

**M. Sc. IN APPLIED NUTRITION CURRICULUM**



**The West Bengal University of Health Sciences**

**DD-36, Sector – 1 Salt Lake,**

**Kolkata 700064**

## **1. Introduction :**

M. Sc. (Applied Nutrition) course was started in the year 2009 and it is conducted by the Department of Biochemistry and Nutrition. This is full time 2 years course. The course is oriented towards the nutrition component of health problems at all levels, viz. individual, family and the community. Training is provided in Nutritional Biochemistry, Physiology, Food science, Food Microbiology, Advanced Nutrition, Community Nutrition, Dietetics, Epidemiology, Biostatistics and Research methodology through theory and practical classes. Students also have to undergo a Field Training Program in rural areas and Internship program in multi-facility hospital and visits to various health care, food establishments. They also have to conduct a dissertation related to Health and Nutrition.

After completion of the course students become capable to:

- Identify the nutritional needs of a community
- Assess and address nutritional problems
- Teach Nutritional sciences in academic Institutions
- Conduct research in the field of Food and Nutrition
- Practice as Dietitian
- Work as Nutritionist in the Community/Food industry/Pharmaceutical industry/National and International organizations

**2. Duration of course:** Two years

**3. Affiliation:** The course is affiliated to the West Bengal University of Health Sciences.

## **4. Admission procedure**

a) **Eligibility Criteria:** B. Sc. (Honours) in Food and Nutrition/B.Sc. in Clinical Nutrition and Dietetics / **B. Sc. (Honours) in Physiology / Biochemistry with at least 50%** marks.

b) **Method of selection: Selection according to University rules.** Information available on [www.thewbuhs.com](http://www.thewbuhs.com)

## **5. Goal:**

- i. Students shall recognize the Nutrition needs of the community, and carry out professional obligations ethically and in keeping with the objectives of the national Nutrition policy/ National Health policy

- ii. Students shall master most of the competencies, pertaining to the Nutrition , that are required to be practiced at the community and various levels of the health care delivery system;
- iii. Students shall become aware of the contemporary advance and developments in the Nutrition and dietetics.
- iv. Students shall acquire a spirit of scientific enquiry and will be oriented to the principles of research methodology and Nutritional epidemiology.
- v. Students shall acquire the basic skills in teaching of the Nutrition, health and paramedical professionals

## **6. Core competencies:**

Student shall be able to;

1. Recognize the importance of Nutrition in the context of the dietary needs of the community and the national priorities in health.
2. Demonstrate sufficient understanding of the basic science of dietetics and its application at all levels of Health care.
3. Practice as Nutritionist/ Dietician/Nutrition advisor ethically and in step with the principles of primary health care.
4. Identify sociocultural, behavioural, environmental and biological determinants of nutrition in a given community/family/case, and take them into account while planning therapeutic, rehabilitative, preventive and promotive measures/strategies.
5. Diagnose and manage majority of the Nutrition related conditions and carry out appropriate nutrition care process.
6. Plan and advice dietetic measures for prevention of lifestyle disorders, management of acute diseases and rehabilitation of patients suffering from chronic diseases.
7. Demonstrate skills in documentation of individual case details and nutritional counselling of patients and their families with empathy and humane approach.
8. Acquire knowledge on the implementation of National Nutrition programmes.
9. Develop skills in using educational methods and techniques as applicable to the teaching of dietetics
10. Function as an effective leader of a Nutrition team engaged in nutrition care and training.
11. Acquire knowledge and skills to work in food and pharmaceutical industry

12. Acquire knowledge and skills in the Policy making/advocacy/programme implementation
13. Acquire knowledge and skills to conduct community and lab based Research in the field of Nutrition.
14. Apply knowledge and skills in the recent advances in the field of nutrition
15. Apply knowledge and skills to assess hygiene, safety and quality aspects of food.
16. Apply knowledge and skills in planning, implementation and evaluation of nutrition educational programme.

## 7. Course content

### Theory

#### Applied Physiology

**Alimentary System:** Structure & functions of different parts of alimentary system; Functions of salivary gland, stomach, intestine, pancreas, liver; Digestion & absorption of food.

**Heart & Circulation:** Structure & function of heart; Cardiac output, cardiac cycle, heart rate, blood pressure.

**Haematology:** Composition of blood, formation & function of blood cells, functions of plasma, coagulation of blood, blood grouping.

**Lymphatic System:** Structure & function of lymph vessels, composition & function of lymph.

**Excretory System:** Structure & function of kidney, composition of urine, process of urine formation.

**Endocrine & Reproductive System:** Structure, function, hypo,& hyper secretion of endocrine glands; Functions of male & female reproductive system.

**Special sense:** Functions of special sensory organs viz. eye, ear, nose, taste buds.

**Respiratory System:** Structure & function of respiratory organs; Lung Capacity and volumes, oxygen transport, oxygen dissociation curve, carbon dioxide transport.

**Nervous System:** Structure & function of nerve fibre, spinal cord, reflex action, ANS, Neurotransmitters

**Muscular System:** Skeletal, smooth & cardiac muscle - structure & function.

**Immunology:** Innate & acquired immunity; Immunoglobins; Antigen antibody reaction, hypersensitivity reactions, auto immunity.

#### Nutritional Biochemistry

**Introduction:** Importance and development of nutritional biochemistry.

**Carbohydrate:** Glycolysis, TCA cycle, gluconeogenesis, glycogenolysis, glycogenesis and its regulation; HMS pathway; Metabolism of fructose and galactose; regulation of blood glucose level; Electron transport chain; Oxidative phosphorylation.

**Lipid:** Fatty acids, neutral fats, phospholipids, steroids, eicosanoids; Oxidation of fatty acids, lipogenesis, metabolism of eicosanoids, triacylglycerols and cholesterol; synthesis of phospholipids; Lipoproteins – classification, composition, metabolism, hyper-lipoproteinemias and ketosis.

**Protein :** Amino acids - structure, classification, physical properties and chemical reactions; Peptides – classification; Proteins - Classification, structure and physico-chemical properties; Amino acid metabolism – transamination reaction, deamination reaction, urea cycle; Metabolism of methionine, branched chain amino acids, lysine ; Synthesis of non-essential amino acids tyrosine and glutamine; Metabolic interrelationship of carbohydrate, lipid and protein; Synthesis of important bio-molecules (porphyrins, creatine, histamine, serotonin, catecholamines, melanin and melatonin) from amino acids.

**Nucleic acid and nucleotide:** Structure and classification; Nucleotide metabolism – purine nucleotide synthesis, salvage pathway for nucleotide, degradation of purine, pyrimidine synthesis.

**Inborn error of metabolism** of carbohydrate, lipid and protein.

**Enzymes:** Introduction; Nomenclature and classification of enzymes; Specificity of enzymes; Mechanism of enzyme action; Enzyme kinetics; Factors affecting enzyme activity; Enzyme inhibition; Allosteric enzyme; Isozymes – properties, significance; Enzymes as diagnostic tools.

**Coenzymes:** Concept and their role in metabolism.

**Free radicals and Antioxidants:** Concept; Free radicals produced in the body and their significance; Mechanism of disposal of free radicals; Natural and synthetic antioxidants and their action;

**Replication, Transcription and Translation:** Concept, significance and control.

**Nutrigenomics** – Concept and significance.

## **Food Science**

**Carbohydrates:** Major dietary carbohydrates; role of sugars in food industry; importance of food polysaccharides viz. starch, non-starch polysaccharides, microbial polysaccharides, algal polysaccharides, extruded gums in food industries.

**Lipids:** Food sources, different dietary fats and oils; functional properties of fats and oils; effect of deep frying; deteriorative changes in fats and oils by oxidative and enzymatic changes, rancidity, lipolysis, prevention of oxidation by antioxidants.

**Proteins:** Classification; food sources of protein viz. animal, plant, single cell protein; functional properties of proteins in foods; protein concentrates viz. soy protein and whey protein concentrates; protein isolates; protein hydrolysates.

**Enzyme:** Use in the food industries.

**Food colloids:** Classification; properties of sol, gel, foam and emulsion. Food quality: Appearance, texture and flavour factors.

**Browning reactions:** Concept; Enzymatic and non-enzymatic; Significance.

**Rancidity:** Mechanism of reactions and determinations of rancidity.

**Food additives:** Concept; Classification and role - Food colours, food flavours, stabilizers and emulsifiers, sweeteners, antioxidants, preservatives, anti-caking agents, sequestrants, buffering agents, anti-foaming agents, carryover of food additives, safety of additives.

**Food processing, preservation and storage:** Significance; principles and methods viz. thermal processing (cooking, blanching, pasteurization, sterilization, canning), dehydration, concentration, freezing, microwave heating, fermentation, chemical preservation, their evaluation – qualitative, quantitative, packaging (elementary knowledge). Convenience foods including extruded food: Concept, types, significance.

**Primary food, Proprietary food:** Definition with examples.

**Genetically Modified food, organic food:** Definitions and their status in India.

**Street foods:** Concept; Common street foods; Significance.

**Functional foods and Nutraceuticals:** Concept, commonly available foods/preparations, significance. Nutritive value of foods and concepts of RDA and safe upper limits of nutrients. Extruder food machine, extruder food, extruder industry.

**Food product design:** new food product development.

## **Advanced Nutrition I**

**Introduction:** Concept; Meaning and significance of the terms AI, RDA, DV%, etc.

**Energy:** Expenditure and requirement; BMR, BEE, RMR, REE; Factors affecting BMR; Thermic effect of food; Physical activity level; Measurement of energy expenditure.

**Carbohydrates, Lipids and Proteins:** Food sources, requirement, function, effects of deficiency and excess

**Dietary Fibre:** Concept; Classification; Significance

**Protein Quality:** Methods for determination of protein quality (DC, BV, NPU, chemical score, PER, NDPCal%, PDCAAS).

**Vitamins:** Food sources, requirement, function, effects of deficiency and excess of vitamins; role in prevention and control of diseases (A, D, E, K, B1, B2, B3, B5, B6, B12, folic acid, C, lipoic acid).

**Minerals:** Sources, requirement, function, effects of deficiency and excess of minerals; role in prevention and control of diseases. (calcium, phosphorous, magnesium, sodium, potassium, chloride, iron, zinc, copper, iodine, fluorine, manganese, selenium and chromium).

**Nutrition for Infants and Preschool Children:** Nutritional needs and RDA; Composition of human milk; Importance of breastfeeding and complementary feeding, IYCF guidelines and feeding during illness.

**Nutrition for Older Children and Adolescents:** Nutritional needs and RDA; Food habits and eating disorders.

**Nutrition for Adults:** Nutritional needs and RDA, including needs during pregnancy and lactation.

**Nutrition for Elderly:** Nutrition needs; Problems associated with old age affecting nutrition; Nutritional risk assessment-MNA, Quality of life, modifications of the diet and environment for betterment of nutrition.

## **Community Nutrition**

**Introduction:** Concept and scope of community nutrition; Health care delivery system.

**Nutritional Problems:** Macro and micronutrient related nutritional problems; Lifestyle disorders.

**Strategies to Combat Community Nutrition Problems:** Food based strategy; Nutrient based approach; Immunization; Supplementary feeding; improving the quality of food; Food and nutrition security; Safe water and sanitation.

**Nutritional assessment:** Anthropometry; Clinical; Biochemistry; Assessment of dietary intake; Vital and health statistics; Ecological assessment; Functional assessment.

**Nutrition Monitoring and Surveillance:** Objectives and components; Uses of nutritional surveillance; Infrastructure for nutrition surveillance; Key indicators for nutrition surveillance; Existing programs of nutrition monitoring. WHO growth charts for boys & girls.

**National Nutritional Policy and Programs:** National nutrition policy; ICDS; Nutrition deficiency control programs; Supplementary nutrition programs;

**Food security program:** PDS, TPDS, Antodaya Anna Yojana, Annapurna Yojana, Food security Act 2013.

**Nutrition Education:** Concept; Scope; Importance; Theories; Process of nutrition education and communication skills.

**Nutrition Education Program:** Formulation- identification of target audience, message designing and communication channels; Methods- Implementation; production of communication support material, social marketing and community participation; Evaluation of nutrition education program- basic concept, purpose, types.

**Economics of Malnutrition:** Malnutrition and its economic consequences.

**Demography and Vital Statistics:** Basic concept; Population trends in India; Population structure; Vital statistics; Relationship between nutrition and quality of life.

## **Research Methodology and Biostatistics**

**Epidemiology:** - Concept, purpose, goals and uses of epidemiology; Descriptive variables for the health and nutrition of the community. Measures of mortality, morbidity and fertility.

**Research process:** Formulation of research hypothesis, Objectives; Research design; Sample size considerations.

**Epidemiological study designs-** Descriptive studies; Analytical studies; Experimental/intervention studies.

**Sampling methods:** Probability sampling – Simple or unrestricted random sampling, stratified sampling, systematic sampling, cluster sampling, multi-stage sampling; Non-probability sampling – Purposive sampling, incidental sampling, quota sampling

**Research tools:** Scales of data measurement; Characteristics of a good research tool – reliability, validity, usability; Types of tools and their uses – questionnaire and schedules, rating scale, attitude scale; Interview; Observation; Documents.

**Organization of data:** Types of data-qualitative and quantitative; Data processing; Preparation of master chart; Tabulation and organization of data- frequency distribution, contingency tables; Graphical presentation- histogram, graphs, bar-Diagram and pie-charts.

**Analysis of data:** Quantitative data - measures of central tendency, measures of variability-Mean, Median, Mode, outlier value Skewness and Kurtosis, Quartiles, Range and Standard Deviation, measures of relative positions, measures of relationships; statistical inference from proportions, relative risk and odds ratio, analysis of descriptive qualitative data.

**Statistical testing of hypothesis:** Parametric tests – sampling distribution of means; Application- Definition of type I and II errors; Level of Significance, t-test, Z-test, F test. Non-parametric tests like Chi-Square, median test & Mann-Whitney “U” test and application of chi-square test, application of median test. ANOVA for One way & Two way classified data.

**Data management and analysis:** SPSS-introduction, features, operation, basic steps in data analysis, data entry, data management, data analysis.

## **Food Microbiology and Safety**

**Microbiology of foods:** Introduction; Role of microorganisms in fermented foods and beverages; Prebiotics, Symbiotic, Probiotic and Post biotics ; Factors affecting the growth of microorganisms (nutrition, oxygen , temperature , moisture requirement ,osmotic pressure , pH, light); Control and destruction of microorganisms (sterilization and disinfection).

**Food safety:** Introduction; Factors affecting Food safety ( Physical , Chemical, Biological ); Microorganisms in food ( Bacteria , fungi, yeast, moulds, virus, parasites) – morphology and characteristics ; Recent concerns of food safety( prions , genetically modified food , dioxin contaminated food )



**Food spoilage:** Introduction; Factors responsible for food spoilage; Chemical change due to spoilage; Spoilage of different foods ( Meat , poultry products, fish and sea foods, fruits and vegetables, cereals and cereal products, milk and milk products, soft drinks and fruit juices).

**Food hazards of microbial origin:** Food borne intoxications ( Staphylococcal, Bacillus cereus poisoning, Botulism); Food borne infections ( Salmonella, Shigella, Enteropathogenic E.coli, Vibrio parahaemolyticus, Hepatitis A and E, Shell fish poisoning.); Food borne toxic infections (Clostridium perfringens, enterotoxigenic E. coli, cholera, listeriosis, Campylobacter) Mycotoxins ( Aflatoxicosis, ergotism).

**Food contaminants:** Natural toxicants in animal and plant foods; Environmental contaminants (biological, pesticide residues, veterinary drug residues, heavy metals).

**Food adulteration:** Introduction –Concept; Foods commonly adulterated and the types of adulterants; Harmful effects of adulterants.

**Food safety in food service establishments:** Food safety measures in food service establishment (premises, equipment and utensils, kitchen lay out, storage and waste disposal, transportation); Food safety measures for street foods; Hygiene and sanitation in food service establishment (cleaning agents, disinfectants, waste disposal, pest and rodent control, sanitation); Health status of food handlers; Personal hygiene.

**Risk analysis:** Risk assessment – Definitions related to food safety, risk assessment of chemical and biological hazards; Risk Management – elements and general principles; Risk communication – roles and responsibilities.

**HACCP:** Introduction –Concept, need, benefits and principles of HACCP; Guidelines for application of HACCP principles.

**Food standards and regulations:** Acts and regulations -Food Safety and Standards Act, 2006; Bureau of Indian Standards Act, 1986; Agmark Grading and Marketing Act and Rules, 1937; Consumer Protection Act, 1986; Regulation related to genetically modified food; International organizations and agreements for food standardization and Quality control – Codex Alimentarius, Codex India, WTO, SPS and TBT, ISO

## **Advanced nutrition II**

**Concepts of Growth, Development and Aging process:** Major stages of growth; Catch up and lag down growth; Growth spurt; Causes and consequence of ageing; Theories of ageing.

**Nutrient-nutrient Interaction and Imbalance:** Concept; Significance.

**Nutrition for Sportspersons:** Nutritional needs for different categories of sportspersons and dietary recommendation; Role of nutrient supplements as performance enhancers.

**Nutrition at High Altitude and Cold Environment:** Nutrition needs and dietary recommendation; Types of foods and nutrient supplements during high altitude expedition and in space.

**Drug-nutrient Interaction:** Effects of food on drug therapy; Effects of drugs on food and nutrition.

**Nutritional Role of Special Components:** Nutraceuticals; Probiotics, prebiotics, symbiotic; Branched chain amino acids, Omega 3 fatty acids, medium chain triglycerides and glutamine.

**Ant nutrients in Foods:** Goiterogens, lathyrogenic foods, Toxins etc.

## **General Dietetics**

**Classification of Food Stuffs:** Body Building, energy giving and protective foods.

**Food Groups:** Classification of food groups; Importance of cereals, pulses, fruits, vegetables, nuts, milk and milk products, egg, meat, fish, poultry, beverages, spices and condiments.

**Food Exchange List:** Concept: Application in menu planning.

**Diet:** Balanced diet-concept; Importance of each food group in relation to formulation of balanced diet; Different types of diet - low cost, low fat, low salt, high protein, high energy, high fibre, low fibre, low copper, low purine diets; Use of nutraceuticals, phytoestrogens and functional foods; Diet for prevention of occupational health hazards;

**Menu Planning:** Planning of menus and calculation of nutritive values for weaning food, children, adolescents, adults, pregnant and lactating women and elderly.

**Food budgeting:** Concept; Importance; Types of budget; Steps in budgeting; budgetary control.

**Food Costing:** Concept; importance; Cost classification with reference to food costing; Breakeven point, Cost control.

**Responsibility of Dietitians:** Nature of work in hospitals and other health care establishments; Responsibilities.

## **Applied Dietetics**

**Therapeutic Diet:** Concept; Significance.

**Counselling of patients for Diet therapy:** Concept, significance and methods

**Formulation of Therapeutic Diets:**

GI disorders: Swallowing disorders, gastritis and peptic ulcer, Steatorrhea, colitis, sprue, Constipation & Piles, short bowel syndrome, Irritable bowel disease, inflammatory bowel disease (Crohn's disease, ulcerative colitis), Intestinal fistula.

Liver, Gall bladder and Pancreatic diseases: Hepatitis, fatty liver, liver cirrhosis, Gall stones, Cholecystitis, Pancreatitis-acute and chronic.

Renal disease: Glomerulonephritis, Acute and Chronic renal failure, renal stones

Infectious diseases: Typhoid, cholera, tuberculosis, Mumps, Diarrhoea & dysentery, AIDS

NCD : Obesity, Diabetes, Hypertension, Cardiovascular diseases- MI, CVA, Gout, Osteoporosis, Cancer, toxemia in pregnancy, , COPD, Thalassemia, Lung disorders, Polyneuropathy, Anaemia, Hypothyroidism and Hyperthyroidism, Stress, Sepsis, Burns.

**Diet in Nutritional Deficiency Disorders:** Planning of diets and calculation of nutritive value for PEM, IDA, VAD, IDD.

**Diet in Special Conditions:** Planning of diets and calculation of nutritive value in thalassemia, trauma, burns.

**Nutrition support for critical care management:** Total parenteral nutrition, enteral feeding, Nutrition in altered metabolic states.

**Community feeding:** Planning of diets and calculation of nutritive value for large scale catering in student hostels and industries.

**Emergency feeding:** Planning of diet in disaster.

### *Practical*

#### **Physiology and Biochemistry:**

Principle of centrifuge, colorimeter, spectrophotometer, Eliza reader, Identification of tissue slides; TC, DC, albumin, bilirubin, Estimation of blood glucose, lipid profile, bilirubin, uric acid, urea, creatinine, total protein, albumin, SGOT, SGPT, Hb, PCV, T3, T4, TSH, ferritin.

## **Food Science**

Training for taste perception and thresholds; Hedonic scaling for attributes of foods; Determination of moisture, ash, fibre and gluten of flour; Determination of moisture content, acid value, free fatty acids, peroxide value and purity of fats and oils; Determination of fat content, percentage of total solids and solid non-fat, protein and additives in milk; Estimation of iodine in salt and vitamin C in citrus foods. Fermented Food production: Homemade soya yoghurt, Preservation of vegetables by lactic acid fermentation.

## **Advanced Nutrition**

Calculation of BMR and energy expenditure; Calculation of chemical score and NDPCal%; Evaluation of protein quality; Planning and evaluation of dishes for supplementary feeding programme; Calcium and nitrogen balance study.

#### **Community Nutrition:**

Diet survey methodologies – Weighment, recall, bowl methods; Assessment of nutritional status by clinical signs and symptoms, anthropometry, Body fat percentage, KAP; Preparation of low

cost nutritious recipes; Formulation of nutritional message; Development and evaluation IEC materials; Data management and analysis – use of MS-excel and SPSS; Graphical representation of data – use of graphs, pie chart, bar diagram.

### **Food Microbiology and Safety:**

Demonstration of preparation of culture media; Inoculation and staining for bacteria, yeast and fungus; Microbiological study of water – presumptive test; Microbiological analysis of food samples – determination and confirmation of coliforms; MBRT for milk; Detection of common adulterants in food items.

### **Dietetics:**

Kitchen and its different components; Weights and measures; Preparation of liquid, semi-solid and solid diets; Diet for infant, children, adolescent, adult and elderly; Diet during pregnancy and lactation; Diet for GI disorders – constipation, diarrhoea, piles, gastric ulcer, irritable bowel syndrome, inflammatory bowel syndrome, sprue, celiac disease, steatorrhea and diverticulitis; Diet in metabolic diseases – obesity, gout and diabetes; Diet in liver diseases – cirrhosis, hepatitis; diet in heart disease – hypertension, dyslipidaemia; Diet in renal disease – glomerulonephritis, nephritic syndrome, chronic and acute renal failure; Nutritional management of fever, TB and mumps.

## **8. Learning objectives**

### **Applied Physiology and Nutritional Biochemistry**

#### **Applied Physiology**

<b>Sl. No</b>	<b>Topic</b>	<b>Specific learning objectives</b>	<b>Teaching learning methods</b>	<b>No. of Sessions (one session is 90 mins)</b>	<b>Evaluation</b>
1.	Cell	Will be able to understand the structure & functions of cell organelles. Understand the distribution of tissues and their functions in different systems.	Lecture	2	In course assessment and final examination
2.	Alimentary System	Illustrate the structure and describe the functions of different parts of the digestive system.	Lecture	3	

		Discuss the secretory and digestive functions of salivary gland, stomach, intestine, pancreas, liver with special reference to the actions of enzymes.	Lecture	10	
		Explain the mechanism of absorption of Carbohydrate, Protein and Fat through the Intestine.	Lecture	5	
3.	Heart & Circulation	Able to understand the structure and function of heart.  Describe how blood is being circulated through the heart.	Lecture	2	
		Describe how heart is contracting and relaxing.  Explain the events taking place in each cycle.  Be able to understand blood pressure, different factors affecting blood pressure.  Able to measure blood pressure by Sphygmomanometer.  Explain the pathology/physiology of hypertension.  Be able to understand the control of heart rate.	Lecture	10	In course assessment and final examination

4.	Haematology	<p>Explain the composition of blood.</p> <p>Describe the formation and functions of different blood cells and plasma proteins.</p> <p>Understand the system of blood grouping and risk of mismatch and RH incompatibility.</p> <p>Able to describe the mechanism of blood coagulation.</p>	Lecture	8	
5.	Lymphatic System	Describe the composition of lymph and its distribution, drainage and structure of lymphatics in the human body.	Lecture	2	
6.	Excretory system	Illustrate the structure and describe the functions of kidney	Lecture	2	
		Be able to understand the normal and abnormal constituents of urine	Lecture	2	
		<p>Able to understand the mechanism of urine formation.</p> <p>Describe the abnormal and non-functioning of kidney.</p>	Lecture	5	
7.	Endocrine and reproductive system	<p>Illustrate the gross structure of endocrine glands.</p> <p>Discuss the role of various endocrine glands in the regulation of body functions.</p> <p>Describe effects of over secretion and under secretion of hormones.</p>	Lecture	12	In course assessment and final examination

		<p>Able to enumerate the various reproductive organs of female and male along with their functions.</p> <p>Describe the role of different hormones involved.</p> <p>Highlight the physiological changes during pregnancy and lactation.</p>	Lecture	5	
8.	Special sense	<p>Explain the structure of eye, internal ear.</p> <p>Be able to understand the mechanism of vision, taste perception, sense of smell and taste perception.</p>	Lecture	5	
9.	Respiratory system	<p>Illustrate the structure and functions of respiratory organs.</p> <p>Describe the mechanism of respiration.</p>	Lecture	3	In course assessment and final examination
		<p>Explain the gaseous exchange taking place in tissues and lungs.</p> <p>Describe the transport of O<sub>2</sub> and CO<sub>2</sub>.</p> <p>Discuss the lung capacities and volumes.</p>	Lecture	7	
10.	Nervous System	<p>Discuss the morphology of neuron.</p> <p>Describe the various parts of brain and spinal cord and their functions</p> <p>Able to understand the reflex mechanism.</p> <p>Explain the mechanism in synaptic transmission.</p>	Lecture	2	

11.	Muscular system	Be able to understand the structure, function and distribution of different types of muscles in the body.	Lecture	3	
12.	Immunology	Explain the body's immune system. Differentiate between innate and acquired immunity.	Lecture	2	
		Discuss antigen, antibody and their role in defence mechanism.	Lecture	2	
		Enumerate antigen, antibody reaction in the body. Able to describe autoimmunity and autoimmune disease.	Lecture	4	

### Nutritional Biochemistry

Sl. No	Topic	Specific learning objectives	Teaching learning methods	No. of Sessions (one session is 90 mins)	Evaluation
1.	Carbohydrate	1. Understand the chemical properties of different carbohydrates 2. Be able to classify carbohydrates according to their structure 3. Understand the catabolism and anabolism of different carbohydrates	Lecture	12	In course assessment and final examination
2.	Lipid	Understand the chemical properties of different lipids	Lecture	3	
		Be able to classify lipids according to their structure	Lecture	2	
		Understand the catabolism and anabolism of different lipids	Lecture	7	



		Be able to understand the chemical properties and function of different lipoproteins	Lecture	2	
3.	Protein	<ol style="list-style-type: none"> <li>1. Be able to classify amino acids according to their structure.</li> <li>2. Be able to differentiate between amino acids, peptides and proteins.</li> <li>3. Understand the classification and physio-chemical properties of different proteins.</li> <li>4. Understand general principles of amino acid metabolism.</li> <li>5. Understand the metabolism of few specific amino acids</li> <li>6. Understand how non-essential amino acids are synthesized.</li> <li>7. Understand the metabolic relationship of macronutrients.</li> <li>8. Know how some important bio-molecules are synthesized in the body.</li> </ol>	Lecture	25	
4.	Nucleic acid and nucleotide	<ol style="list-style-type: none"> <li>1. Understand the structure of different nucleic acids and nucleotides.</li> <li>2. Be able to classify different nucleic acids and nucleotides.</li> <li>3. Understand different pathways of nucleotide metabolism and their significance.</li> </ol>	Lecture	6	In course assessment and final examination

5.	Inborn error of metabolism	Know the names, cause, consequence and management of some important diseases occur due to inborn metabolic defect.	Lecture	4	
6.	Enzyme	<ol style="list-style-type: none"> <li>1. Be able to define and classify enzymes.</li> <li>2. Understand the specificity and mechanism of action of enzymes.</li> <li>3. Understand enzyme kinetics and be able to derive equations.</li> <li>4. Understand how different environmental factors modulate enzyme activity.</li> <li>5. Understand and be able to differentiate different types of enzyme inhibition.</li> <li>6. Understand the significance of allosteric enzymes and isozymes.</li> <li>7. Understand the use of different enzymes for diagnosis of different diseases.</li> </ol>	Lecture	15	
7.	Coenzymes	<ol style="list-style-type: none"> <li>1. Understand what coenzymes are.</li> <li>2. Be able to classify these.</li> <li>3. Understand the role of different coenzymes in metabolism of different biomolecules.</li> </ol>	Lecture	6	

8.	Free radicals and Antioxidants	<ol style="list-style-type: none"> <li>1. Understand what free radicals and antioxidants are.</li> <li>2. Know different kind of free radicals produced in the body and understand their significance and disposal.</li> <li>3. Know about the action of different natural and synthetic antioxidants.</li> </ol>	Lecture	4	
9.	Replication, Transcription and Translation	<ol style="list-style-type: none"> <li>1. Understand how syntheses of proteins are controlled by different nucleic acids and its significance.</li> </ol>	Lecture	6	
10.	Nutrigenomics	Understand the role of gene in controlling nutrient utilization.	Lecture	2	
11.	Separation and Analytical Techniques	<ol style="list-style-type: none"> <li>1. Understand the principle and methodology of different techniques for separation and analysis of bio-molecules.</li> <li>2. Be able to apply the knowledge for analysis of bio-molecules in the laboratory.</li> </ol>	Lecture	10	In course assessment and final examination

## Food Science and Advanced Nutrition-I

### Food Science

Sl. No	Topic	Specific learning objectives	Teaching learning methods	No. of Sessions (one session is 90 mins)	Evaluation
1.	Carbohydrates	Understand the industrial use of different carbohydrates.	Lecture	8	In course assessment and final examination
2.	Lipids	<ol style="list-style-type: none"> <li>1. Able to classify different fats and oils.</li> <li>2. Understand the physio-chemical properties of fats and oils.</li> <li>3. Know the types of deteriorative changes occur in fats and oils in different conditions.</li> <li>4. Understand the role of different antioxidants in the prevention of oxidation of fats and oils.</li> </ol>	Lecture	9	
3.	Proteins	<ol style="list-style-type: none"> <li>1. Be able to classify proteins and understand their food sources.</li> <li>2. Understand the role of proteins in food processing.</li> <li>3. Understand and able to differentiate different Protein preparations.</li> </ol>	Lecture	8	In course assessment and final examination

<b>4.</b>	Enzyme	Understand the use of different enzymes for the industrial production of different food products.	Lecture	2	
<b>5.</b>	Food colloids	<ol style="list-style-type: none"> <li>1. Able to classify different types of food colloids.</li> <li>2. Understand the properties of food colloids and their role in the maintenance of food quality.</li> </ol>	Lecture	3	
<b>6.</b>	Browning reactions	Understand different types of browning reaction, its significance and measure for prevention.	Lecture	3	
<b>7.</b>	Rancidity	Understand what is rancidity, different types of rancidity, its significance and methods for measurement.	Lecture	3	
<b>8.</b>	Food additives	<ol style="list-style-type: none"> <li>1. Understand what food additives are and able to classify these.</li> <li>2. Understand their role in food as well as the safe use of these.</li> </ol>	Lecture	5	
					In course assessment and final examination

9.	Food processing, preservation and storage	<ol style="list-style-type: none"> <li>1. Understand significance, principles and methods of food processing, preservation and storage.</li> <li>2. Understand different methods for evaluation of these.</li> <li>3. Differentiate between common foods and convenience foods and understand its significance.</li> </ol>	Lecture	10	
10.	Street foods	<ol style="list-style-type: none"> <li>1. Understand what street foods are with common examples.</li> <li>2. Understand its significance from the health and nutrition point of view.</li> </ol>	Lecture	2	
11.	Functional foods and Nutraceuticals	Understand what are nutraceuticals and what are their significance from the health and nutrition point of view.	Lecture	3	

## Advanced Nutrition-I

Sl. No	Topic	Specific learning objectives	Teaching learning methods	No. of Sessions (one session is 90 mins)	Evaluation
1.	Introduction	Learn the definition, meaning, scope and application of advance nutrition	Lecture	2	In course assessment and final examination
2.	Energy	<ol style="list-style-type: none"> <li>1. Understand the concept of basal metabolic rate.</li> <li>2. Understand the requirement, expenditure of energy and its relation to food</li> <li>3. know how to measure energy expenditure</li> </ol>	Lecture	7	
3.	Carbohydrates, Lipids and Proteins	Learn the importance of these macro nutrients and their impact in health	Lecture	6	
4.	Dietary Fibre	Know the modern concept of fibre, their classification and beneficial effects of fibre in health and disease	Lecture	2	
5.	Protein quality	Evaluate the quality of different types of protein	Lecture	2	

6.	Vitamins	Understand the function of vitamins and their therapeutic uses	Lecture	12	In course assessment and final examination
7.	Minerals	know the distribution of minerals in food and their role in human body and effect of deficiency and excess	Lecture	10	
8.	Nutrition for Infants and Preschool Children	<ol style="list-style-type: none"> <li>1. Understand the daily requirement of nutrients and calorie through diet for infants and school children</li> <li>2. Know the benefits of breastfeeding along with its composition</li> <li>3. Know the significance of complementary feeding</li> </ol>	Lecture	3	
9.	Nutrition for older children and adolescents	Understand the nutritional requirement for older children and adolescents through diet and also food habits and eating disorders	Lecture	2	
10.	Nutrition for adults	Discuss the daily requirements of nutrients and calorie for adult male and female through diet and also in pregnancy and lactation	Lecture	2	
11.	Nutrition for elderly	<ol style="list-style-type: none"> <li>1. Know the special nutritional requirements as well as nutritional problems in old age</li> <li>2. Understand the modified diet for betterment of old age nutrition</li> </ol>	Lecture	2	



## Community Nutrition Research Methodology and Biostatistics

### Community Nutrition-Unit I

Sl. No	Topic	Specific learning objectives	Teaching learning methods	No. of Sessions (one session is 90 mins)	Evaluation
1	Introduction	<ol style="list-style-type: none"> <li>Understand the concepts and scope Community Nutrition.</li> <li>Describe the factors affecting Nutrition of a community</li> </ol>	Lecture	1	In course assessment and final examination
		<ol style="list-style-type: none"> <li>Describe what is the meaning of Health Care Delivery System</li> <li>Enumerate types of HCDS in India</li> <li>State the structure of HCDS in India in Govt. system</li> <li>Describe the function of HCDS in India</li> </ol>	Lecture	2	In course assessment and final examination
		<ol style="list-style-type: none"> <li>Enumerate different levels of Health Care</li> <li>Define each level</li> <li>Describe the characteristics, importance, services of each level of Health Care</li> </ol>	Lecture	2	
		<ol style="list-style-type: none"> <li>Define National Health Policy</li> <li>Describe the history with importance of the National Health Policy in India</li> <li>What are the important steps which have been included in NHP</li> <li>Narrate the possible scopes for common people and its limitations</li> </ol>	Lecture	2	

2	Nutritional Problems	<ol style="list-style-type: none"> <li>1. Know the important nutritional problems in India.</li> <li>2. Understand the etiology of the nutritional problems.</li> <li>3. Describe prevention and control of nutritional problems.</li> </ol>	Lecture	10	
		<ol style="list-style-type: none"> <li>1. Know the important life style disorders.</li> <li>2. Understand the etiology of the life style disorders.</li> <li>3. Describe prevention and control of life style disorders problems</li> </ol>	Lecture	5	
3	Strategies to Combat Community Nutrition Problems	Understand food fortification, enrichment. Different foods used for fortification.	Lecture	1	In course assessment and final examination
		Know the different nutrient prophylaxis programmes	Lecture	1	
		Know how supplementary feeding can combat malnutrition at different stages	Lecture	2	
		Know the different methods to improve the quality of food	Lecture	1	
		<ol style="list-style-type: none"> <li>1. Understand the Importance of Immunization in prevention of malnutrition.</li> <li>2. Know the National Immunization schedule</li> </ol>	Lecture	1	

		<ol style="list-style-type: none"> <li>1. Able to define food and nutrition security.</li> <li>2. Understand the concept of food security</li> <li>3. Describe Factors affecting food security</li> <li>4. Know Food security programmes in India.</li> </ol>	Lecture	2	In course assessment and final examination
		<ol style="list-style-type: none"> <li>1. Understand the concept and importance of safe water and sanitation and its relation with Nutritional status</li> <li>2. Know different methods to make water safe.</li> <li>3. Know the solid and liquid waste disposal methods.</li> <li>4. Know the programmes for safe water and sanitation in India.</li> </ol>	Lecture	2	
4	Nutritional assessment	<ol style="list-style-type: none"> <li>1. Know different anthropometric methods and their uses.</li> <li>2. Able to use different anthropometric classification</li> <li>3. Demonstrate the anthropometric measurements</li> </ol>	Lecture/ Practical	3	In course assessment and final examination
		<ol style="list-style-type: none"> <li>1. Know different sign and symptoms of nutritional deficiency.</li> <li>2. Understand and demonstrate the method of clinical assessment.</li> <li>3. Able to diagnosis the chemical deficiency signs and symptoms</li> <li>4. Know different biochemical methods for nutritional assessment</li> <li>5. Understand the use of biochemical parameters for assessment of nutritional status</li> </ol>	Lecture/ Practical	3	

		<ol style="list-style-type: none"> <li>1. Know different dietary assessment methods and their concept.</li> <li>2. Understand methods, advantages and disadvantages of each method</li> <li>3. Able to conduct the diet surveys.</li> </ol>	Lecture/ Practical	4	
		<ol style="list-style-type: none"> <li>1. Know the important vital statistics and its use for the assessment of nutritional status</li> <li>2. Understand and assess the ecological factors and their role in nutrition</li> <li>3. Know different functional indicators and their use to assess the nutritional status.</li> </ol>	Lecture	2	
5	Nutrition Monitoring and Surveillance	<ol style="list-style-type: none"> <li>1. Understand the concept of monitoring and surveillance</li> <li>2. Know the importance of the monitoring and surveillance.</li> </ol>	Lecture	1	In course assessment and final examination
		<ol style="list-style-type: none"> <li>1. Know the objectives and components and importance of nutritional surveillance</li> <li>2. Learn about Infrastructure required for nutrition surveillance</li> <li>3. Know the Key indicators for nutrition surveillance;</li> <li>4. Know existing programs of nutrition monitoring</li> </ol>	Lecture	2	
6	National Nutritional Policy and Programs	<ol style="list-style-type: none"> <li>1. Know the objectives of the policy</li> <li>2. Describe the direct and indirect interventions under the policy</li> </ol>	Lecture	1	

		<ol style="list-style-type: none"> <li>1. Know the development, objectives, implementation, of different supplementary programmes</li> <li>2. Critically analyze the programme</li> <li>3. Understand the development, beneficiaries and activities of ICDS</li> </ol>	Lecture	4	
		<ol style="list-style-type: none"> <li>1. Know the development, objectives and implementation, of different supplementary programmes</li> <li>2. Be able to Critically analyze the programme</li> </ol>	Lecture	4	
7	Nutrition Education	<ol style="list-style-type: none"> <li>1. To comprehend the Concepts, Scope and importance of Nutrition Education.</li> <li>2. To list out the theories of Nutrition Education and apply the process of Nutrition Education to bring about desirable changes in the behavior of community regarding Nutrition.</li> </ol>	Lecture	3	
8	Nutrition Education Program	<ol style="list-style-type: none"> <li>1. To identify the target audience.</li> <li>2. To develop skill to design need based messages and select appropriate channels and methods</li> </ol>	Lecture/ Discussion	3	
		<ol style="list-style-type: none"> <li>1. To develop skill to apply appropriate educational methods for bringing about desirable changes in the community.</li> <li>2. To produce need based an appropriate communication support materials.</li> </ol>	Lecture/ Discussion	3	

		<ol style="list-style-type: none"> <li>1. To comprehend the concept of social marketing and apply this concept for desirable changes in the community</li> <li>2. To understand the different steps of community participation and apply this concept for organizing need based nutrition education program</li> </ol>	Lecture/ Discussion	1	In course assessment and final examination
		<ol style="list-style-type: none"> <li>1. To comprehend the concept of social marketing and apply this concept for desirable changes in the community</li> <li>2. To understand the different steps of community participation and apply this concept for organizing need based nutrition education program</li> </ol>	Discussion  Lecture	1	
9	Economics of Malnutrition	<ol style="list-style-type: none"> <li>1. Understand how malnutrition is related to Economics</li> <li>2. Understand how malnutrition is affects economic consequences</li> </ol>	Lecture	1	In course assessment and final examination
10	Demography and Vital Statistics	<ol style="list-style-type: none"> <li>1. Understand the concept of demography.</li> <li>2. Know the population trends in India</li> <li>3. Describe the different vital statistics</li> <li>4. Understand the relation between nutritional status and quality of life</li> </ol>	Lecture	2	

## Research Methodology

Sl. No	Topic	Specific learning objectives	Teaching learning methods	No. of Sessions (one session is 90 mins)	Evaluation
1	Epidemiology	<ol style="list-style-type: none"> <li>1. Define Epidemiology and explain its objectives and goal.</li> <li>2. Describe the key terms in the definition of Epidemiology.</li> <li>3. Compare the job of a Clinician with the job of an Epidemiologist.</li> <li>4. Summarize the historical evolution of Epidemiology, discuss important figures in the history of Epidemiology and important studies.</li> <li>5. Describe the health of the community such as disease incidence, prevalence, and mortality according to three variables: person, place, and time.</li> <li>6. Discuss the current activities and challenges of modern epidemiologists</li> </ol>	Lecture	2	In course assessment and final examination
		<ol style="list-style-type: none"> <li>1. Explain what is research</li> <li>2. Describe the process of research</li> <li>3. Discuss the scope of research in Nutrition</li> </ol>	Lecture	1	
2	Research	<ol style="list-style-type: none"> <li>1. Explain and give example of a research Question</li> <li>2. Formulate a research Question</li> <li>3. Formulate research objectives</li> <li>4. Formulate research hypothesis</li> </ol>	Lecture	1	In course assessment and final examination

		<p>List the types of epidemiological studies</p> <p>Explain the hierarchy of epidemiological studies</p> <p>Distinguish among observational, analytical and experimental studies</p>	Lecture	1	
		<ol style="list-style-type: none"> <li>1. Enumerate different types of Epidemiological studies.</li> <li>2. Describe the characteristics of Observational Epidemiological studies.</li> <li>3. List the differences between Observational Epidemiological studies and Experimental Epidemiological studies.</li> <li>4. Describe the key characteristics of Cross-sectional studies</li> <li>5. Discuss the important features of conducting Cross-sectional studies.</li> <li>6. Specify the advantages and limitations of Cross-sectional studies.</li> </ol>	Lecture	1	
		<ol style="list-style-type: none"> <li>1. Explain the design of a cohort study</li> <li>2. List the types of Cohort studies</li> <li>3. Describe the steps of a cohort study</li> <li>4. Calculate RR , AR PAR</li> </ol>	Lecture	1	In course assessment and final examination



		<ol style="list-style-type: none"> <li>1. Describe the key features of conducting experimental studies, including enrolment and consent process, randomization, use of placebos and masking, follow up, ascertaining the outcomes and data analysis.</li> <li>2. Distinguish between the different types of experimental studies.</li> <li>3. State the established sequence for conducting trials of new drugs.</li> <li>4. Discuss the special ethical issues of experimental studies, including equipoise and use of placebo controls</li> </ol>	Lecture	1	
3	Research Tools	<ol style="list-style-type: none"> <li>1. Define data, Qualitative, Quantitative, Discrete, Continuous data</li> <li>2. Construction of simple frequency distribution and grouped frequency distribution</li> <li>3. Describe class interval, Class boundary, class width, frequency density</li> </ol>	Lecture	1	
		<ol style="list-style-type: none"> <li>1. Describe the steps involved in research work</li> <li>2. Describe different requisites of a good research</li> <li>3. Define reliability and how to estimate it</li> <li>4. Define validity and how to estimate it</li> </ol>	Lecture	1	In course assessment and final examination
		<ol style="list-style-type: none"> <li>1. Describe the different types of research tools and their uses.</li> <li>2. Distinguish between Questionnaire and schedule.</li> <li>3. Define rating scale and its uses.</li> <li>4. Specify the advantages and disadvantages of different types of tools.</li> </ol>	Lecture	1	

		<ol style="list-style-type: none"> <li>1. Determine the sample size of quantitative data for mean study</li> <li>2. Determine the sample size of qualitative data for prevalence study- Estimating a population with a specified precision (both absolute and relative), Estimating the difference between population proportions with specified absolute precision</li> <li>3. Determine the sample size of qualitative data for incidence study- Estimating an incidence rate with specified relative precision</li> </ol>	Lecture and Group Exercise	11	In course assessment and final examination
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## Food Microbiology and Safety and Advanced Nutrition-II

### Food Microbiology and safety

Sl. No	Topic	Specific learning objectives	Teaching learning methods	No. of Sessions (one session is 90 mins)	Evaluation
1	Microbiology of Foods	<ul style="list-style-type: none"> <li>• History of Microbiology, contribution of Scientists in developing the subject of Microbiology.</li> <li>• Classification of Microbes viz. Bacteria, Parasites, viruses &amp; Fungi</li> <li>• Different methods of Culture &amp; culture methods.</li> </ul>	Lecture	4	In course assessment and final examination
		<ul style="list-style-type: none"> <li>• Microorganism present in different food products.</li> <li>• Role of nutrition, Oxygen, Carbon-di-oxide, PH, and Temperature required for growth of Micro-organisms.</li> <li>• Measures taken to control or</li> </ul>	Lecture	6	

		destruction microorganisms in different foods.			
2.	Food safety	<ol style="list-style-type: none"> <li>1. Factors affecting food safety.</li> <li>2. Methods need to be followed for handling of foods for biological safety.</li> <li>3. The Microbes which can cause food borne diseases.</li> <li>4. Recent concerns on food safety.</li> </ol>	Lecture	3	
3.	Food spoilage	<ol style="list-style-type: none"> <li>1. The cause of food spoilage.</li> <li>2. Chemical changes that occur during spoilage.</li> <li>3. Different factors responsible for food spoilage.</li> <li>4. Microbial spoilage of different food groups with specific examples.</li> </ol>	Lecture	5	
4.	Food hazards of microbial origin	<ol style="list-style-type: none"> <li>1. Difference between food borne intoxication, infection and toxic infection.</li> <li>2. Different types of food borne intoxications, infections and toxic infections; microorganisms responsible and the consequence.</li> </ol>	Practical	4	In course assessment and final examination
5.	Food contaminants	<ol style="list-style-type: none"> <li>1. Naturally occurring toxicants in animal and plant foods.</li> <li>2. Different types of environmental contaminants</li> </ol>	Lecture	2	In course assessment and final examination
6.	Food adulteration	<ol style="list-style-type: none"> <li>1. The concept of food adulteration.</li> <li>2. Different foods commonly adulterated and the adulterants commonly used in these.</li> <li>3. Consequence of consuming adulterants on health.</li> </ol>	Lecture	4	In course assessment and final examination
7.	Food safety in food service	<ol style="list-style-type: none"> <li>1. Different food safety measures to be taken in a food service establishment.</li> </ol>	Lecture	5	In course assessment and final

	establishments	<ol style="list-style-type: none"> <li>Food safety measures to be taken by street food vendors.</li> <li>The importance and method for maintaining hygiene and sanitation in a food service establishment.</li> <li>Importance of maintaining health and personal hygiene of the food handlers in relation to food safety.</li> </ol>			examination
8.	Risk analysis	<ol style="list-style-type: none"> <li>Definition and criteria for risk assessment.</li> <li>Elements and general principles of risk management.</li> <li>Roles and responsibilities of risk communication.</li> </ol>	Lecture	2	In course assessment and final examination
9.	HACCP	<ol style="list-style-type: none"> <li>Concept, need, benefits and principles of HACCP.</li> <li>Guidelines for application of HACCP principles.</li> </ol>	Lecture	2	In course assessment and final examination
10.	Food standards and regulations	<ol style="list-style-type: none"> <li>Different food standards and regulations in relation to food safety.</li> <li>About different International organizations and agreements regarding food safety.</li> </ol>	Lecture	4	In course assessment and final examination

## Advanced Nutrition –II

<b>Sl. No</b>	<b>Topic</b>	<b>Specific learning objectives</b>	<b>Teaching learning methods</b>	<b>No. of Sessions (one session is 90 mins)</b>	<b>Evaluation</b>
1.	Concepts of Growth, development and aging process	<ol style="list-style-type: none"> <li>1. Understand the different growth stages of human life.</li> <li>2. Develop the knowledge on the characteristic physiological changes during childhood and adolescence.</li> <li>3. Understand the physiological disorder that occurs during old age.</li> <li>4. Develop the knowledge on different theories of ageing.</li> </ol>	Lecture	7	In course assessment and final examination
2.	Bioavailability of nutrients	<ol style="list-style-type: none"> <li>1. Understand the importance of bioavailability of nutrients.</li> <li>2. Develop the knowledge on different factors facilitating or inhibiting bioavailability.</li> </ol>	Lecture	2	In course assessment and final examination
3.	Nutrient-nutrient Interaction and imbalance	<ol style="list-style-type: none"> <li>1. Understand the significance of nutrient-nutrient interaction with special reference to some of the nutrients.</li> </ol>	Lecture	2	

4.	Nutrition for sportsman	<ol style="list-style-type: none"> <li>1. Learn the requirement of nutrients and calorie for different sports man</li> <li>2. Able to formulate diet for them</li> <li>3. Able to additional allowances of nutrients in order to have maximum performance of the sportsman</li> </ol>	Lecture	2	
5.	Nutrition at high altitude and cold environment	<ol style="list-style-type: none"> <li>1. Develop the knowledge on the special nutritional needs at high altitude and cold environment.</li> <li>2. Understand the importance of special diets and supplements at high altitude and cold environment.</li> </ol>	Lecture	2	
6.	Drug-nutrient interaction	<ol style="list-style-type: none"> <li>1. Understand the effects of different foods on different drugs in the body.</li> <li>2. Understand the effects of different drugs on the utilization of different nutrients in the body.</li> </ol>	Lecture	2	

7.	Nutritional role of special components	<ol style="list-style-type: none"> <li>1. Understand the concept and significance of different nutraceuticals in relation to functioning of the body.</li> <li>2. Understand the concept of probiotics, prebiotics and symbiotic as well as their significance for health benefits with specific examples and use.</li> <li>3. Understand the nutritional significance of branched chain amino acids, omega-3 fatty acids, medium chain fatty acids and glutamine.</li> </ol>	Lecture	8	In course assessment and final examination
8.	Anti-nutrients in foods	Understand the concept and significance of anti-nutrients present in foods with special reference to goitrogens and lathyrogenic foods.	Lecture	2	

### General and Applied Dietetics

#### General Dietetics

Sl. No	Topic	Specific learning objectives	Teaching learning methods	No. of Sessions (one session is 90 mins)	Evaluation
1.	Classification of food stuffs	Know different types of foods required for different physiological functions of the body	Lecture	4	

2.	Food groups	Know the composition of each food group, their utility, judicious, combination and their application	Lecture	16	In course assessment and final examination
3.	Food exchange	Know what is food exchange list and how one food can be used in place of other	Lecture	1	
4.	Diet	Know what is a balanced diet, on what factors does it depend  Know the application of the diets in special condition	Lecture	12	
5.	Menu planning	Know the requirement of special group of people  Formulate the diet rich in nutrients	Lecture	6	
6.	Food budgeting	Know what is meant by budget  Why it is important in dietetics  How to implement the concept in day to day menu planning and in large scale catering	Lecture	10	
7.	Food costing	Know the different classifications of cost with reference to food costing	Lecture	4	
8.	Responsibilities of Dietitians	The duties and responsibilities of dietitians in a hospital  Highlight the importance of patient care and counselling	Lecture	3	



## Applied Dietetics

Sl. No	Topics	Specific learning Objectives (After completion of lesson student will)	Teaching Learning Method	No. of Sessions (Each 1½ Hrs.)	Evaluation
1.	Therapeutic Diet	Understand the purposes of therapeutic diet adaptation  Explain the different ways in which the normal diet can be modified to therapeutic heads	Lecture	2	In course assessment and final examination
2.	Counselling of patients for Dietotherapy	Know the Role of doctor, nurse and nutritionist for diet counselling	Lecture	2	
3.	Formulation of Therapeutic Diets	Comprehend the pathophysiology of disease conditions, causes and complications.  Plan the modification of regular or normal diet to suit different phases of the disease.	Lecture	46	
4.	Diet in Nutritional Deficiency Disorders	Know the common deficiency diseases in India  Know how to prevent them by dietary modification  Formulate the diet for those patients	Lecture	4	

5.	Diet in Special Conditions	<p>Understand mechanism of response to special conditions, phases of response, and its metabolic consequences.</p> <p>Plan the nutritional support required for special conditions.</p>	Lecture	4	In course assessment and final examination
6.	Nutrition support for critical care management	<p>Know the nutritional management of critically ill individuals.</p> <p>Understand basic idea of substrate metabolism in a state of hyper catabolism, &amp; consequences</p> <p>Know the special feeding method.</p> <p>Know the routes of feeding- Enteral and TPN and guidelines for choosing.</p> <p>Understand the principle and protocol for prescribing the nutritional support.</p> <p>Comprehend the criteria for starting or holding feeds, calculating nutrients and monitoring the progress</p>	Lecture	4	
7.	Community feeding	<p>Understand large scale catering and factors to be considered</p> <p>Know the use of equipment's and to make a budget</p>	Lecture	3	
8.	Emergency feeding	<p>Know what is disaster and what should be the dietary pattern in disaster management</p>	Lecture	2	

## Practical

Sl. No	Topics	Specific learning Objectives (After completion of lesson student will)	Teaching Learning Method	No. of Sessions (Each 3 Hrs.)	Evaluation
1.	Physiology and Biochemistry	<ol style="list-style-type: none"> <li>1. Identify and describe the histology of various human organs.</li> <li>2. Able to conduct different cell counts and interpret the results.</li> <li>3. Develop the skill for using different laboratory equipment.</li> <li>4. Be able to do qualitative tests for various biochemical parameters in urine.</li> <li>5. Be able to estimate various biochemical parameters in blood/serum/plasma.</li> </ol>	Demonstration and Practical	25	In course assessment and final examination
2.	Food Science	<ol style="list-style-type: none"> <li>1. Be able to perform organoleptic tests for foods.</li> <li>2. Develop skill for determination of different characteristic parameters of foods.</li> <li>3. Be able to estimate some nutrients present in natural and fortified foods.</li> </ol>	Demonstration and Practical	20	In course assessment and final examination

3.	Advanced Nutrition	<ol style="list-style-type: none"> <li>1. Be able to estimate energy expenditure of a person.</li> <li>2. Be able to evaluate the protein quality of foods and modify to change it according to need.</li> <li>3. Develop the skill for planning and evaluation of supplementary feeding.</li> <li>4. Learn to conduct calcium and nitrogen balance studies.</li> </ol>	Demonstration and Practical	15	In course assessment and final examination
4.	Community Nutrition	<ol style="list-style-type: none"> <li>1. Develop the skill for nutritional assessment by diet survey, anthropometry, clinical examination, KAP and laboratory investigation.</li> <li>2. Be able to develop IEC materials.</li> <li>3. Develop the skill for data management, analysis and presentation.</li> </ol>	Demonstration and Practical	20	In course assessment and final examination
5.	Food Microbiology & Safety	<ol style="list-style-type: none"> <li>1. Develop the skill to operate microscope.</li> <li>2. Able to sterilize and prepare culture media.</li> <li>3. Develop the skill to inoculate and stain bacteria, yeast and fungus.</li> <li>4. Develop the skill for microbiological analysis of water and foods.</li> <li>5. Able to detect common adulterants in foods.</li> </ol>	Demonstration and Practical	15	In course assessment and final examination

6.	Dietetics	Develop the knowledge about the functioning of a kitchen. Able to prepare diet according to the requirement of normal and diseased person. Able to prepare the dishes as required for dietary intake.	Demonstration and Practical	30	In course assessment and final examination
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### 9. Posting:

**Field training:** A field training program will be conducted at a Rural / Urban Area for 10 working days. The training will comprise of diet survey, nutritional assessment, school health survey, assessment of functioning of ICDS, kitchen survey and institutional visits. Students have to prepare the report and present in a seminar for evaluation.

**Internship:** Students shall undergo an internship program for a period of 21 working days in a hospital under a dietician and submit the report for evaluation.

Sl. No	Place of Posting	Duration	Specific learning Objectives (After completion of lesson student will)	Teaching Learning Method	Evaluation
1.	Field Training Program	10 working days	<ol style="list-style-type: none"> <li>1. Develop the knowledge on the activities of different food industries, hospitals, health centres, ICDS centres, etc.</li> <li>2. Develop the skill on diet survey and nutritional assessment among the community.</li> <li>3. Able to conduct nutritional assessment study in a school.</li> <li>4. Able to survey the nutritional quality of the diet served by the institutional canteen.</li> </ol>	Demonstration and practical	In course assessment
2.	Internship in a Recognised Hospital/ Institute	21 working days	<ol style="list-style-type: none"> <li>1. Develop the knowledge on the activities of the dietetics department of a hospital.</li> <li>2. Able to prepare diet charts for patients admitted to the hospital under the supervision of dietician/doctor.</li> </ol>	Demonstration and practical	In course assessment

## 10. Dissertation/Project work:

Students shall work on a research project under the guidance of a faculty member and prepare a thesis as well as present their work in a seminar for evaluation.

Topic	Specific learning Objectives (After completion of lesson student will)	Teaching Learning Method	No. of Sessions (Each 3 Hrs.)	Evaluation
Dissertation	Able to pursue a research project under a supervisor in the area of public health nutrition.	Practical	120	In course assessment and final examination

## 11. Academic calendar

ACTIVITY	M. Sc 1 <sup>st</sup> year	M. Sc 2 <sup>nd</sup> year
Class room lectures/Laboratory work	August to July	August to July
Dissertation		September to March
Mid-term Examination	January	January
Field Visit & Training		January/ February
Presentation of Field visit & Training		March
Presentation of Dissertation		April
Internship		May/June
Final examination	Part I (July)	Part II (July)

## 12. Assessment

### a) Formative assessment

The formative assessment is continuous as well as end-of-term. The former is based on the feedback from the faculty members of the department of Biochemistry and Nutrition, other concerned departments and guest lecturers. Mid-term assessment is held at the mid of each

session. Formative assessment will not count towards pass/fail at the end of the program, but will provide feedback to the candidate.

## **b) Summative assessment**

The examinations shall be organized on the basis of marking system to evaluate and certify candidates' level of knowledge, skill and competence at the end of the training. A candidate shall have to secure a minimum of 50% marks in each of the following:

- I. Theory
- II. Practical
- III. Dissertation
- IV. Field visit and Training
- V. Internship
- VI. Viva Voce

### **Internal Assessment:**

Both M. Sc Part I and M. Sc Part II Examination (Internal assessment) will have 20% marks for theory papers and 50 % marks for practical, dissertation and viva voce. Field visit and training as well as internship will have 100% each. Internal assessment shall be done on the basis of following:

#### **1. Personal attributes:**

**Behaviour and Emotional Stability:** Dependable, disciplined, dedicated, positive approach.

**Motivation and Initiative:** Takes on responsibility, innovative, enterprising, does not shirk duties or leave any work pending.

**Honesty and Integrity:** Truthful, admits mistakes, does not cook up information, has ethical conduct, exhibits good moral values, loyal to the institution.

**Interpersonal Skills and Leadership Quality:** Gets on well with colleagues and paramedical staff, is respectful to seniors, has good communication skills.

#### **1. Practical Work:**

**Availability:** Punctual, available continuously on duty, responds promptly on assignments and takes proper permission for leave.

**Diligence:** Dedicated, hardworking, does not shirk duties, leaves no work pending, and does not sit idle, competent in practical work.

**Academic ability:** Intelligent, shows sound knowledge and skills, participates adequately in academic activities, and performs well in oral presentation and departmental tests.

**Performance:** Proficient in presentations and discussion during academic sessions in the department.

## 2. Academic Activity:

Performance during presentation at Field training activity and Dissertation presentation.

Midterm theory examinations will be conducted at the end of 1<sup>st</sup> and 3<sup>rd</sup>

Session/term

### M. Sc. (Applied Nutrition) Part I:

EXAMINATION/ EVALUATION	PAPER	UNIT/SUBJECT	MARKS (F.E)	MARKS (I.A)
THEORY	Paper I	Unit I: Applied Physiology	40	10
		Unit II: Nutritional Biochemistry	40	10
	Paper II	Unit I: Food Science	40	10
		Unit II: Advanced Nutrition – I	40	10
	Paper III	Unit I: Community Nutrition	40	10
		Unit II: Research Methodology and Biostatistics	40	10

### M. Sc. (Applied Nutrition) Part II:

EXAMINATION/ EVALUATION	PAPER	UNIT/SUBJECT	MARKS (F.E)	MARKS (I.A)
THEORY	Paper IV	Unit I: Food Microbiology and safety	40	10
		Unit II: Advanced Nutrition-II	40	10
	Paper V	Unit I: General Dietetics	40	10
		Unit II: Applied Dietetics	40	10



**Practical:**

## M. Sc. (Applied Nutrition) Part I:

<b>Subject</b>	<b>Marks F.E</b>	<b>Marks I.A</b>
Physiology and Biochemistry	25	25
Food Science	25	25
Advanced Nutrition	25	25
Community Nutrition	25	25

## M. Sc. (Applied Nutrition) Part II:

<b>PRACTICAL</b>	<b>Subject</b>	<b>Marks F.E</b>	<b>Marks I.A</b>
	Food Microbiology	25	25
	Dietetics	25	25
<b>OTHER CURRICULAR ACTIVITIES</b>	Field Training and Nutrition education activity	---	100
	Internship	---	50
	Dissertation	30	20
	Pedagogy- Journal Club/Seminar)	---	50
<b>VIVA VOCE</b>		50	---

A student will be declared to have passed in an examination if he/she secures at least 50% marks in Theory and Practical papers (separately in University Examination and in Internal Assessment), Dissertation, Field Visit and Training and Internship.

### 13. Model question papers

**The West Bengal University of Health Sciences**  
**M.Sc. in Applied Nutrition Part-I Examination**

**Subject: Applied Physiology & Nutritional Biochemistry**

**Full marks: 80**

**Paper: I**

**Time: 3 hrs.**

*Use separate answer script for each unit*

#### **Unit-I (Applied Physiology)**

1. Answer **any two** of the following:

- i. What are the important histological characteristics of cardiac muscles? 3+4+3
- ii. What is the ionic basis of cardiac action potential?
- iii. Describe how cardiac impulse is propagated?

- i. Describe in brief the histological structure of skeletal muscle. 4+2+4
- ii. What is a "Sarcomere"?
- iii. How does "Power Stroke" of muscle contraction occur?

- i. State the basis of blood grouping. 4+4+2
- ii. What are the major aspects of transfusion hazards in human?
- iii. What is Prothrombin?

2. Write short notes on **any four** of the following:

4x5

- i. Innate Immunity
- ii. Composition and functions of saliva
- iii. Functions of adrenal gland
- iv. Platelets and its morphology
- v. Functions of thyroid hormones
- vi. Haemoglobin-Oxygen Dissociation Curve

#### **Unit-II (Nutritional Biochemistry)**

3. Answer **any two** of the following:

- i. Describe B-oxidation of a saturated fatty acid (C16) and calculate the number of moles of ATP formed in B-oxidation of this fatty acid. 8+2
- ii. Justify the statement "Tricarboxylic acid cycle plays an amphibolic role in energy metabolism." 10
- iii. Define Enzyme. What is the significance of Km? Describe competitive inhibition with example. 2+2+6

4. Write short notes on **any four** of the following

4x5

- i. High energy compounds
- ii. Transamination reaction
- iii. Glycogen storage disease

- iv. Glycogenic and ketogenic amino acids
- v. Role of Vit-D in regulation of calcium homoeostasis
- vi. Urea cycle.

**The West Bengal University of Health Sciences**  
**M.Sc. in Applied Nutrition Part-I Examination**

**Subject: Food Science & Advanced Nutrition**

**Full marks:80**

**Paper: II**

**Time: 3 hrs.**

*Use separate answer script for each unit*

**Unit-I (Food Science)**

1. Answer **any two** of the following:

- i. What are the causes of food spoilage? How it can be protected? Is food value decreased by food preservation? 4+5+1
- ii. What is rancidity of oil/fat? Give the mechanism of hydrogen peroxide formation of an unsaturated triglyceride molecule with double bond. 10
- iii. Give a detailed note on food additives 10

2. Write short notes on **any four** of the following: 4x5

- i. Enzymatic Browning
- ii. Food Preservatives
- iii. Nutraceuticals
- iv. Crystallization of sugar
- v. Food Adulteration
- vi. Importance of sea fish as cardio protective

**Unit-II (Advanced Nutrition)**

3. Answer **any two** of the following:

- i. Discuss different methods for the assessment of protein quality with appropriate examples. 10
- ii. What happens to the immune system in protein malnutrition? Discuss the role of selenium and zinc in the body. 4+3+3
- iii. 'Breast feeding is the best for the baby' - justify the statement. What is the indicator of good nourishment of a baby of 0-6 months? 7+3

4. Write short notes on **any four** of the following 4x5

- i. Fluorine toxicity
- ii. Nutrigenomics
- iii. Hypokalaemia and hyperkalaemia
- iv. Role of Vitamin E as an antioxidant
- v. Factors responsible for calcium absorption
- vi. Nutritional significance of dietary fibre

**The West Bengal University of Health Sciences**  
**M.Sc. in Applied Nutrition Part-I Examination**

**Subject: Community Nutrition & Biostatistics & Computer Application**  
**Full marks: 80**

**Paper: III**

**Time: 3 hrs.**

*Use separate answer script for each unit*

**Unit-I (Community Nutrition)**

1. Answer *any four* of the following: 4x5
- i. Briefly discuss the Principles of Health Education
  - ii. Discuss the importance of exclusive breast feeding
  - iii. Give an account of National Nutrition Policy
  - iv. Discuss utility of posters as an IEC medium
  - v. Describe the effects of Zinc deficiency on human health
  - vi. d. What is Kwashiorkor? Describe its main features.
2. What are the dietary sources of Iron? What are the dietary factors that affect Iron absorption? Briefly describe the main features of National Programme for control of nutritional anaemia? 2+2+6
3. Discuss in brief, the prevention and control of PEM in community in Indian settings. 10
4. Discuss in short the methodologies adopted to assess the nutrition status among under-five children in a community. 10

**Unit-II (Biostatistics & Computer Application)**

*Answer any three questions of which Q No. 8 is compulsory*

5. a) Define central tendency. What are its measures? 5+5
- b) The following are the haemoglobin values (g/100 cc) of 10 children receiving treatment for haemolytic anaemia: 10.0,11.4,12.4,9.8,8.3,9.9,9.1,7.5,6.7,8.6
- Calculate mean, median, and mode for the above data.
6. What do you understand by the term dispersion? Calculate the measure of the following data: 10
- 9,11,9,9,10,10,11,9,11,10
7. Write short notes on any two of the following: 2x5
- a. Bar and Pie diagram
  - b. Classical definition of probability.
  - c. Infant Mortality rate
  - d. Random Sampling
8. Write short notes on any four of the following: 4x5

a. Firewall b. Phishing c. WAN d. Network e. Central Processing Unit f. Local Area Network

**Paper IV and V is of Practical**

**The West Bengal University of Health Sciences**  
**M.Sc. in Applied Nutrition Part-II Examination**

**Subject: Food Microbiology & Food service management**  
**marks:80**

**Full**

**Paper: VI**

**Time: 3 hrs.**

*Use separate answer script for each unit*

**Unit-I (Food Microbiology)**

1. Define food poisoning. How do you investigate an outbreak of food poisoning occurred in a hostel? 2+8
2. Name organisms responsible for causing milk borne diseases. How will you process to diagnose any one of them? 3+7
3. Describe the different tests done to monitor the bacteriological quality of water samples for drinking purpose. 10
4. Write short notes on any four of the following: 4x5
  - i. Bacterial growth curve
  - ii. Autoclave
  - iii. Mycotoxicosis
  - iv. Selective media
  - v. Gram's stain
  - vi. Filtration as method of sterilization

**Unit-II (Food service management)**

*Answer any four questions*

5. What are the factors to be kept in mind while designing a commercial kitchen? 10
6. Discuss various food service methods followed commonly in the food service industry. 10
7. Plan a weekly cyclic menu for a college hostel providing breakfast, lunch and dinner. The cost allotment is Rs. 50/- per day. Care must be taken to ensure that the menu is acceptable by all. 10

8. a. what do you mean by food storage management? 3+7

b. Discuss how proper standards can be maintained for food storage.

9. What do you mean by food contamination? Why is it necessary for food service organization to maintain hygienic standard? What can be done to maintain hygiene on personal standards?

2+3+5

**The West Bengal University of Health Sciences**  
**M.Sc. in Applied Nutrition Part-II Examination**

**Subject: General Dietetics and Applied Dietetics**

**Full**

**marks: 80**

**Paper: VI I**

**Time: 3 hrs.**

*Use separate answer script for each unit*

**Unit-I (General Dietetics)**

1. Write short notes on *any four* of the following: 4x5

- i. Goitrogens BOAA
- ii. Trans Fatty Acids
- iii. Balanced diet
- iv. Diets used in peptic ulcer
- v. Preparation of food depending on nutrients

2. Describe with proper dietary examples of the following: 3x4

- i. Low salt diet
- ii. High calorie diet
- iii. Low purine diet

3. Plan a diet, using exchange list, for a diabetic person who is 20% overweight and whose fasting blood sugar is 180 mg/dl. 8

**Unit-II (Applied Dietetics)**

**Answer any three questions of which Q. No 4 is compulsory**

4. Write brief notes on any four of the following: 4x5

- i. Cirrhosis
- ii. Tropical sprue
- iii. Physiological changes during aging
- iv. Gout
- v. Osteoporosis
- vi. Tuberculosis

5. Briefly state the pathogenesis of chronic renal failure (CRF). Mention with reasoning the dietary modifications for a patient suffering from CRF. 4+6
6. What is atherosclerosis? Discuss its pathogenesis in details. What are the dietary changes that are necessary for a patient suffering from this condition? 2+4+4
7. What do you understand by critically ill patient? What are the modifications in feeding techniques that are during feeding of such patients? 10

#### 14.Suggested readings:

##### Core books

- a. Human Physiology (Vol.I& II), C.C.Chatterjee – Medical Allied Agency.
- b. Medical Physiology, R.L.Vijlani.
- c. Review of Medical Physiology, William F.Ganog – Large Medical Publications.
- d. Dietetics, B.Sri Lakshmi – New Age International(p)Limited & Publishers.
- e. Food Science, B.Sri Lakshmi – New Age International(p)Limited Publishers.
- f. Nutrition Science, B.SriLakshmi – New Age International(p)Limited Publishers.
- g. Food and Nutrition(Vol.I& II), M.Swaminathan – The Bangalore Printing and Publishing Ltd.
- h. Human Nutrition & Dietetics, James Garrow – E&S Livingstone Ltd.
- i. Review of Physiological Chemistry, Harlod.A.Harper-The Kothari Book Depot.
- j. Biochemistry, Debajyoti Das-Academic Book Publishers.
- k. Text Book of Physiology and Biochemistry, George H.Bell &J.Normal Davidson – E&S Livingstone Ltd.
- l. Nutritional Biochemistry, J.Brody.
- m. Clinical Dietetics and Nutrition, F.P.Antia and Philip Abraham, Oxford University Press.
- n. Nutrition and Diet Therapy, Fairfax.T.Proderfit-The Macmillan Company.
- o. Krause’s food & Nutrition Therapy, L Kathleen Mahan and Sylvia Escott-Stump, Elsevier
- p. Nutritive value of Indian foods, G.Gopalon, NIN-ICMR.
- q. Nutrient requirement and recommended dietary allowances for Indians-ICMR
- r. Microbiology, Michael J. Pelczar, Jr, E.C.S Chan and Noel r. Krieg, Tata McGraw-Hill
- s. Fundamental Principles of Bacteriology, A. J. Sale, Tata McGraw-Hill
- t. Food Microbiology, William Frazier and Dennis Westhoff, McGraw-Hill
- u. Food Service Management, Stanton
- v. Food Costing, Richard Kotas

##### Reference Books

- a. Health Policies and Programmes in India, Dr.D.K.Taneja,Doctors Publication.
- b. Hookworm Infection and Anaemia (Approaches to prevention and control), Z.S. Panolonoski, G.K.Schad,G.J.Stott.
- c. Measuring change in Nutritional Status,WHO,Geneva.
- d. Endemic goitre and Endemic Cretinism, John B.Stanbury,BasilS.Hetzel,Wiley eastern Limited.

- e. Nutrition: An integrated approach, Ruth L.Pike, Myrtle L.Brown,Wiley eastern Private Ltd.
- f. The prevention of food adulteration act, 1954 Confederation of Indian Industry.
- g. A manual of Laboratory Techniques, NIN-ICMR edited by N.Ragluramuln, K.Madhavan, S.KalyanSundaram.
- h. Nutrition and child development. Dr. K. E Elizebeth, Paras Publications
- i. Nutrition and Diet Therapy. Carroll Alutz and Karen Rutherford, 3<sup>rd</sup>edicion,F.A Davis Company
- j. Hotel Management, Dr. BarunChakravarty

### **Journals**

- a. Advances in Nutritional Research
- b. European Journal of Nutrition
- c. Food Microbiology
- d. Food Science
- e. Indian Journal of Nutrition and Dietetics
- f. International journal of Food science and Nutrition
- g. International journal of for Vitamin and Nutritional research
- h. Journal of Human Nutrition and Dietetics
- i. Journal of Nutrition Education
- j. Nutrition Foundation of India Bulletin
- k. Nutrition News
- l. Nutrition Reviews
- m. Obesity Reviews
- n. Journal of Nutrition in Gerontology and Geriatrics
- o. British Journal of Nutrition
- p. Journal of The American Dietetic association
- q. World Review of Nutrition and Dietetics

### **Web resources:**

[www.icmr.nic.in](http://www.icmr.nic.in)  
[www.ninindia.org](http://www.ninindia.org)  
[www.nnmbindia.org](http://www.nnmbindia.org)  
[www.nutritionssocietyindia.org](http://www.nutritionssocietyindia.org)  
[www.pubmed.nl](http://www.pubmed.nl)  
[www.ajcn.nutrition.org](http://www.ajcn.nutrition.org)  
[www.who.int](http://www.who.int)  
[www.mohfw.nic.in](http://www.mohfw.nic.in)  
[www.internationaldietetics.org](http://www.internationaldietetics.org)  
[www.andjrnl.org](http://www.andjrnl.org)  
[www.gerontologyindia.com](http://www.gerontologyindia.com)