

REVISED CURRICULUM AND SYLLABI

(With effect from the academic year 2021 – 2022)

Modified in the Annual Board of Studies meeting held on 11.08.2021

M.Sc. Food, Nutrition and Dietetics



**Department of Food, Nutrition & Dietetics
College of Science and Technology
Andhra University**

M.Sc. FOOD, NUTRITION AND DIETETICS
(Credit based Semester System)
(Effective from the academic year 2021-22)
Scheme of Instruction and Examination

Paper No	Title of the paper	Hours/ week	Duration of Exam	Max. Marks	Credits
I Semester					
<u>Theory</u>					
FND 1.1	Food Chemistry	4	3	100	4
FND 1.2	Food Science	4	3	100	4
FND 1.3	Human Physiology	4	3	100	4
FND 1.4	Advanced Nutrition I	4	3	100	4
<u>Practical</u>					
FND 1.5	Food Chemistry	3	4	50	2
FND 1.6	Food Science	3	4	50	2
Total Marks and credits for I Semester				500	20
II Semester					
<u>Theory</u>					
FND 2.1	Food Processing & Preservation Technology	4	3	100	4
FND 2.2	Food Analysis & Instrumentation	4	3	100	4
FND 2.3	Nutritional Biochemistry	4	3	100	4
FND 2.4	Advanced Nutrition II	4	3	100	4
<u>Practical</u>					
FND 2.5	Food Processing & Preservation Technology	3	4	50	2
FND 2.6	Food Analysis & Instrumentation	3	4	50	2
FND 2.7	Nutritional Biochemistry	3	4	50	2
FND 2.8	Advanced Nutrition II	3	4	50	2
Total Marks and credits for II Semester				600	24
III Semester					
<u>Theory</u>					
FND 3.1	Food Microbiology & Toxicology	4	3	100	4
FND 3.2	Clinical and Therapeutic Nutrition	4	3	100	4
FND 3.3	Institutional Food Administration	4	3	100	4
FND 3.4	Research Methodology & Statistics	4	3	100	4
<u>Practical</u>					
FND 3.5	Food Microbiology & Toxicology	3	4	50	2
FND 3.6	Clinical and Therapeutic Nutrition	3	4	50	2
FND 3.7	MOOCs course I	-	-	100	4
FND 3.8	Intellectual Property Rights	-	-	50	2
Total Marks and credits for III Semester				600	24
IV Semester					
<u>Theory</u>					
FND 4.1	Nutrition in Critical Care & Diet Counselling	4	3	100	4
FND 4.2	Sports Nutrition	4	3	100	4
<u>Practical</u>					
FND 4.3	Nutrition in Critical Care & Diet Counselling	3	4	50	2
FND 4.4	Internship	4	4	100	4
FND 4.5	Dissertation based on Project work	8	8	200	8
FND 4.6	Comprehensive Viva-voce	4	4	50	2
FND 4.7	MOOCs II	-	-	100	4
FND 4.8	Entrepreneurship	-	-	50	2
Total Marks and credits for IV Semester				700	28
Grand Total of Marks and Credits for 4 Semesters				2400	96

* Theory marks include 20 marks for internal assessment and 80 marks for semester-end examinations.

Program Outcomes (POs)

PO1	Encompass exceptional knowledge in core areas of Diet therapy, Clinical Nutrition, Food Science, Food Analysis and Nutritional management
PO2	Achieve cognizance in interdisciplinary fields of Food Microbiology, Food processing technology, Nutritional Biochemistry, Food safety and Sports Nutrition through knowledge fortification
PO3	Develop multidisciplinary proficiency in contemporary domains through availing MOOCS and value-added courses
PO4	Accomplish dexterity in all the fields under the umbrella of Food, Nutrition and Dietetics to attain practical competency
PO5	Impregnate adept expertise and hands on experience through Dissertation, project work, internship/industrial training, field trips, food institutional and industrial visits
PO6	Amass exploratory research skills with innovative ideas, lab to field technology, systemic approach towards achieving sustainable nutrition goals
PO7	Employ critical thinking towards innovation, synthesis of novel ideas, knowledge dissemination and community interaction for the benefit of the community and society at large
PO8	Develop problem solving, decision making and communication skills to emerge as a potential leader
PO9	Evolve as a professionally sound wellbeing with societal responsibility fortified with moral and ethical values well equipped for nation building

Program Specific Outcomes (PSOs)

PSO1	Emanate as an adept in all the core spheres of Food, Nutrition and Dietetics theory as well as practical aspects
PSO2	Competent to pursue career in newer areas of Dietetics as Renal Dietitian, Keto dietitian, Paediatric Dietitian, and Sports nutritionist
PSO3	Become a successful professional and entrepreneur to start a food industry, food business and NGOs
PSO4	Ability to create value added products, synthesize novel approaches relating to diet formulations in the prevention and management of disease
PSO5	Well-equipped with current scenario in the field of personalized nutrition with reference to nutrigenetics and Gut Microbiome and take up research
PSO6	Acquire exhaustive skills in planning, monitoring and evaluation of nutrition and health programs
PSO7	Capability to develop distinctive functional food based products for different age groups to nurture healthy society
PSO8	Take up professions in community upliftment programmes and critically evaluate Nutrition schemes and their implementation
PSO9	Transcend as Academicians and Researchers in reputed academic and research institutions

FND 1.1 FOOD CHEMISTRY

Course Outcomes

1. Assimilate the synergistic integration of food physics and food chemistry
2. Acquire knowledge on carbohydrate, fruit and vegetable chemistry
3. Gain knowledge on chemistry of plant and animal foods
4. Comprehensive know-how on the identification of rancidity of oils and fats
5. Explore the molecular mechanisms in perception of flavours and colours

Course Specific Outcomes

1. Understand the molecular composition and chemistry of major and minor components in foods
2. Understand the uses of novel enzymes in food industry
3. Perceive the importance of gums and non-nutritive sweeteners in food and health industry
4. Evaluate and compare the industrial uses of plant and animal proteins
5. Grasp the current innovative technologies for structured lipids

Learning Outcomes

1. Enable students to better understand the role of chemistry in food
2. Apply the concepts of food chemistry in food preparation
3. Familiarise students with how chemistry impacts quality and highlights its role in creating novel foods
4. Understand the interaction of food and medium of cooking
5. Explore the nuances in natural flavour and colour extraction and encapsulation

FND 1.1 FOOD CHEMISTRY

Course Content**UNIT I**

Introduction to Food Chemistry- Moisture in foods, Free & bound water, states of water, factors influencing boiling point and freezing point of water. Physics and Food- Solids, liquids and gases. Dispersions- True solutions, colloidal solutions & suspensions, Gels, emulsions and foams. Types of enzymes in foods, functions and use of enzymes in Food Industry.

UNIT II

Carbohydrate chemistry – Classification, chemical reactions of carbohydrates, structure, Types of starches, physical and chemical properties of starches, structure, Modified starches, non-starch polysaccharides- Cellulose, hemicellulose, pectin & Gums, types of gums and their uses in food industry, Commercial sugars & Non-nutritive sweeteners

Vegetables and fruits: structural constituents of fruits and vegetables, changes during maturation, changes in pectic substances, post-harvest changes, browning reactions, Phytochemical constituents in food and its role in food industry

UNIT III

Protein Chemistry - Chemical and physical properties of proteins, structure, denaturation & coagulation, theories of gel formation, collagen and gelatine, extraction of pure proteins from foods, Plant proteins, Animal Proteins- Animal muscle structure, connective tissue, adipose tissue, post mortem changes, colour of meat, tenderness and juiciness. Structure & properties of poultry, & fish meat, structure of egg, egg proteins & Milk Proteins

UNIT IV

Lipid chemistry- Fatty acids, structures, types of edible fats and oils, crystallinity of solid fats, physical and chemical properties of fats, flavour changes, rancidity, methods of evaluation of rancidity, reversion, shortening value of fats, Fat substitutes & Structured lipids

UNIT V

Food flavours, pigments and colours - Molecular mechanism of flavour perception, Flavour compounds from vegetables, fruits, spices, milk and meat products, role of flavours in food products, flavour encapsulation. Pigments in Animal and Plant tissues (Haeme compounds, chlorophyll, carotenoids, flavonoids) classification, structure and properties, Effects of processing and cooking on pigments in foods. Factors influencing stability of colours in foods, role of synthetic colours in food products and safety limits

FND 1.1 FOOD CHEMISTRY

BOOKS AND JOURNALS

1. Meyers LH. (1969) Food Chemistry, Van Nostrand Reinhold Co.
2. Sri Lakshmi L (2004) Food Science. New Age Int.
3. Pecham GG, Foundation of food preparation.1972. Mac millan Pbs.
4. Potter NH and Hotchkiss JH (1996) Food Science. 5thed.. New Delhi, CBS pbs.
5. Sethi M and Rao SE (2001) Food science experiments and application. CBS pbs. New Delhi.
6. Fennema's Food Chemistry, 4th edition, Srinivasan Damodaran, Kirk L Parkin, Owen R.Fennema
7. Food Chemistry A Laboratory Manual, Dennis D.Miller (1998
8. Principles of Food science- A Practical Manual (2013) EramS.Rao
9. Food Quality Evaluation (2013) EramS.Rao
10. Journal of Food chemistry
11. Indian food Industry - AFST Pbs
12. J of Food Sc. And Technology- AFST Pbs.

FND 1.2. FOOD SCIENCE

Course Outcomes

1. Understand the food groups and their and functions
2. Acquire knowledge on principles of cereal and sugar cookery
3. Gain knowledge on changes during cooking of pulses and meats
4. Comprehend the knowledge on use of oils, spices and condiments in cooking
5. Acquire knowledge on concept of novel food product development

Course Specific Outcomes

1. List and classify foods based on its nutritive value and understand the properties of food
2. Criticize the factors affecting cooking quality
3. Understand the importance of nutritive breakfast cereals in present world
4. Evaluate the nutrient losses during cooking
5. Learn methods of preparing convenience foods for defence services

Learning Outcomes

1. Enable students to use the theoretical knowledge in various applications and food preparations
2. Develop skills in cooking and apply the scientific principles while making new recipes
3. Familiarise students with changes occurring in various foodstuffs as a result of processing and cooking.
4. Design and create novel instant and value-added products
5. Evaluate the acceptability of food products and apply the sensory evaluation methods for testing on new product

FND 1.2. FOOD SCIENCE

Course Content

UNIT-I

Introduction to food Science- Food groups, food in relation to health, General Methods of cooking- dry and moist heat methods, microwave and solar cooking, advantages and disadvantages, Nutrient losses during cooking. Sensory Evaluation of Foods- **Introduction to sensory analysis, threshold concentrations of primary tastes, effect of Temperature on taste, physiological basis of sensory evaluation, Neural networks in sensory analysis**, sensory characteristics of food, selection of taste panel, types of tests used for sensory evaluation

UNIT-II

Cereals & Millets- Types, Composition, nutritive value, Cereal cookery and changes during cooking, gelatinization, dextrinization, retrogradation and syneresis. Non enzymatic browning. Composition of commonly consumed cereal products, Breakfast cereals, Principles of baking, different types of flours for baking, Role of leavening agents in baking, methods of preparation of breads, biscuits, cakes and pastry. Sugar cookery- stages of sugar cookery, amorphous and crystalline candies, Sugar related products

UNIT-III

Pulses- Types, Composition, nutritive value, Pulse cookery, Anti nutritional factors, types and composition of pulse-based products, Milk & Milk products- Composition, coagulation, types of milk, Milk cookery, Changes during cooking, methods of preparation of milk products- cheese, butter, cream.

Flesh Foods: Meat & Poultry- Composition, nutritive value, cuts of meat, post-mortem changes, and methods of cooking, factors affecting tenderness. Fish: Composition, types of fishes, selection & cooking methods. Eggs: Composition, nutritive value, selection, storage, methods of cooking & changes during cooking

UNIT-IV

Fats and Oils- Types, energy value, Composition, sources, role of fats & oils in cookery, composition of unconventional oils

Fruits and Vegetables- Types, composition, nutritive value, sources, effect of cooking on plant pigments and cooking methods. Composition & Nutritive value of Beverages: Tea, Coffee, & Cocoa, Nuts and Oil seeds, Spices and condiments

UNIT-V.

Food Product Development- Hypothetical proposal for new product development, enhancement of nutritive Value, role of Ingredients, Cost Effectiveness, Value Addition, Convenience foods for defence services –Methods of preparation of dehydrated vegetables, vegetable powder, dehydrated fruit slices, fruit bars, fruit milk, soup powder. Foods designed by DFRL for defence services

FND 1.2. FOOD SCIENCE

BOOKS AND JOURNALS

1. Meyers LH. (1969) Food Chemistry, Van Nostrand Reinhold Co.
2. Sri Lakshmi L (2004) Food Science. New Age Int.
3. Pecham GG, Foundation of food preparation.1972. Mac millan Pbs.
4. Swami Nathan M (1992) Handbook of Food Science and Experimental foods. 2nd Ed. Bangalore.
5. Potter NH and Hotchkiss JH (1996) Food Science. 5thed.. New Delhi, CBS pbs.
6. Sethi M and Rao SE (2001) Food science experiments and application. CBS pbs. New Delhi.
7. Principles of Food science- A Practical Manual (2013) EramS.Rao
8. Food Quality Evaluation (2013) EramS.Rao

FND 1.3 HUMAN PHYSIOLOGY

Course Outcomes

1. Understand the current state of knowledge about the cellular organization of the human body
2. Develop insight of physiological functioning of all digestive and renal systems
3. Gain knowledge on blood components and immunological aspects
4. Understand the physiological aspects of endocrine system and hormones
5. Comprehend the knowledge on muscle and bone physiology

Course Specific Outcomes

1. Distinguish the physiological functions of organs in the body
2. Perceive the role of immune changes in malnutrition
3. Correlate physiology with various disorders and their pathogenesis
4. Elaborate on the regulation of body fluids, acids and bases
5. Learn the role of nervous system in sleep and memory

Learning Outcomes

1. Illustrate the role of gut in digestion and absorption
2. Understand and distinguish the functions at cellular level
3. Comprehend the pathophysiology of commonly occurring diseases
4. Get an insight of role of exercise in building bone and muscle strength
5. Get sensitized about urinary and respiratory systems and their functions

FND 1.3 HUMAN PHYSIOLOGY

Course Content**UNIT-I**

Introduction to cell structure and function: Levels of cellular organisation and function- organelles, tissues, organs and systems, Brief review of Cell membrane, Transport mechanisms across cell membrane (diffusion, osmosis, facilitated diffusion & active transport) and intercellular communication, Regulation of cell multiplication

Respiratory system - Structural plan of respiratory system, Mechanism of respiration, pulmonary ventilation, Chloride shift, Control of respiration

UNIT- II

Digestive system- Anatomy of Gastrointestinal Tract including liver, pancreas & gall bladder, Physiological functions of Gastrointestinal Tract, Digestion and Absorption of Macro and micro nutrients, regulation of food intake, digestion and absorption

Urinary system -Anatomy and functions of the kidneys, structure and types of Nephrons, renal physiology, Glomerular Filtration rate and its regulation, Mechanism of urine formation, Maintenance of acid base balance, Water and electrolyte balance.

UNIT-III

Blood-Composition of blood, Functions of cellular components, their significance, blood Groups. Clotting of blood, Erythropoiesis.

Cardiovascular System- Structure of heart, cardiac cycle, cardiac output, Structure and functions of blood vessels, Blood pressure and its control mechanism.

Brief outline of lymphatic system and immunity. Types of immunity, humoral and cell mediated immunity, cells of the immune system, immune response, **immune changes in malnutrition**

UNIT-IV

Endocrine system - Endocrine glands, mechanism of hormone action, Syndromes resulting from hypo and hyperactivity of pituitary, thyroid, parathyroid, adrenal, pancreatic and other hormones.

Nervous system: Organisation, structure and function of Nervous system, structure and functions of neurons, Overview of physiological functions of neurotransmitters& spinal cord, structure and function of Brain, Blood Brain Barrier, role of nervous system in sensation, sleep, learning & Memory.

UNIT-V

Skeletal system - Structure and functions of bone, Histology of bone tissue, bone formation, bone growth, bones and homeostasis, Types of bones and joints. Muscular system - Structure, types and functions of muscle tissue, anatomy of muscle fiber, types of muscle fibres. Contractions of muscle fibers.

FND 1.3 HUMAN PHYSIOLOGY

BOOKS

1. Tortora SJ and Grabowski SR (2004) Principles of anatomy and Physiology. New York, John Wiley and Sons
2. McArdle W, Katch F, Katch V (1996) Exercise Physiology. Energy, Nutrition and Human Performance. 4th ed. Williams and Wilkins, Philadelphia
3. Human Physiology&health , David Wright (2004)
4. Fundamentals of Human Physiology, Stuart Ira fox (2008)
5. Human Anatomy and Physiology, S.B.Bhise, AV.Yadav, NiraliPrakashan (2005)
6. Handbook Of General Anatomy, B.D. Chaurasia, Third Edition (1996)
7. Review Of Medical Physiology, William F.Ganong, MD , 20 th Edition.
8. Elements Of Human Anatomy Physiology& Health Education by Ramesh K.Goyal
9. Physiology, Council Medical Physiology, SujataK.Chandhuri,NCBA(Publishing) Ltd. Kolkata, India

1.4 ADVANCED NUTRITION I

Course Outcomes

- CO1. Understand the nutritional problems of energy imbalance
- CO2. Knowledge on different nutrient requirements for different age groups
- CO3. Gain knowledge on the effects of micronutrient deficiency
- CO4. Understand the role of vitamin like nutrients in health and diseases
- CO5. Understand the knowledge on nutritional regulation of gene expression

Course Specific Outcomes

- CSO1. Understand the role of different nutrients in normal health.
- CSO2. Comprehend the functions of vitamin like molecules
- CSO3. Understand the importance of non-nutritive components on human health
- CSO4. Analyse the interaction of nutrients with other nutrients and anti-nutrient substances
- CSO5. Get insight into the newer aspects of nutrient- Gene interactions

Learning Outcomes

- LO1. Relate metabolism of macro and micro nutrients with health
- LO2. Understand the reasons for malnutrition, under nutrition and over nutrition
- LO3. Associate knowledge of nutrients with their deficiencies.
- LO4. Apply the knowledge in determining the nutritional requirements
- LO5. Acquire skills to overcome nutritional deficiency diseases

1.4 ADVANCED NUTRITION I

Course Content

UNIT-I

Introduction to Nutrition Science, Progress of nutrition research in India, Recommended Dietary Allowances, Energy- Components of Total Energy Expenditure (TEE), Factors affecting TEE, Measurement of Energy expenditure, Energy content of foods, Estimating Energy requirements, Associated nutritional problems of energy imbalance- Under nutrition & Obesity

UNIT-II

Carbohydrates- Types, Functions, sources, Dietary requirements and recommended allowances, Glycaemic index of foods, Fructo oligo saccharides, Dietary Fibre, sources, requirements and its role in prevention of disease.

Proteins - Types, Functions, sources and recommended allowances. Functions of amino acids. Quality of Proteins, PDCAAS, Protein Energy Malnutrition .

Lipids- Functions, types, sources and the recommended allowances, Essential fatty acids, functions, requirements and its deficiency, Role of n3 & n6 in health and disease, Trans fatty acids, Prostaglandins, Cholesterol. Importance of Medium Chain Triglycerides

UNIT-III

Vitamins- Water- and Fat-soluble Vitamins –Sources, functions, deficiency symptoms, toxicity, bioavailability and recommended allowances

Minerals- Ca, P, Mg, Na, K and trace minerals, Sources, functions, deficiency, toxicity, Bio availability and recommended allowances

UNIT-IV

Non-Nutritive food components with potential health effects: Polyphenols, Tannins, Phytates, Phytoestrogens, cyanogenic compounds, lectins and saponins, Vitamin Like Molecules - Choline, carnitine, inositol, taurine-chemistry, metabolism, functions, deficiency and excess, Antioxidants – Definition, mechanism of action, free radicals, natural and diet derived antioxidants

UNIT-V

Nutritional regulation of Gene expression- Influence of Gene-Nutrient interactions on metabolic processes & Gene expression

Food, Nutrient & drug interactions, nutrient-nutrient interactions, food-nutrient interactions, interdependence between nutrients and hormones, Nutraceuticals& Functional foods in prevention of diseases

1.4 ADVANCED NUTRITION I

BOOKS AND JOURNALS

1. Shills ME, Olson JA, Shike N, Ross AC (1999): Modern Nutrition in Health and Disease. 9th Ed. Williams and Wilkins
2. Mahan LK & Ecott- Stump S (2000): Krause's Food, Nutrition and Diet therapy, 10th ed. WB Saunders Ltd.
3. Anderson L, Dibble M, Mitchell N (1982) Nutrition in health and disease (17th ed). Philadelphia: JB. Lippincott co.
4. McArdle W, Katch F, Katch V (1996) Exercise Physiology. Energy, Nutrition and Human Performance. 4th ed. Williams and Wilkins, Philadelphia
5. Bamji M, Prahlad Rao N, Reddy V (2000). Text book of Human Nutrition. Oxford and IbH publishing Co. Pvt.Ltd..
6. Swaminathan M(1985) Essentials of Food and Nutrition. Vol I and II.
7. Gopalan C and Narasinga Rao B(1988) Dietary Allowances for Indians. NIN
8. Nutrition Reviews
9. Annals of Nutrition and Metabolism
10. British J of Nutrition

FND 1.5. FOOD CHEMISTRY

1. Qualitative tests for identification of different sugars
2. Estimation of reducing sugars by Lane –Eynon method
3. Microscopic examination of starch from different sources
4. Gelatinization temperature of range and % sag of various cereal starches
5. Experiment on Hydrolysis of starch from different sources
6. Experiment on Properties of Starch and dextrin
7. Precipitation reactions of proteins, colour reactions of proteins, Reactions of Albumin, Casein and Gelatine.
8. Development of Gluten from various flours and study of its properties
9. Determination of Specific gravity of foods (Milk & Oils)
10. Determination of Acidity in foods (Milk & Oils)
11. Estimation of Chlorophyll content in vegetables
12. Estimation of Pectin content of fruits and vegetables

FND 1.6. FOOD SCIENCE

1. Survey of locally available foods in the market
2. Preparation of recipes using different cooking methods- Boiling, pressure cooking, grilling, simmering, poaching, stewing, frying, roasting and baking
3. Sensory Evaluation of Foods using different sensory tests
4. Factors affecting Gelatinization & Dextrinization of cereal starches. Preparation of recipes based on gelatinization & Dextrinization
5. Study of Stages of sugar cookery. Preparation of recipes using different stages of sugar cookery.
6. Study of germination of whole pulses.
7. Fermentation in cereals and pulses. Preparation of recipes using fermentation method
8. Factors affecting coagulation of milk proteins. Recipes using milk and milk products
9. Gel formation in foods, preparation of recipes using gelatine and egg protein
10. Effect of different methods of cooking on flavour, colour, texture and palatability of flesh foods
11. Effect of various cooking factors on pigments and texture of vegetables.
12. Effect of enzymatic browning in fruits and vegetables goods

2.1. FOOD PROCESSING AND PRESERVATION TECHNOLOGY

Course Outcomes

- CO1. Understand the Knowledge of principles and methods of preservation.
- CO2. Understand the different methods of processing foods.
- CO3. Recollect the food safety system and quality attributes
- CO4. Aware of laws governing food packaging and labelling
- CO5. Get insights into newer concepts of application of Biotechnology in food industry

Course Specific Outcomes

- CSO1. Gain expertise in recent food processing and preservation technologies
- CSO2. Ability to choose appropriate food processing techniques for better preservation
- CSO3. Evaluate the advantages of different processing methods
- CSO4. Comprehend the knowledge on food laws and food safety regulations by FSSAI
- CSO5. Elucidate the nutritional and safety aspects of implications of biotechnology in foods

Learning Outcomes

- LO1. Apply the Knowledge of basic and applied aspects of food processing and technology
- LO2. Choose appropriate packaging materials and interpret labelling information
- LO3. Relate the theoretical Knowledge of Processing Techniques in food product development
- LO4. Compare the novel technologies with the traditional methods in food preservation
- LO5. Knowledge of potential use of various by-products of food industry

2.1. FOOD PROCESSING AND PRESERVATION TECHNOLOGY

Course Content

UNIT I

Principles of food processing and preservation- Preservation by traditional methods, Low and high temperatures, Canning, osmotic pressure, dehydration & drying, Irradiation. & Use of Preservatives, Food additives, Definition, types, importance and industrial uses of Food additives. **Recent advances in food processing and preservation – nanotechnology, hurdle technology, pulse electric field technology and minimal processing for preservation of fresh foods**

UNIT II

Technology of food processing- Processing technology of cereals, legumes, oilseeds, fruits & vegetables, milk & milk products and animal foods, **processing technology of spices, extraction of essential oils, colours, storage and preservation of spices**, examples of processed foods with value addition, Equipment commonly used in processing and preservation of foods, by product utilisation from food processing industries.

UNIT III

Food fortification and enrichment technology-current trends & applications. Fermentation technology of various fermented products, Milk products, beverages, vegetables, fermented soya products. Extrusion technology- merits & demerits, Food safety and quality control- Food adulteration, Food laws and regulations, FSSAI and its role, Hygiene, Methods of quality control in food industries, GMP, GHP, HACCP,

UNIT IV

Food Packaging technology- recent Concepts, basic packaging materials, types of packaging, Effects of packaging on nutritive value of foods, packaging of different food products. Nutrition labelling, Recent developments in Food Labelling

UNIT V

Food Biotechnology- Development and progress of biotechnology related to food production and processing, scope and importance. Impact of biotechnology on the nutritional quality of foods. Single cell protein and mycoprotein, Role of biotechnology in the production of food additives synthesis – citric acid, gluconic acid High fructose corn syrup (HFCS), thickeners and gelling agents and xanthan gums, Genetically modified foods – need, challenges, potential benefits, nutritional improvement, issues of concern

2.1. FOOD PROCESSING AND PRESERVATION TECHNOLOGY

BOOKS AND JOURNALS

1. Sri Lakshmi B (2004) Food Science. New Age Int.
2. Pecham GG, Foundation of food preparation.1972. Mac millan Pbs.
3. Subbulakshmi G and Udipi A. 2004. Food Processing and Preservation techniques. New Age Int.
4. Swaminathan M (1992) Handbook of Food Science and Experimental foods. 2nd Ed. Bangalore.
5. Potter NH and Hotchkiss JH (1996) Food Science. 5thed.. New Delhi, CBS pbs.
6. Sethi M and Rao SE (2001) Food science experiments and application. CBS pbs. New Delhi.
7. Fellows PJ (2000) Food Processing Technology. Principles and Practice. 2nd Ed. CRC Woodhead Pbs. Cambridge.
8. Indian food Industry Journals- AFST Pbs
9. J of Food Sc. And Technology- AfST Pbs.
10. Food and Nutrition News

FND 2.2. FOOD ANALYSIS AND INSTRUMENTATION

Course Outcomes

- CO1. Obtain knowledge in various methods of food analysis
- CO2. Learn the analysis of carbohydrate and fat analysis
- CO3. Understand basic principles of protein and vitamin analysis
- CO4. Comprehend various aspects of food analysis
- CO5. Understand the principles of spectroscopy and chromatography in food analysis

Course Specific Outcomes

- CSO1. Analyse the nutritional quality of the food products.
- CSO2. Understand the need for analysis and instrumentation
- CSO3. Decipher the methods of non-nutrient component analysis in foods
- CSO4. Have an insight into instrumental measure of texture of foods
- CSO5. Update knowledge on analytical instruments by visiting laboratories

Learning Outcomes

- LO1. Identify an appropriate technique for analysing specific components in food substances
- LO2. Hands on experience in analysis of nutritional quality of food products.
- LO3. Competent to estimate vitamins and minerals in food sample
- LO4. Have an insight into the advanced techniques in food and nutrient analysis
- LO5. Apply the knowledge of food analysis in establishing standards for food quality

FND 2.2. FOOD ANALYSIS AND INSTRUMENTATION

Course Content

UNIT-I

Introduction to Food Analysis- Steps in food analysis, choice and validity of method, criteria for choice of food analysis methods, role of AOAC International, General principles of sampling of foods for analysis, Sampling methods and sample preparation, overview of physical, chemical, Instrumental and Gravimetric methods of analysis. Principles and methods of estimation of moisture, Methods of estimation of Ash as an indicator of total mineral content. Estimation of Calcium, phosphorus & iron from ash solution.

UNIT-II

Carbohydrates- Methods and principles of starch determination, sugar determination and polarimetry, refraction index, gel strength, brix and densitometry of sugars. Crude fibre and fibre fractions- methods of determining fibre fractions, soluble, insoluble and neutral detergent fibre estimation
Total fat- methods and principles of estimation of fats, methods of separation of lipid fraction and determination of neutral glycerol, fatty acids, phospholipids and cholesterol in foods

UNIT-III

Total Proteins- principles and methods of determination of Protein nitrogen and non-protein nitrogen. Principles in Micro and Macro determination of nitrogen by Kjeldahl method, other methods of protein estimation- biuret method, lowry Method, dye binding method and enhanced Duma's method, advantages and disadvantages: Vitamins- General methods of estimation of Vitamins from foods, Estimation of Vitamin A, thiamine, riboflavin and Vitamin C

UNIT IV

Non-nutritive component Analysis- Qualitative and quantitative determination of phytochemicals, analysis of lycopene, oxalates, polyphenol content, chlorophyll extraction in leafy vegetables by different methods, determination of antioxidant activity of plant food extracts, analysis of food colours and additives

UNIT V

Food analysis Instrumentation- Principles and application of colorimetry, spectroscopy, flame photometry, atomic absorptiometry, Principles and Application of Chromatographic procedures in food analysis: Ion exchange, thin layer, solid, liquid, gas, column, paper and high-performance liquid chromatography with suitable examples. Instrumental measure of viscosity, Rheology and texture of various foods- dough, pastry, baked products, fruits, vegetables, dairy products, meat and meat products.

FND 2.2. FOOD ANALYSIS AND INSTRUMENTATION

BOOKS AND JOURNALS

1. Berk. Z. Introduction to the Biochemistry of food, Department of food engineering & Bio technology, Izreal Institute of Technology, Haila (Izreal) Amsterdam, Oxford, New Yor.
2. Clifton. E. Meleon, Food analysis 3rd edition (Theory& practice) YeshajahuPomerrauz.
3. David & Robinson, Food biochemistry & nutritional value.
4. Food chemistry, A Laboratory manual by Dennis D. MellerAwiley – Inter science publication John Wiley &Sons, INC.
5. Food Chemistry Seemayadav, Author publication of Anmol Pvt. Ltd., 437/4B Ansari Road, Daryaganj, New Delhi, 1997.
6. Owen R. Fennema, Food chemistry 2nd edition Revised & Expanded.
7. A First Course In Food Analysis by Ay Sathe 1999
8. Food Analysis, Theory& Practice by Yeshajahu P, Clifton E &Meloan

FND 2.3. NUTRITIONAL BIOCHEMISTRY

Course Outcomes

- CO1. Understand the advanced concepts of nutritional biochemistry
- CO2. Acquire systematic knowledge on carbohydrate metabolism.
- CO3. Understanding the protein and nucleic acid metabolism
- CO4. Decipher basics of lipid metabolism and biological oxidation
- CO5. Understanding the biochemical roles of vitamins and minerals

Course Specific Outcomes

- CSO1. Understand the biochemical changes and altered metabolism in diabetes mellitus
- CSO2. Insight into interrelationships between various metabolic pathways
- CSO3. Acquire knowledge on functions and mode of action of different hormones.
- CSO4. Know the constituents of body fluids and their clinical significance
- CSO5. Understand the association between biochemical parameters and nutritional status

Learning Outcomes

- LO1. Potential to differentiate normal metabolism and disorders of metabolism
- LO2. Relate the clinical symptoms to metabolic changes in diseases
- LO3. Interpret and associate results of biochemical tests to symptoms and progression of diseases.
- LO4. Acquire the knowledge on diagnostic levels of biochemical parameters in blood and urine
- LO5. Recognise the biochemical aspects of Inborn errors

FND 2.3. NUTRITIONAL BIOCHEMISTRY

Course Content

UNIT I

Introduction to Nutritional biochemistry – Meaning and importance, Development of nutritional biochemistry and contemporary interests in nutritional biochemistry. Clinical Biochemistry- Evaluation/Interpretation of changes in various biochemical parameters in pathological conditions and diseases, Enzymes- Classification, biochemical functions, intracellular distribution of enzymes, Enzymes in clinical diagnosis (SGPT, SGOT, alkaline phosphatase).

UNIT II

Carbohydrate metabolism- Classification of carbohydrates, biochemical functions, Glycolysis, TCA cycle, oxidative phosphorylation; HMP Shunt, energetics of aerobic and anaerobic Breakdown, Glycogenesis, Glycogenolysis, Gluconeogenesis and Regulation, Regulation of blood glucose, Altered metabolism in Diabetic Mellitus.

UNIT III

Protein metabolism- Classification of proteins; Amino acids and its classification, Pathway of entry of amino acids into TCA cycle; Transamination, deamination (oxidative and non-oxidative pathway); Decarboxylation for amino acids, Detoxification of ammonia, Urea cycle, Protein biosynthesis (Transcription and Translation) , Creatine and creatine synthesis. Biosynthesis and degradation Haemoglobin

Metabolism of nucleic acids- Structure of Nucleotides and nucleic acids (DNA & RNA), Genetic code, Genetic mutations, Biosynthesis and degradation of purine and pyrimidine ring nucleotides.

UNIT IV

Lipid Metabolism- Classification, functions, Biosynthesis and oxidation of fatty acids, Ketosis and control mechanisms and steps of ketone bodies formation, cholesterol synthesis; bile acids metabolism. Biological oxidation: Concept of enzyme system and carriers in oxidation chain reactions, respiratory chain components, functions, redox potentials, energy carriers and oxidative phosphorylation

UNIT V

Vitamin and mineral metabolism- biosynthesis, biochemical functions of vitamins (A, D, C, K, B vitamins) and minerals (Ca, Fe, P, Mg, Na, K, I)

Inborn errors of metabolism- Alkaptonuria, Phenylketonuria, Albinism, Homocystinuria, Cystinuria, Maple Syrup Urine Disease, Galactosemia, Glycogen storage disease, Fructosuria and Pentosuria.

FND 2.3. NUTRITIONAL BIOCHEMISTRY

BOOKS

1. Murray RK, Granner DK, Victor WR (2006) Harper's illustrated biochemistry, 27th ed. Mc Graw Hill Lange.
2. RamaRao AVSS (2000) a text book of Medical Biochemistry. New Delhi: UBS
3. Delvin TH (1997) Text book of biochemistry with clinical correlations. New York. John Wiley Pbs.
4. Lehninger A (1993) Principles of Biochemistry.
5. Ramakrishna S (1989). A text book of medical Biochemistry. New Delhi: UBS
6. Oser BL (1970) Hawk's physiological chemistry. New Delhi: Tata McGraw Hill.
7. J of Nutritional Biochemistry
8. A Manual of Practical Biochemistry by Dr. G. Devala Rao Birla Publications Pvt Limited
9. Nutritional Biochemistry and Metabolism, M. yaday, Arise Publishers and distributors
10. A Text Book of Advanced Biochemistry, Dr.S.S. Radhrarao, Vikas and Co Publisher (Jalandhar)

FND 2.4. ADVANCED NUTRITION II

Course Outcomes

- CO1. Gain knowledge on menu planning and balanced diets
- CO2. Be aware of the nutritional demands in physiological stages of life cycle
- CO3. Understand the nutritional problems in different age groups
- CO4. Outline of the different methods of assessment of nutritional status
- CO5. Get insights into the nutritional needs of special and emergency conditions

Course Specific Outcomes

- CSO1. Develop skills in planning balanced diet for different age group
- CSO2. Analyse the nutritional alterations needed for nutritional problems of different age group
- CSO3. Plan healthy diets and prescribe healthy dietary practices for vulnerable groups
- CSO4. Have an insight into the nutritional management in emergency conditions
- CSO5. Familiarize various organizations involved in combating malnutrition

Learning Outcomes

- LO1. Suggest balanced diet to overcome nutritional deficiency diseases.
- LO2. Distinguish between healthy and unhealthy diets and life style practices.
- LO3. Correlate prudent diet and healthy life style practices with health outcomes
- LO4. Understand and apply nutritional assessment techniques
- LO5. Opportunities in Government and NGO s as public health nutritionist

FND 2.4. ADVANCED NUTRITION II

Course Content:

UNIT I

Introduction to diet therapy, Menu planning- principles, factors to be considered, food guide pyramid and food exchange lists. Balanced diet, Food security, Standardization of recipes and portions. Therapeutic diets- Modification of normal diet to suit special needs. Routine hospital diets, **special feeding methods, Enteral and parenteral nutrition, tube feeds, home-made blenderized and commercial formula feeds, pre- and post-operative nutrition,**

UNIT II

Nutritional Requirements and diet management through life cycle- Infancy, Preschool, School going, Adolescence, Adults, old age, Expectant and Lactating Mothers, Importance of Colostrum, Advantages of Breast feeding & Complementary feeding, Nutrition related problems in different age groups.

UNIT III

Nutritional Requirements and diet management in overweight, obesity, underweight, Food allergies, Fevers- Acute and chronic. Nutritional problems in India, Nutrition Intervention Schemes & Programmes operating in India, National Nutrition Policy, Role of various National and International agencies in combating Malnutrition

UNIT- IV

Assessment of nutritional status – Anthropometry, clinical examination, biophysical assessment, functional, laboratory and biochemical assessment, Different methods of dietary assessment and vital health statistics. Importance of nutrition education for improving the nutrition status of community.

UNIT- V

Nutrition in Special Conditions and emergency situations- Extreme temperatures - low and high temperatures, nutrition in high altitudes, Space nutrition and food systems, Nutrition in Emergency situations- Famine, drought, flood, earthquake and cyclones.

FND 2.4. ADVANCED NUTRITION II

BOOKS AND JOURNALS

1. Shills ME, Olson JA, Shike N, Ross AC (1999): Modern Nutrition in Health and Disease. 9th Ed. Williams and Wilkins
2. Mahan LK & Escott- Stump S (2000): Krause's Food, Nutrition and Diet therapy, 10th ed. WB Saunders Ltd.
3. SrilakshmiB(2012) Nutrition Science. 4th ed.
4. Srilakshmi B (2005) Dietetics, 5th ed. New age International (P) Ltd. Pbs.
5. Bamji M, Prahlad Rao N, Reddy V (2000). Text book of Human Nutrition. Oxford and IbH publishing Co. Pvt. Ltd.
6. Guthrie H (1986) Introductory Nutrition. 6thEd.Mosby college Pbs.
7. Michele JS, Sadler J, strain J, Benjamin C (1999) Encyclopedia of Human Nutrition. Vol I to III. Academic Press.
8. Gopalan C and Narasinga Rao B(1988) Dietary Allowances for Indians. NIN
9. Nutrition Research Reviews
10. American J Clinical Nutrition
11. British J of Nutrition

FND 2.5. FOOD PROCESSING AND PRESERVATION TECHNOLOGY

- I. Preparation, packaging, storage and shelf-life studies of following food products
 1. Squashes and juices from locally available fruits
 2. Mixed fruit jam, guava jelly, murabba, marmalade
 3. Candied peels and jelly crystals
 4. Tomato ketchup and green chilli sauce
 5. Pickles and chutneys from mango, tomato, lime, carrots etc.
 6. Dehydrated products from vegetables
 7. Papads from sago, rice, dal
 8. Salad dressings

- II. Visits to: Food analysis laboratories, Bakeries, Food processing & Food packaging Industries

FND 2.6. FOOD ANALYSIS AND INSTRUMENTATION

1. Determination of moisture in different foods
2. Estimation of Ash value in different foods and preparation of Ash solution
3. Estimation of Fibre in foods
4. Estimation of Protein content in foods by Kjeldahl method
5. Estimation of Fat content in foods by Soxhlet method
6. Estimation of total sugars and reducing sugars
7. Estimation Calcium, Phosphorus and Iron content of foods
8. Estimation of Vitamin A/Beta carotene in foods
9. Estimation of Vitamin C in foods
10. Determination Saponification value Iodine value, Free fatty acid value and Peroxide value of fats and oils
11. Determination of Lipid peroxidation in fats and oils by Thio Barbituric Acid reactive substances assay
12. Estimation of Phospho lipid and cholesterol content of foods
13. Determination of Oxalic acid content in foods
14. Determination of tannin content of foods
15. Determination of Anti-oxidant activity of foods

FND 2.7. NUTRITIONAL BIOCHEMISTRY

1. Complete Blood Count, Blood Grouping, Measurement of Blood Pressure & Pulse rate
2. Glucose: Qualitative tests for glucose, Estimation of Glucose in blood and urine
3. Estimation of Serum Albumin, Globulin & Albumin/Globulin Ratio
4. Estimation of Haemoglobin
5. Estimation of Serum Calcium, Phosphorus and Iron
6. Estimation of Serum Cholesterol
7. Estimation of urea in serum and urine
8. Estimation of Creatinine in serum and urine
9. Estimation of Bilirubin in Serum
10. Estimation of Serum phospholipids
11. Estimation of Serum Alkaline Phosphatase
12. Urine Analysis

FND 2.8. ADVANCED NUTRITION II

1. Exchange list preparation & Standardization of recipes
2. Planning, preparation & evaluation of various therapeutic diets - Routine hospital diets, regular diet, light diet, soft diet, liquid diet, and tube feed, parenteral feeds
3. Planning, preparation & evaluation of diets for various age groups in life cycle keeping in mind various principles of menu planning
(Infancy, preschool, school-going, adolescents, adulthood, pregnant and lactation)
4. Planning, preparation & evaluation of diets for- obesity, underweight, fevers and infections, vitamin and mineral deficiency disorders.
5. Assessment of nutritional status of different age groups
6. Development of Audio-visual aids and Presentation to the target groups for Nutrition education
7. Conducting Dietary survey of different age groups using different methods

FND 3.1. FOOD MICROBIOLOGY & TOXICOLOGY

Course Outcomes

- CO1. Understand the field of Food Micro biology and its relevance to everyday life
- CO2. Understand the microorganisms involved in food spoilage, food infections and intoxications.
- CO3. Comprehend the methods of isolation and detection of microorganisms
- CO4. Acquire knowledge on food toxicity and implications on health
- CO5. Understand various plant and environmental toxins

Course Specific Outcomes

- CSO1. Acquire the knowledge on the basic concepts of microbes in food and human welfare.
- CSO2. Understand the relevance of microbial spoilage of various foods and its intoxications
- CSO3. Learn about contamination of water
- CSO4. Ability to relate the theoretical knowledge with the microbes in environment
- CSO5. Comprehend the concept of biofilms in food systems

Learning Outcomes

- LO1. Prevent food borne infections and food poisonings.
- LO2. Relate the knowledge of probiotics to application in prevention of diseases
- LO3. Assess the microbial safety of drinking water
- LO4. Understand and apply the control measures for prevention of biofilms
- LO5. Identify the newer toxicants in foods and methods to control

FND 3.1. FOOD MICROBIOLOGY & TOXICOLOGY

Course Content:

UNIT I

Introduction to food microbiology- Microorganisms of importance in food and their general characteristics- fungi (moulds and yeast), bacteria and viruses. Intrinsic and extrinsic factors affecting microbial growth. **Beneficial microorganisms – Sources, characteristics, biochemical activities, and their use in food products**, Importance of probiotics and prebiotics.

UNIT II

Food Safety-Sources of contamination and spoilage of different kinds of food and their products (cereals, pulses, fruits and vegetables, milk and milk products, egg, meat and meat products, fish). **Contamination of water – Microorganisms in contaminated water, standards for drinking water**, Food poisoning and food infections- causative agents, symptoms and food involved and prevention. In general bacterial and viral diseases of man. Pathogenic yeasts and moulds.

UNIT III

Microbiological techniques-Sterilisation and disinfection: Sterilisation by physical agents- heat, moist heat, fractional sterilisation, pasteurisation, other types of sterilisations, chemical sterilisation. Methods of Isolation and detection of microorganisms in food and water (general outline of different methods). **Biofilms in food systems- Cell signalling and quorum sensing, Biofilm development in food processing systems, examples, Identification and control of biofilms in food processing industries**

UNIT IV

Toxicology Definition, classification of food toxicants, Factors effecting toxicity of foods and disease out breaks. Food toxins and implications on human health: Neurotoxicity, Hepato toxicity, Nephron toxicity, Haemotoxicity, skeletal toxicity, reproductive toxicity, allergenicity, Teratogenic effects, Carcinogenic and miscellaneous manifestations. Toxic Food Contaminants from Industrial Wastes. Pesticide Residues in Foods and polycyclic aromatic hydrocarbons and health effects. Toxicants formed during food Processing. Toxic effects of food colours and food additives

UNIT V

Non-organic and organic metallic contaminants, Endogenous toxicants in food derived from plants: classification of toxic plant metabolites in food, cyanogenic glycosides, Vasoactive amines, Psychoactive compounds, Lathyragens, plant polyphenolic substances, Flavones, Chalcones, Carcinogens, Phytoestrogens, toxic fatty acids. Toxic mushrooms and other macro fungi, Toxicology of marine foods: Molluscs, Fish and marine algae.

FND 3.1. FOOD MICROBIOLOGY & TOXICOLOGY

BOOKS AND JOURNALS

1. Bharucha FD and Mehta A (2000) Handbook of microbiological methods and media. Sevak Printers (pbs)
2. Frazier WC and Westhof DC (1978) Food Microbiology. New Delhi. Tata Mc Graw Hill
3. James MJ (1996). Modern Food Microbiology. 4th edition, New Delhi CBS(pbs)
4. Pelezar MJ, Reid RD and Chan (1977). Microbiology. New Delhi. Tata Mc Graw Hill
5. Stanier rY, Ingraham JL, Wheelis ML, Painter PR(1986) General Micro Biology. Mc Millan Education Ltd. London.
6. Joshua AK (1988) Microbiology. Popular book Dep.
7. Food Toxicology, Part-A. Principles and concepts by Jose M.Concon, Mareel Dekker, Inc., New York, 1988.
8. Food Toxicology, Part-B. Principles and concepts by Jose M.Concon, Mareel Dekker, Inc., New York, 1988.
9. Pharmaceutical microbiology (a laboratory hand book) Dr. A.K. Seth Pee Vee.4. Some aspects of toxicology by Ranjit Roy Chaudhaury, Oxford and IBH publishing Co. New Delhi.
10. Hand Book of Food Toxicology by Deshpande, 2002.
11. Indian Food Industry Journals, AFST Pbs.
12. J food Sc and Technology Journals. AFST Pbs.

3.2 CLINICAL AND THERAPEUTIC NUTRITION

Course Outcomes

- CO1. Understand the etiology and patho-physiology of gastro intestinal diseases
- CO2. Comprehend the medical nutrition therapy for diabetes and renal diseases
- CO3. Understand the dietary management of cardiovascular and pulmonary disorders
- CO4. Gain knowledge on medical nutrition therapy of inborn errors of metabolism
- CO5. Get insights in to the medical nutrition therapy for endocrine disorders

Course Specific Outcomes

- CSO1. Acquire knowledge on dietary management of Pancreatitis
- CSO2. Infer knowledge on the applications of low glycaemic index foods
- CSO3. Understand the MNT for thyroid related diseases
- CSO4. Demonstrate the knowledge of medical terminology and medical abbreviations
- CSO5. Comprehend the role of Gut Microbiome in nutrition and health

Learning Outcomes

- LO1. Apply nutrition principles to health promotion and the prevention of diseases
- LO2. Apply the principles in planning menu for disease conditions
- LO3. Mastering of professional diet counselling skills
- LO4. Manage a dietary department at the capacity of a dietitian.
- LO5. Recommend personalized diets for various disease condition

3.2 CLINICAL AND THERAPEUTIC NUTRITION

Course Content

UNIT-I

Gastro Intestinal Diseases- Gastro Esophageal Reflux Disease, esophagitis, peptic ulcers, malabsorption syndrome, celiac disease, lactose intolerance, Inflammatory Bowel Diseases, Irritable Bowel Syndrome, hepatitis, alcoholic liver disease, cirrhosis, hepatic coma and gall stones, **Pancreatitis**- etiology, Symptoms, complications, clinical parameters, diagnostic tools and Medical Nutrition Therapy of Gastro intestinal diseases

UNIT-II

Diabetes mellitus- IDDM, NIDDM, Diabetic keto acidosis, Diabetic Nephropathy, Gestational diabetes - etiology, symptoms, complications, clinical parameters, diagnostic tools and Medical Nutrition Therapy for diabetes mellitus and complications. An overview of Glycosylated Haemoglobin, Glucose Tolerance Test, Oral hypoglycaemic drugs, Insulin therapy, Glycemic Index of foods.

Renal disorders – Glomerular nephritis, Nephrotic syndrome, Acute & chronic renal failure and renal calculi- etiology, symptoms, complications, clinical parameters, diagnostic tools and Medical Nutrition Therapy of renal disorders

UNIT-III

Cardio Vascular Disorders - Atherosclerosis, myocardial infarction, Congestive heart failure, hypertension and hyperlipidemias- Etiology, symptoms, complications, clinical parameters, diagnostic tools and Medical Nutrition Therapy of cardio vascular disorders

Pulmonary Disorders- Asthma, Bronchitis, Chronic obstructive pulmonary disease, cystic fibrosis - Etiology, symptoms, complications, clinical parameters, diagnostic tools and Medical Nutrition Therapy of cardio vascular & Pulmonary disorders.

UNIT-IV

Rheumatic Disorders - Etiology, symptoms, complications, clinical parameters, diagnostic tools and Medical Nutrition Therapy of Rheumatoid arthritis, osteoarthritis & gout, Neurological Disorders- Alzheimer's disease, & epilepsy, Inborn disorders of metabolism - Phenyl ketonuria, Maple syrup urine disease, Galactosemia, essential fructosuria, disorders of sulphur amino acid metabolism

UNIT- V

Endocrine disorders: Etiology, symptoms, complications, clinical parameters, diagnostic tools and Medical Nutrition Therapy of Polycystic ovarian syndrome and Thyroid related disorders

Gut Microbiota in nutrition and health- Microbiome, Microbiota, Microbiota diversity and health, role of food, nutrients and drugs on modulation of gut microbiota, effect of the gut microbiota on diseases- metabolic, immune related, autism, anxiety and depression, Personalised nutrition through gut microbiota

3.2 CLINICAL AND THERAPEUTIC NUTRITION

BOOKS AND JOURNALS

1. Shills ME, Olson JA, Shike N, Ross AC (1999): Modern Nutrition in Health and Disease. 9th Ed. Williams and Wilkins
2. Mahan LK & Ecott- Stump S (2000): Krause's Food, Nutrition and Diet therapy, 10th ed. WB Saunders Ltd.
3. Srilakshmi B (2005) Dietetics, 5th ed. New age International (P) Ltd. Pbs. New Delhi
4. Gopalan C (1996) Nutritive value of Indian foods. NIN. Hyderabad.
5. Michele JS, Sadler J, strain J, Benjamin C (1999) Encyclopedia of Human Nutrition.
6. Ganesh and Co., Williams S (1981) Nutrition and diet therapy. 4th Ed. Missouri. Masby co. Pbs.
7. Gopalan C and Narasinga Rao B(1988) Dietary Allowances for Indians. NIN
8. Nutrition Research Reviews
9. American J Clinical Nutrition
10. British J of Nutrition
11. J of American Dietetic Association
12. Indian J of Nutrition and Dietetics

FND 3.3. INSTITUTIONAL FOOD ADMINISTRATION

Course Outcomes

- CO1. Understand organization and network of different departments in food service institutions
- CO2. Understand the factors affecting the planning of space and purchase of equipment
- CO3. Demonstrate skill in storage of food and maintenance of store room
- CO4. Competent in accounting procedures practiced in the food service organizations
- CO5. Understand the reasons for automation process in a food service unit

Course Specific Outcomes

- CSO1. Understand the need for buying latest equipment and maintenance
- CSO2. Understand the organization, duties and responsibilities of staff.
- CSO3. Aware of various sources of finance and marketing procedures
- CSO4. Know and understand the food service and book keeping procedures.
- CSO5. Comprehend the newer aspects of applications of RPA in food industry and service sectors

Learning Outcomes

- LO1. Understand the importance of methodical planning, preparation and service of food
- LO2. Evaluate and analyse the quality of prepared, packed food items and food preparation area
- LO3. Understand the governmental and non- governmental food service organizations.
- LO4. Acquire skills in documentation of the reports and maintenance of financial statements
- LO5. Comprehend the overall requirements to be an entrepreneur in setting up a food service unit

FND 3.3. INSTITUTIONAL FOOD ADMINISTRATION

Course Content:

UNIT I

Introduction to Food Service industry - Objectives, scope, Organisation chart of Dietary/Food Service Department, Types of food service systems – Centralised and Decentralised. Introduction to the complex nature of medical food service management, roles and responsibilities of the health care team. Staff and personnel management- Manpower Planning, Recruitment, Selection, Induction, Performance Appraisal and Motivation, Training and Development, Labour Laws, Need and process of communication.

UNIT II

Planning and equipment purchase- Layout Design: Space allowances, design development, space relationship, flow of traffic Equipment, Factors affecting selection of equipment; features of equipment, List of Equipment required specific to Dietetics/ Food Service Department: receiving, preparation, cooking, service, washing and garbage disposal, Care, maintenance and replacement.

UNIT III

Service Management- Table service, Dining room management, Delivery and service of food in different institutions, Materials Management- Meaning, definition, importance, Purchase and inventory management, Methods and process of purchase, documents used in purchase control, Store Keeping: Principles, essentials and duties of store keeper, Storage temperatures, Storing and issuing management control.

UNIT IV

Costing- Definition of cost, costing, Elements of cost – Material (Food) Cost – Labour – Overheads and calculation of percentages, Concept of profit – gross profit, after-wage profit, net profit and calculation of percentages, Cost profit volume analysis, Budget and budgetary control for food service institutions.

UNIT V

Introduction to Automation and RPA- Basics of RPA- RPA benefits- Types of robots, Automation and RPA concepts, Reason for automation process. Process Automation in food industry, in food preparation, serving and packaging industry. Advantages and Disadvantages of Automation in food Industry.

FND 3.3. INSTITUTIONAL FOOD ADMINISTRATION

BOOKS

1. Mohini Sethi & Surjeet Malhan (1987) Catering Management. An Integrated Approach. Wiley Eastern Ltd. New Delhi.
2. Awatramani P (1980). Catering management for Indian Hotels. Bombay. Popular Book depot.
3. Bessie B and West Le Wood (1986) Food Service in Institutions (6th Ed.) Macmillan Publishing Co.
4. Buttle F (1992) Hotel and Food Services marketing- a managerial approach. London ELBS/Casell
5. Lillicrap DR (1998) Food and Beverage service, 5th ed. London: ELBS/Hader and Stoughton
6. Tom Tauli (2020) , The Robotic Process Automation, APress Pbs.

FND 3.4. RESEARCH METHODOLOGY AND STATISTICS

Course Outcomes

- CO1. Comprehend the current research areas in Food, Nutrition & Dietetics
- CO2. Understand various tools of data collection and research designs
- CO3. Comprehend the role of statistical analysis in food and nutritional research analysis
- CO4. Gain competence in parametric and non-parametric tests
- CO5. Interpret and understand the applications of computers and statistical packages in research

Course Specific Outcomes

- CSO1. Inculcate knowledge about essentials of high-quality research.
- CSO2. Introduce students to the skills needed in conducting research
- CSO3. Understand the publication of research findings by adhering to research ethics
- CSO4. Able to apply computer applications in documentation of research findings
- CSO5. Conduct both qualitative and quantitative research in the fields of Food science and Nutrition.

Learning Outcomes

- LO1. Apply measurement & scaling techniques as well as the quantitative data analysis in research
- LO2. Analyse the criteria to select an appropriate statistical test to answer a research question
- LO3. Translate the knowledge on research techniques in conducting research
- LO4. Understand the compilation of data using latest software
- LO5. Explore the nutritional software and journals in professional and academic endeavours.

FND 3.4. RESEARCH METHODOLOGY AND STATISTICS

Course content

UNIT I

Meaning, significance and objectives of research, criteria of good research, merits and demerits, Different types of research, Current research areas in Foods and Nutrition. Research process- selection and statement of research problem, statement of hypothesis and types of hypotheses, principles and formulation of hypothesis, formulation of research designs. **Research variables- meaning and their significance in research, types of variables**

UNIT II

Techniques and methods of data collection. Research Design, **Need for a research design, features of a good design**

Types of research designs- Explorative/ descriptive/ experimental/ Survey/ Case Study, Sampling, types of sampling methods, merits and demerits, Measurement and scaling techniques- Measurement scales: Nominal, Ordinal Interval, Ratio, Validity, Reliability and Practicality, Scaling, scaling techniques, Rating scales (paired comparison, rank order), likert scales etc.

UNIT III

Meaning and scope of statistics, role of statistics in research, statistical representation- Parts of table, tabulation of data, Frequency distribution, Diagrammatic and graphical representation, Measures of central tendency, measures of dispersion and variation, skewness and kurtosis, concept of probability and normal distribution

UNIT IV

Analysis and Interpretation of statistical data- Testing of hypothesis, Parametric and Non parametric tests- Chi-square test, application of Students 't' test, Correlation, Regression and prediction, ANOVA- Analysis of variance- One way and two-way classification, Sign test, Wilcoxon signed-ranks test, Mann-Whitney U test and Kruskal-Wallis test

UNIT V

Statistics and Computer – Fundamentals of computer, History of computer, Generation of computer, Language, Components, Applications of Computers. Operating System & Internet: MS-DOS, MS-Windows, and Internet, MS-Office: MS-Word, MS Excel and Power Point. Introduction to Data-base, Application of modern tools such as statistical packages (SPSS, Lotus 123, Access, Excel, Visual Fox pro etc.) in research

FND 3.4. RESEARCH METHODOLOGY AND STATISTICS

BOOKS

1. C.R. Kothari. "Research Methodology – methods & techniques" 2nd edition, New Age International publishers, New Delhi, 1985.
2. Misra RP (2001) Research Methodology, Concept Pbs. New Delhi
3. Alan Bryman (1998) Quantity and Quality in Social Research, Unwin Hyman Ltd. UK
4. Burns RB (2000) Introduction to Research Methods. Sage Publications Pvt. Ltd.
5. Research Methodology, Deepak Kumar Bhattacharya, Excel Book Publishing, New Delhi.
6. Research Methodology, R. Paneerselvam practice- Hall of India Pvt Ltd (PHPublishing) New Delhi.
7. Fisher A.R. Yates. I. "STATISTICAL TABLES" 6th edition Longman group ltd., England.1982.
8. Freud. E.J .Smith. M.R. "STATISTICS- A FIRST COURSE" 4th edition, Prentice-hall-inc, New Jersey.
9. Sancheti DC & Kapoor VK (2005) Statistics (Theory, Methods & Application).Sultanchand& sons (pbs).
10. Diwan, Parag, Information System Management, Deep & Deep Publications, New Delhi, 1997.
11. Mehta, Versham Management Information System, Anmol Publication, New Delhi, 1998.
12. Banerjee, Utpal K. and sachdeva, R.K., Management Information System: A New Framework, Vikas Publishing House, Pvt. Ltd., New Delhi

FND 3.5. FOOD MICRO BIOLOGY & TOXICOLOGY

1. Study of principles and types of compound microscope.
2. Preparation of common laboratory media for cultivation of bacteria, yeast and moulds.
3. Inoculation techniques and different methods of isolation of microorganisms.
4. Staining of bacteria: Gram's staining acid fast, staining of yeasts and moulds.
5. Study of microbiological analysis in the food preparation area.
6. Study of microbiological flora of both processed and unprocessed foods like vegetables and fruits, cereals, spices and canned foods.
7. Bacteriological analysis of water and milk: total count and MPN coli form count.
8. Compare the growth of microorganisms: -
 - (a) In jams/ sauces (hypotonic).
 - (b) Temperature zones (cold, hot and room temperature).

FND 3.6. CLINICAL AND THERAPEUTIC NUTRITION

- I. Computation of nutrient requirements, planning, preparation & evaluation of therapeutic diets for the following conditions.
 1. Gastro Intestinal Diseases
 2. Diabetes mellitus & its complications
 3. Renal disorders
 4. Cardio Vascular Disorders
 5. Pulmonary Disorders
 6. Rheumatic Disorders
 7. Neurological Disorders
 8. Inborn disorders of metabolism
 9. Thyroid disorders
- II. Diet counselling of patients
- III. Case study writing and interpretation of cases based on clinical parameters.

FND 4.1. NUTRITION IN CRITICAL CARE AND DIET COUNSELLING

Course Outcomes

- CO1. Understand the screening tools for assessment of malnutrition.
- CO2. Understand the importance of immune supplements in critical care
- CO3. Understand the etiology of zoonotic diseases
- CO4. Explain the etiology, patho-physiology and national management of critical care patients
- CO5. Comprehend the role of a Dietitian in counselling the critically ill patients

Course Specific Outcomes

- CSO1. Understand the physiology, metabolism and special nutritional requirements of the critically ill.
- CSO2. Gain knowledge about the importance of nutritional assessment in critical care patients
- CSO3. Acquire professional diet counselling skills
- CSO4. Comprehend the nutritional management of Zoonotic diseases.
- CSO5. Acquire skills to address the nutrient requirements of COVID-19 patients

Learning Outcomes

- LO1. Apply the dietary principles in planning menu for critically ill and ICU patients
- LO2. Get hands on experience in malnutrition assessment tools
- LO3. Correlate prudent diet and healthy life style practices with health outcomes
- LO4. Manage nutrient requirements of ICU patients at the capacity of a dietitian.
- LO5. Learn the judicial and appropriate use of nutraceuticals in critical care

FND 4.1. NUTRITION IN CRITICAL CARE AND DIET COUNSELLING

Course content

UNIT -I

Nutritional screening, different types of screening tools, advantages and disadvantages, nutritional status assessment of the critically ill, methods of nutritional status assessment, nutritional support systems and other life saving measures of the critically ill, Complications of critically ill patients

UNIT- II

Complementary nutrition in critical care- Role of immune enhancers, conditionally essential nutrients, Immune suppressants, protein supplements, special diets in critical care, **nutraceuticals and functional foods in in health promotion, disease prevention and management, Role of selected bioactive constituent - Beta glucan/ Arabinoxylan/ Resistant starch, Bioactive peptides and GABA, Omega-3 fatty acids, CLA, Phytosterols, poly phenols, Carotenoids and Isoflavones**

UNIT-III:

Pathophysiological, clinical and metabolic aspects, special nutrient requirements, medical nutrition therapy in newly emerging infectious diseases and Zoonotic diseases, (Nipahvirus, SARS, MERS, COVID-19), key aspects in nutritional management of COVID-19 and associated complications

UNIT IV

Pathophysiological, clinical and metabolic aspects, special nutrient requirements, medical nutrition therapy in critical illnesses like- Stress, trauma and burns, Pre and post-surgery, Dialysis, transplants, Multiple organ failure, HIV and AIDs, Cancer, Radiation and chemo therapy conditions

UNIT V

Nutrition counselling, definition, concept, the roles of dietitian, the recipients, counselling environment and equipment. Factors to be considered in counselling-nutritional and health conditions. Designing of counselling plans-goals and objectives. Methods and Techniques of Diet counselling,

FND 4.1. NUTRITION IN CRITICAL CARE AND DIET COUNSELLING

BOOKS

1. Shills ME, Olson JA, Shike N, Ross AC (1999): Modern Nutrition in Health and Disease. 9th Ed. Williams and Wilkins
2. Mahan LK & Ecott- Stump S (2000): Krause's Food, Nutrition and Diet therapy, 10th ed. WB Saunders Ltd.
3. Anderson L, Dibble M, Mitchell N (1982) Nutrition in health and disease (17th ed). Philadelphia: JB. Lippincott co.
4. Srilakshmi B (2005) Dietetics, 5th ed. New age International (P) Ltd. Pbs. New Delhi
5. Gopalan C (1996) Nutritive value of Indian foods. NIN. Hyderabad.
6. Seth V and Singh K (1995) Diet Planning through life cycle in Health and disease- a practical Mannuel , 2nd ed. . New delhi. Wheeler Pbs.

FND 4.2. SPORTS NUTRITION

Course Outcomes

- CO1. Understand the role of sports and exercise on health
- CO2. Understand the macro nutrients required for sports persons of different categories
- CO3. Comprehend the importance of hydration and diet in enhancing sports performance
- CO4. Get insight into management of sports injuries
- CO5. Acquire knowledge on nutrition for athletes with special dietary needs

Course Specific Outcomes

- CSO1. Understand the physiological and biochemical events which occur in sports
- CSO2. Get insights in to the advantages and disadvantages of nutrient loading
- CSO3. Comprehend the safety aspects of ergogenic aids
- CSO4. Acquire knowledge on protective sports equipment
- CSO5. Understand the nutritional management of Athletes with nutrition related disorders.

Learning Outcomes

- LO1. Apply the principles of sports nutrition in planning diets for professional athletes
- LO2. Develop innovative products using functional foods for ergogenic effects
- LO3. Successfully plan, implement sport-specific diets for athletes of recreational sports
- LO4. Ability to develop innovative hydration drinks for sports personnel
- LO5. Know-how of starting and managing a fitness centre.

FND 4.2. SPORTS NUTRITION

Course Content

UNIT -I

Role of sports and exercise in promoting health, delay in onset of diet related disorders, Control / Management of diseases such as Diabetes, Heart diseases and Neuroendocrine, Respiratory diseases and Musculo skeletal disorders by exercise, different categories of sports activities in India, Energy systems and exercise – ATP, CP, aerobic pathway, and anaerobic pathway.

UNIT- II

Nutrition & Performance- Energy requirements, Carbohydrates, requirements, Carbohydrate loading, Carbohydrate utilization during exercise, Lipids-- Fat Metabolism and utilization during exercise, Fat loading & requirements, Proteins, requirements, Sources of proteins. Vitamins & Minerals- requirements, functions, role of vitamins and minerals in sports performance, Phosphate loading, Magnesium, calcium, sodium, potassium and chloride

UNIT-III: Hydration, guidelines, types of fluids, fluid volume, composition, temperature, effects of dehydration, importance of sports drinks. Ergogenic aids, Types, effects and safety concerns, Functional foods available for athletes. Impact of Steroids on the performance of sports persons, safety issues of steroidal use, Training diet, Pre exercise meals – intake during exercise, feeding after exercise – Liquid v/s solid meals. Dietary modifications and diet plans for different sport events

UNIT IV

Prevention and management of sports injuries- Causes of injuries, Basic principles of management of injuries, Orthotics and protective sports equipment, Role of yoga for health and fitness. Visits to Yoga, Fitness, Sports centres and Gyms.

UNIT V

Athletes with Nutrition related disorders, athlete with Diabetes, sports anaemia: Causes and consequences, athletes with Osteoporosis, Nutrition for athletes with special groups - special Olympics, Paralympics, Nutrition for Athletes with special dietary needs, children and adolescent athletes, female athletes, Female athletic triad (FAT) including eating disorder, menstrual irregularity and poor bone mineral density; assessment for FAT, Dietary guidelines and suggestions for FAT and Vegetarian athletes

FND 4.2. SPORTS NUTRITION

BOOKS AND JOURNALS

1. Shills ME, Olson JA, Shike N, Ross AC (1999): Modern Nutrition in Health and Disease. 9th Ed. Williams and Wilkins
2. Mahan LK & Ecott- Stump S (2000): Krause's Food, Nutrition and Diet therapy, 10th ed. WB Saunders Ltd.
3. Anderson L, Dibble M, Mitchell N (1982) Nutrition in health and disease (17th ed). Philadelphia: JB. Lippincott co.
4. McArdle W, Katch F, Katch V (1996) Exercise Physiology. Energy, Nutrition and Human Performance. 4th ed. Williams and Wilkins, Philadelphia
5. Int. J of Sports nutrition and Metabolism
6. J of Dietary supplements
7. J of American Dietetic Association
8. American J of Clinical Nutrition
9. Sports Nutrition, B. Vijayalakshmi , neha Publishers & Distributors
10. Sports Nutrition & Health ,H.S Anderson , Sports and Physical Education

FND 4.3. NUTRITION IN CRITICAL CARE AND DIET COUNSELLING

Computation of nutrient requirements, planning, preparation & evaluation of therapeutic diets, formula diets and diet counselling methods for the following conditions.

1. Stress and Trauma
2. Burns
3. Pre and Post surgery conditions
4. Dialysis
5. Pre and post transplantation
6. HIV and AIDs
7. Radiation and chemo therapy conditions
8. COVID-19 Patient

FND 4.4. INTERNSHIP

Every candidate shall undergo professional training for 45 days in a Food Industry / Hospital / Community Centres like NGOs at the end of the Third semester of the course. At the end of professional training the student has to submit a report for which Viva will be conducted both by internal and external examiner.

FND 4.5. DISSERTATION BASED ON PROJECT WORK

Project work & Dissertation may be undertaken in the relevant field preferably on current issues. It can be continuation of the research work from the 3rd Semester. The thesis should be typed in Times New Roman in 12 font size with 1.5 line spacing from the beginning of the thesis including titles to the chapters and sections. Bold font may be used where ever necessary. The students are expected to follow scientific grammar for writing *in vivo* etc. which should be in italics.

Guidelines for writing the thesis:

The thesis should have the following pages in order:

1. Title page highlighting the title, name of the candidate, Reg.no .Guide name, College name and month and year of submission and the inner title page containing the same details on white background.
2. Certificate from the Head of the institute & Guide
3. Certificate from the ethical committees for approval of study, if any
4. Declaration by the student
5. Acknowledgements
6. Index highlighting chapter titles and sections titles
7. Index for tables, figures and plates, if any
8. Abbreviations and symbols
9. Materials used in the investigation with their procurement details like name of the company, batch number etc.
10. Equipment used in the study with the model number and other details.
11. Aim and objectives of the investigation.
12. Introduction and literature survey
13. Materials & Methods
14. Result
15. Discussion
16. Summary and conclusion
17. References

FND 4.6. COMPREHENSIVE VIVA-VOCE

Viva-voce will be conducted to test the knowledge gained by the student in all the four semesters (both theory & practical) and other relevant issues in the area of specialization