 | 3 | 4 | 5 | 6 |

**Mean = 3.64**

**PFN 5304 Food Processing and Preservation (4/wk) (3cr)**

PFN 44

The course aims at food processing and preservation include principles of food storage, processing and preservation by heat and removal of water. It also includes cold preservation, preservation using irradiation, chemical preservatives and non-thermal methods.

**Course outcomes**

Upon completion of this course, the student will be able to:

i. Understand pre & post-harvest technologies and its role in providing better quality produce to the consumer.
ii. Plan a processing method to increase the shelf life using Thermal and non-thermal method of processing techniques.
iii. Choose the best processing techniques to be used for a specific group of produce.
iv. Compare the novel technologies with the traditional methods in food preservation.
v. Critique the importance of fermentation and pickling process to enrich the food for diversity of flavour and nutrients and eliminate the antinutrients.

**Unit 1: (10 hrs)**

**Pre & post-harvest processing:** Nature of harvested crop, plant & animal products. Maturity index – definition, principle, Assessment methods for various crops. Principles of storage: storage of grains – conditions and effects of cold storage on quality.

**Unit 2: (10 hrs)**

**Processing and preservation by heat:** Blanching, Pasteurization, sterilization and UHT processing, canning, extrusion cooking, dielectric heating, microwave heating, roasting and frying. Retort processing. Drying – types, principles, drying curve, water activity, microbial spoilage due to moisture. Dehydration of fruits, vegetables, and animal products – ultra filtration, reverse osmosis.

**Unit 3: (10 hrs)**

**Preservation using low temperature:** Refrigeration, freezing, CA, MA & freeze-drying-principles, mechanism of action, and effect on the quality of food product quality, advantages and disadvantages.

**Unit 4: (15 hrs)**

**Food irradiation and chemical preservation**: Food irradiation – history and mechanism, forms of radiant energy, principles of using electro-magnetic radiation in food processing, ionizing and non-ionizing radiation, advantages and disadvantages, regulations in food irradiation. Food additives and chemical preservatives- GRAS and permissible limits for chemical preservatives, advantages and disadvantages.

**Unit 5: (15 hrs)**

**Processing and principles using Non-thermal methods:** High-pressure processing, Pulse Electric field technology, Cold plasma technology, Power ultra sound, Dense phase CO2, SPF, hurdle technology – principles, advantages and disadvantages. Use and application of enzymes and microorganism in processing and preservation of foods. Food fermentation, pickling and smoking.

**Text Book**

1. Das, H. “Food Processing Operations Analysis”, Asian Books, 2005.

**References:**

1. Rao, M.A., S.S.H. Rizvi and A.K. Datta “Engineering Properties of Rood”, 3rd Edition, Taylor & Francis, 2005.
2. Majumdar, A.S. “Dehydration of Products of Biological Origin”, Oxford & IBH Publication, 2004.
3. Fellows, P.J. (2005). Food processing technology: Principle and Practice. 2nd Ed. CRC Publishers
4. Desrosier NW & James N. (2007). Technology of food preservation. AVI. Publishers

| **Bloom’s Taxonomy** | **K1** | **K2** | **K3** | **K4** | **K5** | **K6** |
|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | | | | |
| CO 2 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO 3 | | 2 | 3 | | | |
| CO 4 | 1 | 2 | 3 | 4 | 5 | |
| CO 5 | 1 | 2 | 3 | 4 | 5 | 6 |

**Mean = 3.1**

**PFN 5810** **Project** **(10hrs/wk)(8cr)**

This course aimed at orienting students towards research methodology and to do independent research work. The students will do experiments individually after designing them by standard statistical procedures followed by critical interpretation and drawing valid conclusions. The research project is evaluated at the end of the fourth semester.

**Course Outcomes:**

Upon successful completion of the project the students will be able to

i. Formulate a hypothesis to investigate on any particular issue
ii. Design a set of experiments to verify the formulated hypothesis
iii. Compile the set of data generated by the designed experimental setup
iv. Analyze the different parameters that are studied to verify the hypothesis
v. Communicate the outcome of the analytical approach to resolve the hypothesis

**PFN 4311 Exercise and Sports Nutrition (4 hrs/wk) (3 cr)**

The course aims at providing the Learners a complete knowledge to understand the Science of Exercise that will have an improved physiological understanding of how your body responds to exercise. It will give you the knowledge and skills you need in order to achieve your sports nutrition and athletic performance goals.

**Course Outcomes**

Upon completion of this course, the student will be able to:

i. Explain the body's adaptation to exercise and understand the physiology of exercise.
ii.Compile the importance of nutrition and its impact on sport performance.
iii.Critique the quality of protein and its importance in athlete's diet.
iv.Outlinethe effect of Ergogenic aids, nutaceuticals and herbal diuretics in sports nutrition.
v.Comprehensive understanding of how hydration status effects performance and exact recommended requirement of fluid pre, during, and post-exercise.

**Unit 1: (10 hrs)**

**Introduction to Exercise:** Definition – Types of Exercise - Physiology of Exercise - Fuels for Exercise - Acute Adaptations to Exercise (Cardiovascular Responses, Pulmonary System Adaptations, Hormonal Responses to Exercise, Immunological Adjustments) - Chronic Adaptations of Exercise (Skeletal Muscle Adaptations, Ligament and Tendon Adaptations, Metabolic Adaptations) - Absolute Contraindications to Exercise - Precautions with Exercise.

**Unit 2: (12 hrs)**

**Introduction to Sports Nutrition:** Definition and scope of Sports Nutrition - Diet and Performance - Importance of Sports Nutrition -Digestion, Absorption & Assimilation - Definition of Energy and ATP Measuring energy expenditure - Measuring Physical activity - Types of Competition/ event/ sport - Athletics - Track & Field - Team Sports - Individual Sports.

**Unit 3: (12 hrs)**

**Protein needs of athletes:** Complete and incomplete proteins - assessing the quality of protein - dietary sources of protein - proteins found in dietary supplements (gelatin protein, wheat protein, pea protein, beef, poultry, and fish protein, soy protein, egg protein, milk protein, whey protein, casein, bovine colostrum, fast and slow-proteins)- protein supplementation during training (egg protein, soy protein, milk protein, whey protein, bovine colostrum).

**Unit 4: (14 hrs)**

**Ergogenic Aids:** Definition, Benefits & Side effects- Anti doping agency - list of banned drugs/substances - Nutritional Ergogenic Aids - Ergogenic value of carbohydrates & High fibre carbohydrates, Ergogenic value of fat-related nutrients.Nutraceuticals (Beta-D-Glucan, Chitosan, Dietary Fiber, Guar Gum, Gum Arabic, Inulin, Pectin, Psyllium, Phaseolus Vulgaris Extract) – Herbal diuretics.

**Unit 5: (12 hrs)**

**Dehydration & Performance:** Assessing Fluid loss - Proper Pre-Hydration, Rehydration / fluid replacement - Electrolytes - Role of electrolytes in Muscular contraction- Electrolyte loss & exercise - Maintaining / Restoring electrolyte Balance - Sports &Energy drinks - Osmolality &osmolarity - Hypotonic, Isotonic, Hypertonic – Acclimatization.

**Text Book:**

1. Richard B. Kreider, 2019. Essentials of Exercise & Sport Nutrition: Science to Practice Kindle Edition.Lulu publishing services.

**References:**

1. Heather Mangieri ,2017.Fueling Young Athletes, Versa Press, United states of America.
2. O'Halloran, P and Bhogal, G (Eds). Exercise Medicine for Students: A one-stop resource for the knowledge and promotion of physical activity.

| Bloom's Taxonomy | K1 | K2 | K3 | K4 | K5 | K6 |
|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | 3 | 4 | | |
| CO2 | 1 | 2 | 3 | 4 | | 6 |
| CO 3 | 1 | 2 | 3 | 4 | 5 | |
| CO 4 | | 2 | 3 | 4 | 5 | |
| CO 5 | 1 | 2 | | 4 | 5 | 6 |

**Mean = 3.2**

**PFN 4313 Food Service Management (4h/wk) (3cr)**

The course aims at the basic principles of organization and management in the food service units and develops skills in food selection, purchase, storage and service of food and train students in implementing sanitary procedures in food services.

**Course Outcomes**

Upon completion of this course, the student will be able to:

i. Discuss about the scope of food industries.
ii. Explain the function of management organization.
iii. Plan about the developing of kitchen plant.
iv. Compare the electrical and non-electrical equipment's for food storage.
v. Outline the sanitation of plant and safety.

**Unit 1: (12 hrs)**

**Food Service:** Introduction, Definition of food service industry, principles of food service industry, objectives, types of food service industry.

**Unit 2: (12 hrs)**

**Tools of management:** Definition, classification – tangible tools, intangible tools, Organization chart, structure, function, work improvement techniques.

**Unit 3: (12 hrs)**

**Kitchen Layout:** Factors in menu planning for large groups, systems for maintaining quality in food preparation and service, types of kitchen, kitchen control and maintenance of Kitchen records.

**Unit 4: (12 hrs)**

**Financial Management:** Definition, managerial accounting,
**Costing:** definition of costing, cost, cost components, behavior of cost,
**Cost control:** food cost concept, method of controlling food cost,
**Food cost analysis:** pricing, definition, methods of pricing – cost plus and rate of returning, calculation of food cost statement, costing of dishes and meals

**Unit 5: (12 hrs)**

**Personnel management:** Definition, scope, concept of personnel management, approaches of personnel management, personnel policies, staff employment, training, placement, promotion, personnel records, work appraisals.

**Text Book:**

1. Bessie W B and Levelle W (1988). Food Service in Institutions. Sixth Edition. Mac million Publishing Company NewYork.

**References:**

1. Mohini S (2005). Institution Food Management. New Age International Publishers. New Delhi.
2. Mohini Sethi and Surjeet Malhan, 2015. Catering Management An Integrated Approach,New Age International Publishers, 3rd Edition.
3. Thangam Philip (2008). Modern Cookery for Teaching and Trade. Part I & II Orient Longman, Chennai.

PFN 50

| Bloom's Taxonomy | K1 | K2 | K3 | K4 | K5 | K6 |
|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | | | | |
| CO2 | 1 | 2 | 3 | | | |
| CO3 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO4 | | 2 | 3 | 4 | 5 | |
| CO5 | | 2 | 3 | 4 | 5 | 6 |

**Mean = 3.2**

**PFN 4314 Obstetrics and Neo Natal Nutrition (4hrs/wk) (3cr)**

The course deals with the basic sciences relevant to obstetrics and gynecology. It provides effective and adequate care and diet to the obstetrical and neonatal diseases.

**Course Outcomes**

Upon completion of this course, the student will be able to:

i. Explain the biochemical and endocrine changes during pregnancy.

ii. Discuss the signs and symptoms along with complications.

iii. Outline the anatomy and physiology of foetus and the principles of diet and nutrient modifications for the growth and development of foetus

iv. Outline the importance of lactation in neo natal nutrition and awareness on the immunization schedule.

v. Compute the required RDA as per ICMR guidelines for Pregnancy, Lactation and infancy.

**Unit 1: (12 hrs)**

**Pre-natal Period:** Signs & symptoms, Biochemical and endocrine changes during pregnancy, complications – Food fads & taboos.

**Unit 2: (12 hrs)**

**Foetal Growth and Development:** Anatomy of foetus, foetal physiology and foetal circulation - Development, structure and function of placenta, umbilical cord and amniotic fluid- importance of micro nutrients.

**Unit 3: (12 hrs)**

**Postpartum Period:** Risk in Labour- Still birth -Pre-mature- cord around the neck- Crosssection.

**Unit 4: (12 hrs)**

**Neo natal nutrition:** Lactation -Importance of breast feeding- Infant Formula– identify normal and sick neonates – immunization schedule.

**Unit 5: (12 hrs)**

**Nutritional and Food Requirements:** ICMR guidelines for Pregnancy, Lactation and infancy - nutritional needs and diet plan.

**Text Book:**

1. Chatterjee CC (1988) Text Book of Medical Physiology. W B Saunder's Co. London.

**References:**

1. Srilakshmi B (2014) dietetics, 7th edition, New Age International (P) Ltd, Publishers

2. Guyton (1991) Human physiology and Mechanism of diseases. W.B Saunders and Co.London.

| Bloom's Taxonomy | K1 | K2 | K3 | K4 | K5 | K6 |
|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | | 4 | | |
| CO 2 | 1 | 2 | | | | |
| CO 3 | 1 | 2 | 3 | 4 | 5 | |
| CO 4 | | 2 | 3 | 4 | 5 | 6 |
| CO 5 | 1 | 2 | 3 | 4 | 5 | 6 |

**Mean = 3.1**

**PFN 4316 Nutrition in Mental Health (4 hrs/wk) (3 cr)**

The course aims at providing a wide knowledge on common mental illness and the way to manage through foods and specific function and effects of its components. This course also deals with the food addiction and stress management.

**Course outcomes**

i. Discuss on food addiction and mental health problems in various age groups.
ii. Analyze the role of food in mental health.
iii. Identify the role of lipids for a healthy mind.
iv. Outline the different mental disorders and role of nutrients for prevention and management.
v. Critique the stress and its effect on mental health.

**Unit 1: (6 hrs)**

**Mental health problems and food addiction-** Mental health problems in adults, children, adolescence, pregnancy and aging.Food addiction- Alcohol addiction, Caffeine addiction.

**Unit 2: (6 hrs)**

**The role of food in mental health problem-** The role of diet in relation to specific mental health problem, Nutritional factors affecting mental health; The intersections of nutrition and the mind, Nutrition for the brain, Contents of meal affect the brain.

**Unit 3: (6 hrs)**

**Role of lipids in mental health-** EFA, anger & anxiety, violent behavior and EFA, effect of cholesterol in mental health and cholesterol lowering drugs and nutrients.

**Unit 4: (6 hrs)**

**Role of nutrients in mental disorders-** Nutrients and autism- Role of lipids, proteins, carbohydrates, vitamins & minerals, Nutrients in attention deficit hyperactivity disorder- Role of lipids, carbohydrates, vitamins and minerals.

**Unit 5: (6 hrs)**

**Nutrition in stress-** Stress and food carvings, glucocorticoids and the brain, Essential fatty acids and the brain, Nutrition and stress and the developing fetus.

**Text Book:**

1. FeliceJacka, Brain Changer: The Good Mental Health Diet, Macmillan Publishers Aus., 26-Feb-2019 - Health & Fitness

**References:**

1. Patrick Holford, Optimum Nutrition for the Mind, ReadHowYouWant.com, 21-Apr-2009 -Health & Fitness
2. Ruth Leyse-Wallace, Nutrition and Mental Health, CRC Press, 29-Jan-2013 - Medical
3. Shlomo Yehuda, David I. Mostofsky, Nutrients, Stress and Medical Disorders, Springer Science & Business Media, 2006 - Medical

| Bloom's Taxonomy | K1 | K2 | K3 | K4 | K5 | K6 |
|---|---|---|---|---|---|---|
| CO 1 | | 2 | | 4 | | 6 |
| CO 2 | | 2 | | | 5 | |
| CO 3 | | 2 | 3 | 4 | | |
| CO 4 | | 2 | 3 | 4 | 5 | |
| CO 5 | | 2 | 3 | 4 | 5 | |

**Mean = 3.5**

**PFN 4318 Tamil Traditional Foods (4hrs/wk) (3cr)**

The course aims at to understand the historical perspective of traditional foods. It critically evaluates the methods of preparation of ethnic foods.

**Course Outcomes**

Upon completion of this course, the student will be able to:

i. Understand the historical perspective of nutrient requirements
ii. Explain the emerging concepts in nutrition.
iii. Critically evaluate the methodology and derivation of requirements for specific macronutrients.
iv. Apply the importance of nutrition immunity interactions and their implications.
**v.** Identify various measures for enhancing nutritional quality of diets

**Unit 1: (10 hrs)**

**Traditional food style**: History – Concept and Principles of Traditional Foods – Benefits and nutritional content of Traditional Foods.

**Unit 2: (12 hrs)**

**Healthy aspects of traditional foods:** National health benefits - impacts of consuming traditional foods.

**Unit 3: (14 hrs)**

**Religious and Ethnic diversity:** Food in Christianity, Hindu. Halal Requirements for Meat, Poultry and Seafood based on religious and cultural practices. Halal Certification.

**Unit 4: (12 hrs)**

**Fermented Ethnic Foods:** Traditional fermented foods and drinks. Principles of downstream processing and Product recovery.

**Unit 5: (12 hrs)**

**Traditional Cooking Methods:** Traditional chimney kiln, modern mechanical fish smoking kiln, examples of smoked and dried products.

**Text Book:**

1. Kristbergsson K and Oliveira J (2016) Traditional foods: general and consumer aspects. Springer, New York.

**Reference:**

1. Pathak YV (2011) Handbook of nutraceuticals Volume 2, CRC Press, USA.

| Bloom's Taxonomy | K1 | K2 | K3 | K4 | K5 | K6 |
|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | 3 | 4 | 5 | |
| CO4 2 | 1 | 2 | 3 | 4 | 5 | |
| CO 3 | 1 | 2 | | 4 | | |
| CO 4 | 1 | 2 | 3 | 4 | 5 | 6 |
| CO 5 | 1 | 2 | 3 | | 5 | 6 |

**Mean = 3.1**