# M. Sc. in Nutrition and Dietetics

# Duration – 2years

# (Choice Based Credit System)

## Vidyasagar University

### Paschim Medinipur : 721102

# M.Sc. (2years Course) in Nutrition and Dietetics

## Outline of the syllabus (Semester system)

**Total Marks = 1200**

**Theoretical Marks = 800**

**Practical Marks = 400**

**Total Credits= 96**

# Summary of Courses of Studies: M. Sc. in Nutrition and Dietetics

**(Under choice based Credit System)**

**1st Semester**

| Course No. | Core/Elective | Title | Credit Hour |
|---|---|---|---|
| NUD – 101 | (Core) | Physiological aspects of Nutrition | 4 (Theory) |
| NUD – 102 | (Core) | Biophysical & Biochemical aspect of Nutrition | 4 (Theory) |
| NUD – 103 | (Core) | Metabolism of Macro and Micro Nutrients and its Molecular Basis | 4 (Theory) |
| NUD – 104 | (Core) | Food Hygiene & sanitation and Food Toxicology & food Safety | 4 (Theory) |
| NUD – 105 | (Core) | Experiments on Nutritional Biochemistry | 4 (Practical) |
| NUD – 106 | (Core) | Experiments on Physiology and Nutritional Anthropometry | 4 (Practical) |
| | | | **Total = 24** |

**2nd Semester**

| Course No. | | Title | Credit Hour |
|---|---|---|---|
| NUD – 201 | (Core) | Nutrition through life cycle and Growth & development | 4 (Theory) |
| NUD – 202 | (Core) | Diet therapy | 4 (Theory) |
| NUD – 203 | (Core) | Food Microbiology and Nutritional Anthropology | 4 (Theory) |
| NUD – 204 | **(Elective)** | Food Biotechnology | 4 (Theory) |
| NUD – 205 | (Core) | Experiments on Food Microbiology and Review Work | 4 (Practical) |
| NUD – 206 | (Core) | Preparation of Normal Diet Chart and Preparation of Therapeutic Diet Chart in Hospitals | 4 (Practical) |
| | | | **Total = 24** |

**3rd Semester**

| Course No. | | Title | Credit Hour |
|---|---|---|---|
| NUD – 301 | (Core) | Bio-statistics in Nutrition and Research Methodology | 4 (Theory) |
| NUD – 302 | (Core) | Computer Application and Bioinformatics | 4 (Theory) |
| NUD – 303 | (Core) | Concept of Nutritional Genomics & Proteomics and Drug Nutrient Interaction | 4 (Theory) |
| NUD – 304 | **(Elective)** | Preventive and Social Medicine | 4 (Theory) |
| NUD – 305 | (Core) | Experiments on Biostatistics & Computer Applications in Nutrition | 4 (Practical) |
| NUD – 306 | (Core) | Nutritional Survey and Nutrient & food Analysis | 4 (Practical) |
| | | | **Total = 24** |

**4thSemester**

| Course No. | | Title | Credit Hour |
|---|---|---|---|
| NUD – 401 | (Core) | Food & Nutrition Services in Hospital and Nutrition in Critical Care | 4 (Theory) |
| NUD – 402 | (Core) | Nutrition Counseling and Sports Nutrition | 4 (Theory) |
| NUD – 403 | (Core) | Nutraceuticals & Health Foods and Food Processing & Preservation | 4 (Theory) |
| NUD – 404 | (Core) | Nutritional epidemiology and Public Health Nutrition | 4 (Theory) |
| NUD – 405 | (Core) | Internship Training in Hospital & Report Preparation in Community Nutrition and Nutritional Epidemiology | 4 (Practical) |
| NUD – 406 | (Core) | Project Work | 4 (Practical) |
| | | | **Total = 24** |

# M.Sc. 1st Semester

# Theory

**Course No. NUD – 101 Physiological Aspects of Nutrition** **4 Credits**

**Unit-1: Physiological Aspects of Nutrition I** **2 Credits**

- **1.1 : Circulatory System:** Heart, Blood vessels, circulation of the blood; Composition of blood - plasma, cellular content; Blood pressure and it's regulation. Circulatory importance of hepatic portal system, lymphatic system.

- 1.2 **:Digestive system:** Organs of the digestive system, General plan of the alimentary canal- Salivary glands, Pharynx, Oesophagus, Stomach & gastric juice, Small intestine, large intestine, rectum and anal canal, Pancreas, Liver, Bile. Digestion and absorption of carbohydrate, protein and lipid.

- 1.3: **Excretory system:** Anatomy and function of kidney, formation, composition, and excretion of urine. Role of kidney in water, electrolytes and acid base balance.

- 1.4 **:Muscular System:** Structure and functions of muscles of the face and neck, Muscles of the back, Muscles of the abdominal wall, Muscles of pelvic floor, Diseases of muscles

- 1.5: **Respiratory system:** Anatomy, mechanism of respiration, regulation of respiration exchange of gases, transport of oxygen and carbon dioxide.

**Unit-2: Physiological Aspects of Nutrition II** **2 Credits**

- 2.1 **Immune system**: Properties, natural and acquired Immunity, features of immune responses, antigen – antibodies – types, properties, antigen – antibody interaction, B – and T – cell biology, MHC, Auto immune disorders, hypersensitivity and allergy, Immunomodulation by food.

- 2.2 **:Nervous System:** Central nervous system- structure and functions of brain and spinal cord; Peripheral Nervous system- spinal nerves and cranial nerves; Autonomic nervous system; Neurons.

- 2.3: **Sense Organs:** Structure and functions of ear, eye, skin, nose, physiology of smell, Sense of taste.

- 2.4 **: Endocrine System:** Structure and functions of Pituitary gland and Hypothalamus, Thyroid gland, Parathyroid gland, Adrenal and Suprarenal glands, Pancreatic islets, Pineal body, Thymus gland, local hormones, Disorders of Endocrine glands in brief.

- 2.5 **: Reproductive System:** Anatomy and Physiology of female reproductive system- External and internal organs- puberty in the female, Menstrual cycle, menopause, Anatomy and Physiology of Male Reproductive system- External and internal organs, Functions of male reproductive system

**Course No. NUD – 102 Biophysical** and **Biochemical Aspect of Nutrition**

**Unit-3: Biophysical Aspect of Nutrition.** **2 Credits**

- 3.1 **Acid base equilibrium:** Bronsted Lowry theory, protolysis of water, hydrogen ion concentration, PH, Acid base balance, Henderson and Hasselbalch equation.
- 3.2 **Thermodynamics:** Basics of thermodynamics, laws of thermodynamics and living organism, entropy, enthalpy, Efficiency and free of energy system, concept of energy in biological system, chemical potential.
- 3.3 **Separation techniques I:**Principle and application of column chromatography, TLC, GLC, HPLC: Mobile Phase systems, modes of operations, Application, Fundamental Principles of Centrifugation, Ultracentrifugation and their applications in molecular weight, and size determination, Viscosity and its physiological importance.
- 3.4 **Separation techniques II:** Electro kinetics methods, Electrophoresis - Paper, SDS-PAGE, capillary, Iso-electric focusing, Agarose gel electrophoresis. Electrophoretic mobility (EPM)

**Unit-4: Biochemical Aspect of Nutrition** **2 Credits**

- 4.1 **Carbohydrates:** classification and sources of dietary carbohydrates – free sugars, short chain carbohydrates, starch, non-starch polysaccharides-, functions of carbohydrates, carbohydrate content of foods, requirements and intakes of dietary carbohydrates.

- 4.2 **Proteins:** Chemistry of proteins, classification and functions of Proteins, Protein turnover, Protein requirements, conformation and structure of proteins – primary, secondary, tertiary and quaternary structure.

- 4.3 **Lipids:** Types of natural lipids and their functions- structural lipids, storage lipids and metabolic lipids, fats in various foods, composition of fats in diets, chemical properties and characterization of fats. Waxes, Cerebrosides, Gangliosides, Phospholipids and Proteoilipids. Steroids and Bile salts.

- 4.4 **Nucleic Acid:** Types of Nucleic Acid and their functions, structure of Nucleic Acid ,classification of Nucleic Acid, biosynthesis and degradation of purines and pyrimidines and their regulation. Inherited disorders of purine and pyrimidine metabolism.

**Course No. NUD – 103 Metabolism of Macro** and **Micro Nutrients and its Molecular Basis** **4 Credits**

**Unit – 5: Metabolism of Macro Nutrients and its Molecular Basis** **2 Credits**

- 5.1 **:** Metabolism : Catabolism, anabolism,catabolic, anabolic and amphibolic pathways. Metabolic pathways of macronutrients.
- 5.2 Metabolism of Carbohydrates: Glycolysis, TCA cycle, HMP shunt, Bioenergetics, Glycogenolysis, Alcoholic fermentation, hormonal regulation of blood glucose.
- 5.3 Protein and Amino acid metabolism: Protein degradation, metabolism of aromatic, sulfur containing, BCAA and other amino acids, fate of nitrogen (Urea cycle), glutamine and alanine cycle, protein biosynthesis.
- 5.4 Lipid metabolism: Beta – oxidations of saturated fatty acids. Biosynthesis of fatty acids – Acetyl-CoA carboxylase reaction, Biosynthesis of triglycerides, cholesterol & phospholipids, Regulation of fatty acid biosynthesis.

**Unit – 6: Micronutrients in Nutrition** **2 Credits**

- 6.1 Metabolism of Iron, Zinc, Iodine, Selenium, Fluoride, Chromium, Other essential trace elements.
- 6.2 Folate and Vitamin B12 during reproduction; Vitamin B12 during aging
- 6.3: Iron, Zinc, copper, and Iodine in growth and development, including cognitive development(emphasis on infancy and early child hood)
- 6.4 Sodium, Potassium and chloride in hypertension
- 6.5 Role of Vitamins A, C, E and selenium as antioxidants and their importance in chronic diseases
- 6.6 Importance of Calcium, Vitamin D, Magnesium, Phosphorus, and Vitamin K in Bone Health (emphasis on infancy and aging)

**Course No. NUD – 104 Food Hygiene and Sanitation & Food Toxicology, Food laws and Food Safety**
**4 Credits**

**Unit – 7 Food Hygiene and Sanitation.** **2 Credits**

- 7.1 General principles of food hygiene, hygiene in rural and urban areas in relation to food preparation. Personal hygiene and food handling habits. Place of sanitation in food plants.
- 7.2 (a) safe and effective insect and pest control: extraneous materials in foods, principles of insects and pets control.
  (b) Physical and chemical control. Effective control of micro organism: Importance of microorganism in food sanitation. Microorganism as indicator of sanitary quality.
- 7.3 Sanitary aspects of water supply, source of water, quality of water, water supply and its uses in food industries. Purification and disinfection of water prevention contamination of potable water supply.
- 7.4 (a) Effective detergency and cleaning practices: Importance of cleaning technology, physical and chemical factors in cleaning, classification and formulation of detergents and sanitizers, cleaning practices.
  (b) Sanitary aspects of waste disposal, establishing and maintaining sanitary practices in food plants, role of sanitation, general sanitary consideration and sanitary evaluation of food plants.

**Unit – 8 Food Toxicology and Food Safety** **2 Credits**

- 8.1. a. Concept and meaning of food quality and food safety, food adulteration, food hazards.
  b. Natural toxins.
- 8.2 Food laws and regulations – national and international food laws, governing bodies.
- 8.3. Exposure, estimation, toxicological requirements and risk assessment.
- 8.4. Safety aspects of water and beverages such as soft drinks, tea, coffee, cocoa.
- 8.5. a. Safety assessment of food contaminants and pesticide residues.
  b. Safety evaluation of heat treatments and related processing techniques.

# Practical

**Course No. NUD – 105 Experiments on Nutritional Biochemistry** **4 Credits**

**Unit – 9: Experiments on Nutritional Biochemistry I** **2 Credits**

- 9.1 Determination of Saponification Number.
- 9.2 Determination of Acid Number and iodine number
- 9.3 Estimation of Creatinine and uric acid in urine and blood
- 9.4 Estimation of Serum cholesterol, triglyceride.
- 9.5 Estimation of Blood glucose by Glucose oxidase / Nelson Somogy method

**Unit – 10: Experiments on Nutritional Biochemistry II** **2 Credits**

- 10.1 Estimation of Serum proteins by Biuret method / Lowry method.
- 10.2 Estimation of Albumin / globulin ratio by Biuret method
- 10.3 Estimation of starch from wheat flour
- 10.4 Estimation of lactose from milk
- 10.5 Bio chemical testing of food additives

**Course No. NUD – 106 Experiments on Physiology & Nutritional Anthropometry (With Seminar)**
**4 Credits**

**Unit – 11: Experiments on Physiology** **2 Credits**

- 11.1 Microscopic examination of various tissues
- 11.2 Determination of clotting and bleeding time
- 11.3 Enumeration of RBC and WBC
- 11.4 Estimation of hemoglobin and Red blood cell indices
- 11.5 Determination of blood group and Rh factor
- 11.6 Determination of pulse rate and Blood pressure
- 11.7 Determination of Respiratory Rate
- 11.8 Lung function test
- 11.9 E.C.G. – recording and analysis

**Unit – 12: Nutritional Anthropometry** **2 Credits**

- 12.1 Nutrition status of Pre-school children using anthropometric parameters.
- 12.2 Nutrition status of school going children using anthropometric parameters
- 12.3 Nutritional status of adolescence using anthropometric parameters.
- 12.4 Nutrition status of geriatric person.

(Above nutritional assessments should be made by measuring height, weight, head circumference, Mid-arm circumference, BMI and other anthropometric indices and skin fold thicknesses)

# M. Sc. 2nd Semester

## Theory

**Course No. NUD – 201 Nutrition through Life cycle and Growth Development** **4 Credits**

**Unit-13: Nutrition through Life Cycle** **2 Credits**

- **13.1:Food Groups and Recommended Allowances**

Different food groups and planning diets to meet the requirement at different socioeconomic levels, Recommended allowances for Indians, Basics requirement for computation of the allowances (comparison of India's recommended allowances with that of UK, USA, FAO & WHO),

- **13.2 :Nutrition in Pregnancy and Lactation**

Nutritional status and general health, weight gain during pregnancy and nature of weight gain, requirements, storage of nutrients in normal pregnancy. Physiological cost, complications fetal growth and implications of public health programmes. Nutritional requirements of lactation.

- **13.3 :Nutrition in infancy**

Nutritional status of infants, weight as the indicator, Nutritional allowance for the infants, breast feeding, breast feeding versus formula feeding, Weaning foods suitable for infants, feeding the premature infant

- **13.4:Nutrition in Preschool**

Prevalence of malnutrition in preschool age, food habits and nutrient intake of preschool children, dietary allowances – supplementary foods, feeding programmes for preschool children

- **13.5: Nutrition during school age**

Physical development – Nutritional status of school age children, school lunch programmes, food habits, nutritional requirements for school age children

- **13.6 :Nutrition during adolescence**

Change of growth, characteristics of adolescents, nutritional needs of the adolescents, changes needed to prevent malnutrition in adolescence

- **13.7:Nutrition for Adults**

Nutrition for the adults, basis for requirement nutrition and work efficiency

- **13.8 :Nutrition for the Aged**

Nutritional requirements for aged, socio economic and psychological factors, Clinical needs, malnutrition of elderly persons

**Unit-14 Growth and Development** **2 Credits**

- 14.1 Human growth development
- 14.2 Uterine and neonatal growth
- 14.3 Skeletal and muscular growths.
- 14.4 Reproductive growth and development.
- 14.5 Determinants of growth and development
- 14.6 Impact of altered nutrition on growth and development
- 14.7 Changes in Body composition throughout the life cycle.
- 14.8 Alterations in body composition and their consequences

**Course No. NUD – 202 Diet Therapy** **4 Credits**

**Unit-15 Diet therapy I** **2 Credits**

15.1. **Introduction to Clinical Nutrition and Dietetics**; Definition and history of dietetics. Dietetics in contemporary medical management. Interrelationship between food, nutrition and health. Factors affecting food choices. **Basic principles of planning a normal diet:** characteristics of a normal diet,meeting nutrient requirements of individuals and family. Use of dietary guidelines for Indians.

- 15.2. **Objectives of diet therapy**- Regular diet and rationale for modifications in energy and other nutrients, texture, fluid, soft diets. Principles of enteral and parenteral nutrition

- 15.3. **Assessment of nutritional status in clinical situations and development of nutrition care plan**: Assessment nutritional status in hospital setup-dietary, clinical, biological, somatic, behavioral methods. Psychological factors affecting food intake. Data analysis and interpretation. Medical records-types, uses. Factors to be considered for counseling, Nutritional and health conditions including body care- skin, hair, face, hands, feet etc. Aging, gender related and other problems.

- 15.4. **Dietary management for nutritional disorders**.
  Protein and energy malnutrition (hospital and domiciliary treatment), Vitamin A deficiency, other deficiencies-osteoporosis, iodine and iron deficiency disorders etc

- 15.5. **Dietary management of febrile diseases** – Fever-acute and chronic (Tuberculosis, poliomyelitis, typhoid, pneumonia, measles, chicken pox, malaria) problem with resistance virus, chikungunea,

**Unit-16 Diet therapy II** **2 Credits**

16.1. **Dietary principles and management Gastro-Intestinal Disorders** –Etiology, symptoms, treatment and prevention of the following: i. Gastritis ii. Peptic ulcer iii. Diarrhoea iv. Constipation v. Malabsorption syndromes-Sprue / Tropical sprue vi. Ulcerative colitis and Crohn's disease vii. Diverticulosis viii. Irritable bowel syndrome.

- 16.2. **Upper gastrointestinal diseases:** Gastroesphophageal reflux and esophagitis**.** Disorders of stomach-indigestion, dyspepsia, gastritis, (causes, pathology, management). Nutritional management

- 16.3. **Nutritional management in pulmonary diseases:** Nutritional management, causes, pathology of chronic obstructive pulmonary disease, cystic fibrosis, pneumonia, and tuberculosis,

- 16.4. **Rheumatic disorders:** Nutritional management, causes, symptoms, treatment of Arthritis- osteo and rheumatoid arthritis, gout, preventive measures.

- 16.5. **Liver diseases:** Nutritional management of Hepatitis (A, B, C). Cirrhosis, Cholecystisis, Cholelithiasis. alcoholic liver disease, cholestatic liver disease, inherited disorders

- 16.6. **Pancreatitis**. Functional tests and dietary management of acute and chronic pancreatitis.

- 16.7. **Neurological diseases:** Stroke, epilepsy, migraine, Parkinson's' neurotrauma myasthenia gravis - causes, effect of malnutrition, feeding problems, effect of nutrients.

**Course No. NUD – 203 Food Microbiology and Nutritional Anthropology** **4 Credits**

**Unit-17 Food Microbiology** **2 Credits**

- 17.1. Importance of microorganisms in food – cultivation of microorganism and factors affecting the growth of microorganisms in food - intrinsic and extrinsic parameters that affect microbial growth.
- 17.2. Contamination and spoilage of cereal, pulses and their processed products
- 17.3. Contamination and spoilage of vegetables and fruits and their products
- 17.4**.** Contamination and spoilage of flesh foods, eggs and poultry, milk and milk products
- 17.5 Fermented food and it's nutritional benefits

**Unit-18 Nutritional Anthropology** **2 Credits**

- 18.1 Principle of Nutritional status by anthropometric assessment – advantages and disadvantages.
- 18.2 Age group specific height, weight, weight for age, weight for height, BMI. Indian reference value, process-limitation.
- 18.3 Body fat determination - process and its impact on nutritional anthropology
- 18.4 Body mass determination.
- 18.5 BMR determination from Anthropometric parameters.
- 18.6 Different Anthropometric measures and their importance in nutritional status.
- 18.7 Anthropometry – methods, reference standards in children and adults, scales of comparison (percentiles, Z score) classification and interpretation of somatic data, somatic indicators of PEM.

**Course No. NUD – 204 Food Biotechnology** **4 Credits**

**Unit-19 Food Biotechnology I** **2 Credits**

- 19.1. a. Use of Biotechnology for food processing.

  b. Indian fermented foods – historical perspective, mechanism of fermentation, effect on nutritional value.
- 19.2. Genetically modified foods - need for GM foods. food challenges, potential benefits in agriculture, Crop engineered for input and output traits, nutritional improvement, animal foods, issues of concern – safety of GM foods.
- 19.3. Technology for production of alcoholic beverages
- 19.4. a. Fermented cereal and legume based products, traditional and yeast leavened products.
  b. Fermentation of vegetables and fruits – lactic acid fermentation.
  c. Fermented milk products – yoghurt, butter- milk, cheese.
  d. Fermentation of meat and fish.

**Unit-20 Food Biotechnology II** **2 Credits**

- 20.1 Safety aspects of food produced by Biotechnology and Genetic engineering.
- 20.2 Food Preservation: Method of food preservation by physical methods – a) Heat processing: sterilization, pasteurization, blanching, canning. b) cold preservation; refrigeration, freezing, freeze drying, refrigerated gas storage c) food irradiation: technology, application and safety assessments
  Chemical methods like, concentration, fermentation, preservatives. Preservation by natural antimicrobial compound, biologically based preservation system and pro biotic bacteria, newer method of food preservation

- 20.3 special food processing technology: a) Membrane technology (reverse osmosis and ultra filtration), agglomeration, agitation, extrusion, b) enzyme technology – production of enzymes – amylase, protease, lipase, lactase and pectinase, Use of enzymes in food and beverage industry (e.g., cheese, fruit, juice, wine, Meat tenderizing & dairy)

# Practical

**Course No. NUD – 205 Experiments on food Microbiology** and **Review Work** **4 Credits**

**Unit-21 Experiments on food Microbiology** **2 Credits**

- 21.1 Identification of microorganism – yeast, mould, algae.
- 21.2 Simple staining, gram staining and hanging drop preparation.
- 21.3 Observation of culture characteristics and preparation of culture media.
- 21.4 Identification of microorganisms in curd.
- 21.5 Identification of mould in bread.
- 21.6 Bacteriological testing of milk

**Unit-22 Review Work** **2 Credits**

An independent review work should be undertaken by student under the guidance of a teacher. A report should be submitted at the end of semester in a standard format. The review topic can be selected in consultation with the supervisor.
The student will be required to appear before examiners board and to deliver a seminar on the review work

**Course No. NUD – 206 Preparation of Diet Chart and Therapeutic diet chart in Hospitals**
**4 Credits**

**Unit-23 Preparation of normal Diet chart** **2 Credits**

- 23.1Preparation of Diet chart of infants
- 23.2 preparation of diet chart for preschool children
- 23.3 preparation of diet chart for school children
- 23.4 preparation of diet chart for adolescents
- 23.5 Preparation of diet chart for old age
- 23.6 Preparation of diet chart for athletes
- 23.7 Preparation of diet chart for pregnant mother
- 23.8 Preparation of diet chart for lactating mother

**Unit-24 Therapeutic diet chart in Hospitals** **2 Credits**

- 24.1 Preparation of diet chart for diabetic Patients
- 24.2 Preparation of diet chart for hypertensive patients
- 24.3 Preparation of diet chart for patients with cardiovascular ailments
- 24.4 Preparation of diet chart for hypeurecic /Gout patients
- 24.5 Preparation of diet chart for patients with renal diseases
- 24.6 Preparation of diet chart for cancer patients
- 24.7 Preparation of diet chart for gastro intestinal disorders
- 24.8 Internship Training (a. Internship in hospitals or Food Service Institutions & Hospitals / Clinics b) Submission of report on case studies on a minimum of 10 patients in any disease condition.)

# M. Sc. 3rd Semester

# Theory

**Course No. NUD 301 Biostatistics in Nutrition & Research Methodology** **4 Credits**

**Unit – 25 Bio-statistics in Nutrition** **2Credits**

- 25.1 Presentation of data: Frequency distribution , bar and pie diagrams , Frequency polygon, histogram , Scattergram
- 25.2 Statistics of dispersion : range, mean deviation , standard deviation and error , variance
- 25.3 Characteristics of distributions: probability distribution , normal distribution ,skewness, kurtosis
- 25.4 Mean, median , mode and percentile and percentile rank
- 25.5 Testing hypotheses: Null Hypothesis , levels of significance, error of inference and estimation of Z scores
- 25.6 Parametric tests of difference between means: t test, ANOVA and post hoc analysis of significance
- 25.7 Non-parametric tests: Mann Whitney test , Chi square test
- 25.8 Correlation and Regression

**Unit 26 Research Methodology** **2 Credits**

- 26.1 Objectives of research: definition, objectives, types of research, quantitative and qualitative research in food and nutrition.
- 26.2 Basic Principles of research design: Meaning and need, types of research designs – exploratory, descriptive, experimental, survey and case study - cross–sectional and longitudinal, Study design issues, sampling methods and sample size.
- 26.3 Instruments of data collection; Observation, questionnaire, interview: reliability and validity of measuring instruments, data management and quality control
- 26.4 Research Strategies in food and Nutrition: Issues in design, conduct, analysis and interpretation a) descriptive studies ( case studies, case-control and cohort studies – prospective and retrospective)
- 26.5 Ethics in nutrition research
- 26.6 Scientific writing as a means of communication: a) Different forms – research articles / notes, review articles, monographs, dissertations, and reports b) components of dissertation / research report / article c) Methods of presenting research findings – oral / poster
- 26.7 Background of Literature review, aims and objectives, Methodology, Expenditure, Bibliography of project proposal formulation, PERT chart.
- 26.8 Pilot project and its importance.
- 26.9 Implementation of project proposal and its evaluation.

**Course No. NUD 302 Computer Applications & Bioinformatics and Community Nutrition**

**4 Credits**

**Unit – 27 Computer Application & Bioinformatics** **2 Credits**

- 27.1 Basics of computer: a) Generations of computer and types of computer b) computer hardware – CPU, Peripherals devices, computer memory
- 27.2 computer software: system software, application soft ware, Operating systems, Computer Languages, software packages
- 27.3 Word processing and data management:- Ms Word, Ms excel and nutritional data management, Ms PowerPoint – its application
- 27.4 Concept of internet – components, uses. WWW, browsing, Searching nutritional information / data, downloading and uploading through internet, application in nutrition
- 27.5 Basic Bioinformatics – Introduction to bioinformatics, its importance and scope, Biological databases, primary and secondary sequence databases, Genbank, EMBL, DDBJ, PDB, MMDB.
- 27.6 Current advancements in bioinformatics: Introduction to System Biology, Structural Biology, Structural bioinformatics, Chemoinformatics, Immunoinformatics etc.
- 27.7 Sequence analysis:
  • Scoring matrices: basic concept of a scoring matrix, PAM and BLOSUM series.
  • Sequence-based Database Searches: what are sequence-based database searches, BLAST and FASTA algorithms, various versions of BLAST and FASTA.

**Unit – 28 Community Nutrition** **2 Credits**

- 28.1 Community health concept: Definition and brief study of community, family, village and block. Definition, dimension and determinant of health, positive health, health situation in India, Relationship between health and nutrition. Role of public nutritionist in health care delivery. Health Indices: fertility indicator, vital statistics, mortality, morbidity and demographic indicator, human development Index, Reproductive health index. IMR, MMR, birth rate, sex ratio, poverty level. Concept of disease, causation (Agent, host, environmental factors) concept and control & prevention, modes of intervention.

- 28.2 Nutrition intervention Programmes – Objectives, operation of feeding programmes. ICDS, TINP, NNMS, IRDP, DWACRA. National organizations and their role in nutrition programmes – ICMR, NIN, NNMB, ICAR, CFTRI, international organizations – FAO, WHO, UNICEF.

- 28.3 Nutrition Education – Meaning, nature and importance of nutrition education to the community, training of workers in nutrition education programme. Principles of planning, executing and evaluation nutrition education programme. Methods and Techniques of organizing nutrition programmes using audio, video aids and exhibition, Problems of nutrition.

- 28.4 Nutrition and National development: National nutritional policy – Aim objectives, guidelines and thrust areas. PDS – Public distribution system. Need for voluntarism in community development, Assistance available to voluntary agencies from ministries, departments, Government of India, Central State Social Welfare Board etc, national nutrition surveillance system etc.

**Course No. NUD 303 Concepts of Nutritional Genomics & Proteomics and Drug & Nutrient Interaction**

**4 Credits**

**Unit – 29 Concepts of Nutritional Genomics, Proteomics and Metabolomics**

**2 Credits**

- 29.1 Fundamentals of DND – structure and function
- 29.2 Fundamental of genetic engineering
- 29.3 Fundamental of PCR, RTPCR, and Q-PCR for gene expression
- 29.4 a) Nutrient and Gene expression with special reference to vitamin and other macronutrient, b) role of nutrient and dilatory component in regulation of genome structure expression and stability.
- 29.5 Role of individual nutrient requirement on genetic variation,
- 29.7 a) Idea about nutriogenomics. Nutrition is only one player in the epigenetic repertoire, b) Epigenetic effect of nutritional supplement to pregnant mother to regulate the undesirable gene expression of fetus like cancer, obesity and diabetes.

**Unit – 30 Drug & Nutrient Interaction** **2 Credits**

- **30.1 Drugs and pharmaceutical compounds**- natural and synthetic, use of excipients.

- 30.2. **Characteristics of drugs action:** Pharmacodynamics, pharmacokinetics, route and form of excretion. Drug abuse and drug resistance

- 30.3. **Drug-nutrient interaction**s – effect of drugs on ingestion, digestion, absorption and metabolism of nutrients, effect on nutritional status, effect on organ function, drug dosage and efficacy.

- 30.4. **Nutrient effects on drug therapy –** effects of dietary composition, interactions between medication and milk, iron, fruit juices, antacids.

- 30.5 Intestinal microflora and nutrition of hosts, pre-biotics and probiotics.

- 30.6 Nutrients as medicine (Pharmacologic use of nutrients)

**Course No. NUD 304 Social Medicine and Community Health** **4 Credits**

**Unit – 31 Preventive and Social Medicine I** **2 Credits**

- 31.1 Health planning in India including various committees and National health Policy and health goals set from time to time
- 31.2 Organised sector with reference to centre, state, district and block level structures and local bodies and Panchayati Raj
- 31.3 Organisation and functions of community health centers and primary health centers
- 31.4 Health Manpower
- 31.5 Primary health care and concept
- 31.6 Alternative systems of medicine, like Ayurveda, Homeopathy, etc.

**Unit – 32 Preventive and Social Medicine II** **2 Credits**

- 32.1 Definition and scope of social and behavioral sciences in health
- 32.2 Concept and significance of social structure and social organization
- 32.3 Culture and behavior related to health and disease
- 32.4 Political and economical aspects of health
- 32.5 Concepts and techniques of information, education and communication including counseling methodology
- 32.6 Environmental sanitation

# Practical

**Course No. NUD 305 Experiments on Biostatistics & Computer Applications in Nutrition**
**4 Credits**

**Unit – 33 Experiments on Biostatistics** **2 Credits**

- 33.1 Computation of mean, median and mode of grouped and ungrouped data
- 33.2 Data representation by, bar diagram, histogram and pie diagram
- 33.3 Computation of standard deviation and standard error of mean
- 33.4 Students t-test – a) for Independent group b) paired group
- 33.5 Chi square test
- 33.6 Computation of correlation coefficient
- 33.7 Computation of one way ANOVA

**Unit – 34 Computer Applications in Nutrition** **2 Credits**

- 34.1 computer application in Nutrition and Dietetics
- 34.2 Formulation Bar diagram, Pie diagram, Line diagram from the supplied data using MS Excel.
- 34.3 Analysis of nutritional data using computer – use of software packages.
- 34.4 Use of Ms Word – data representation in tabular form, manipulation of tables
- 34.5 Use of Ms Excel – data tabulation, data representation by charts
- 34.6 Statistical analysis of data by Ms Excel
- 34.7 Use of Ms power point

**Course No. NUD 306 Nutritional Survey and Advanced Food & Nutrient Analysis**

**4 Credits**

**Unit – 35 Nutritional Survey** **2 Credits**

The Students should participate in a nutritional survey in the community and submit a report during examination. The Survey may be made on the following topics:

- 35.1 Determination of socioeconomic status
- 35.2 Determination of energy requirement of sedentary persons
- 35.3 determination of energy requirement of light, moderate and heavy workers
- 35.4 determination of nutritional consumption by questionnaire method
- 35.5 Determination of nutritional status by weighing method / cooked food method
- 35.6 study on nutritional status of the beneficiaries under National nutritional Programme

**Unit – 36 Advanced Food and Nutrient Analysis** **2 Credits**

- 36.1 Estimation of calcium in food.
- 36.2 Estimation of phosphorus in food
- 36.3 Estimation of iron in food.
- 36.4 Estimation of ascorbic acid in food
- 36.5 Estimation of thiamine in food
- 36.6 Estimation of food Composition

# M. Sc 4th Semester

## Theory

**Course No. NUD 401 Food and Nutrition Services in Hospital and Nutrition in Critical Care**

**4 Credits**

**Unit – 37 Food and Nutrition Services in Hospital** **2 Credits**

- 37.1. Scope for food and nutrition services in hospitals- importance of nutritional care and foods service in hospitals.
- 37.2. Role of nutrition support team- dietetic interns, dietitians (therapeutic, administrative and consultant dietitian) medical doctors and nurses. Team approach in patient care, Psychological considerations in patient care, inter personal relationship with patients.
- 37.3. Types of services- services in primary, secondary and tertiary health care setup, patients in different critical care centers, post-natal, pediatric and geriatric patients.
- 37.4. Basic quality management in nutrition services- total quality, structuring quality program in health care, assessment of quality of services.
- 37.5. Patient satisfaction- meeting patient needs and wants, managing customer's expectations, assessing patient's satisfaction as a mark of quality
- 37.6. Continuous quality improvement- strategies, training and monitoring.

**Unit – 38 Nutrition in Critical Care** **2 Credits**

- **38.1 Nutritional care:** Nutritional care of hospitalized patients - hospital malnutrition, impetus for improved nutritional care of patients, nutritional screening, assessment of the critically ill. Preparation of nutritional care plan**.**
- 38.2 **Nutritional support systems:** Nutritional support systems and other life saving measures for the critically ill- monitoring nutrient intake and providing nutrition support service, role of immuno enhancers, conditionally essential nutrients, immune-suppressants and special diets.
- 38.3 **Planning, monitoring and management of enteral and parenteral feeding:** Designer feeds, commercial feeds, techniques, applications and complications.
- 38.4 **Management of high risk conditions:** including patho-physiological clinical and metabolic aspects in the following conditions: burns, CV complications and surgery, cancer, AIDS, multiple organ failure, chronic renal failure (CRF), dialysis, transplant, GI tract surgery, hepatic failure and transplants, neurosurgery, fractures and other conditions of stress, trauma and sepsis, dumping syndrome.
- 38.5 Home care for critically ill and requiring long term nutrition support.
- 38.6 **Complications of nutritional support systems**: Including re-feeding syndrome, palliative care, rehabilitation diets (stages).

**Course No. NUD 402 Nutrition counseling and Sports Nutrition 4 Credits**

**Unit – 39 Nutrition counseling 2 Credits**

- 39.1 Nutrition Counseling: definition, concept, the role of clinical dietician, the recipients, counseling environment. A systems approach to nutritional care: overview of the system, components of the system. Dietician as part of the medical team and outreach services
- 39.2 Factors for Counseling: dietary diagnosis and tests for nutritional status – correlation, clinical and dietary information, nutritional and health conditions including cares of skin, hair, face, hands, feet etc. Psychological conditions, food allergies, aging, gender related and other problems. Aesthetic attributes of diets.
- 39.3 Assessment and planning component: medical history assessment – techniques of obtaining relevant information for patient. Methods of interview – verbal and nonverbal techniques. Counseling models – data analysis (dietary, biological, environmental, behavioral data). Facilitator resource analysis – culmination of the assessment process. Designing of counseling plans – goals and objectives, classifying objections, resource planning – client care plan and designing evaluation instruments.
- 39.4 Implementation and evaluation component: resources and aids of counseling the client/patient – client concurrence, co-ordination of care plans - the provision of learning experience. Measuring the success of performance of client and evaluating the counseling process. Patient education and counseling – assessment of patient needs, establishing report, counseling relationship. Follow up visits and patient education
- 39.5 Nutrition Advocacy: concepts and practices in nutrition advocacy – steps for success concept of mainstreaming nutrition in all child survival programs and in national health and development programs. National policies and nutrition advocacy – Nutrition Mission of various states and its implications, need for revision in state nutrition policies.

**Unit – 40 Sports Nutrition 2 Credits**

- **40.1 Approaches to the management of fitness and health:** Nutrition, exercise, physical fitness and health - their interrelationship. Significance of physical fitness and nutrition in prevention and management of weight control regimes. Nutrition guidelines for maintenance of health and fitness.

- 40.2. **Nutritional requirements of exercise:** Effect of specific nutrients on work performance and physical fitness. Nutrients that support physical activity, mobilization of fuel stores during exercise. Fluid requirements

- 40.3. **Nutrition in sport activities:** Sports specific requirements- importance of carbohydrate loading, pre game and post game meals, diets for persons with high energy requirements, stress, fracture and injury

- 40.4. **Dietary supplements and ergogenic aids:** Definitions, Use of different nutragenic / ergogenic aids and commercial supplements, sports drinks, sports bars etc.

**Course No. NUD 403 Nutraceuticals and Health Foods & Food Processing and Food Preservation**

**4 Credits**

**Unit – 41 Nutraceuticals and Health Foods** **2 Credits**

- 41.1 Nutraceuticals: a) Use of neutraceuticals in traditional health sciences. Their role in preventing / controlling diseases. B) Definition, classification, food and non food sources, mechanism of action. Role of Omega-3 faty acids, carotenoids, dietary fiber, phytoestrogens; gulcosinates; organosulphur compounds as neutraceuticals
- 41.2 Functional foods: Definition, development of functional foods, benefits and sources of functional foods in Indian diet. Effects of processing conditions and storage. Development of biomarkers to indicate efficacy of functional ingredients.
- 41.3 Development of nutraceutical and functional foods – standards for health claims. Process of developing – preclinical and clinical studies, marketing and regulatory issues.
- 41.4 Other food components with potential health benefits: polyphenols: flavonoids, catechins is flavones tanning. Phytoesterogens, Phytoserrls, Glucosinolates, Pigments: Lycopene, Curcumin etc. Organosulphur compounds, Other components – Phytates, Protcase inhibitions, saponins, amylase inhibitions, harmagglutinims, active biodynamic principles, in spices, condiments and other plant materials.

**Unit – 42 Food Processing and Food Preservation** **2 Credits**

- 42.1 Processing technology of foods and nutritional implications for cereals and pulses, fruits and vegetables, milk & products meat, fish & egg.
- 42.2 A. Classification of food in relation to shelf life-Spoilage in food and its control: spoilage Caused by microorganism (bacteria, fungi and virus), enzymes, pets and rodents. B. Food dehydration and concentration: methods of drying and concentration, types of dryers, factors affecting drying process.
- 42.3. Heat processing: sterilization, pasteurization, blanching, canning.
- 42.4. Cold preservation; refrigeration, freezing, freeze drying, refrigerated gas storage.
- 42.5 A. Food irradiation: technology, application and safety assessments B. Chemicals in food preservation, safety of preserved foods.
- Food Biotechnology : Membrane technology (reverse osmosis and ultra filtration), agglomeration, agitation, extrusion, b) Enzyme Technology - Production of enzymes - Amylase, Protease, Lipase, Lactase and pectinase, Use of enzymes in food and beverage industry (e.g., Cheese, fruit, juice, Wine, Meat tendarizing and dairy)

**Course No. NUD 404 Nutritional epidemiology and Public Health Nutrition** **4 Credits**

**Unit – 43 Nutritional epidemiology** **2 Credits**

- 43.1 Definition and concepts of epidemiology
- 43.2 Concepts of health and disease
- 43.3 Types of epidemiology and uses of Epidemiology
- 43.4 Role of genetics in health and disease
- 43.4 Levels of prevention
- 43.5 Important Public Health Acts
- 43.6 Health problems of developed and developing countries

**Unit – 44 Public Health Nutrition** **2 Credits**

- 44.1 Problems of population growth
- 44.2 Birth rates, death rates, fertility rates, age-specific mortality rates, MMR, CPR, etc.
- 44.3 Approaches and methods of contraception
- 44.4 Family welfare and planning
- 44.5 Communicable and non-communicable diseases
- 44.6 Occupational disorders like, Pneumoconiosis, hearing loss, accidents, dermatosis, etc
- 44.7. Major nutritional problems, etiology, manifestations and prevention. Components of RCH care.
- 44.8 Need and package of services under RCH Program.

## Practical

**Course No. NUD 405: Internship** **4 Credits**

**Unit – 45: Internship Training in Hospital** **2 Credits**

**Unit – 46: Report Preparation** **2 Credits**

Students are required to perform internship in hospitals / foods service institutions / Clinics and they have to submit a report on the internship training during examination. Evaluation of internship shall be made on the basis of report and viva-voce examination.

**Course No. NUD 406 Project Work** **4 Credits**
**Unit – 47: Project Work** **2 Credits**

**(**An independent research project work undertaken by student under the guidance of a teacher, can either be a survey or Laboratory oriented research. The research should be submitted at the end of session in the form of a dissertation. The project work can be undertaken at University departments, affiliated research institutions, quality control laboratories, food industries or other institutions with prior approval**)**

**(**The student should appear before examiners board and the dissertation shall be evaluated by means of presentation and viva - voce**)**

**List of Reference Books**


1. Guyton, A.C. and Hall, J.E. (1999): Textbook ofMedical Physiology, 9th Edition,
2. W.B. Saunders Co.Stuart Ira Fox, Human Physiology 11th
3. William F Ganong, Review of Medical Physiology.
4. Nelson, D.L. and Cox, M.M. (2000): 31'd Ed. Lehningcl"s Principles of Biochemistry, Macmillan Worth Publishers.
5. Devlin, T.M. (1997): 4th Ed. Text book of Biochemistry with Clinical Correlations, Wiley Liss Inc
6. Stryer, L. (1998): 4th Ed. Biochemistry, WH Freeman and Co.
7. Conn, E.E., Stumpf: P.K., Bruening, G. and Doi, R.H. (2001): 5th Ed. Outlines of Biochemistry, John Wiley and Sons.
8. Voet, D. Voet, J.G. and Pratt, C.W. (1999). Fundamentals ofBiochemistry.
9. Tietz, N.W. (1976) Fundamentals of Clinical Chemistry. WB Saunders Co.
10. King, EJ. and Wootton, LD.P. (1956). 3rd ed. Micro-Analysis in Medical Biochemistry. J and A Churchill Ltd.
11. Plummer, D.T. (1987). 3rd ed. An Introduction to Practical Biochemistry. McGrawHill Book Co.
12. Mahan, L.K. and Escott Stump, S.2000. Krause's Food Nutrition and Diet Therapy 10th Ed., WB Saunders & Co. London
13. Antia, F.P. and Abraham, P. 1997. Clinical Dietetics and Nutrition 4th Ed., Oxford University Press, New Delhi
14. Anderson, L; Dibble, M.U. and Turkki. 1982 Nutrition in Health and Disease. JB Lippincott Co. Toronto.
15. Srilakshmi, B. 2000. Dietetics. Wiley Eastern Ltd. 4835/24, Ansari Road, Daryaganj. New Delhi.
16. Gibson,R.S.1990. Principles of Nutritional Assessment. Oxford University Press. New Delhi
17. Gopaldas, T and Seshadri, S. 1987. Nutrition – Monitoring and Assessment. Oxford University Press. New Delhi
18. Jelliffe, D.B. Latest Ed. The Assessment of Nutritional Status of Community WHO/FAO Monograph series No.53, WHO Geneva.
19. Mann, S.K; Sangha, J.K; Mehta, U and Jain, R.1999. Manual on Community Nutrition, College of Home Science, PAU, Ludhiana
20. Robinson, C.H. and Lawler, M.R.1982 Normal and Therapeutic Nutrition. Oxford & IBH Pub. Co. New Delhi
21. Swaminathan, H. 1995, Essentials of Food and Nutrition Vol I &Vol. II Bappco. Bangalore
22. Anonymous, 1998, Indian Nutrition Profile. Dept. of Women & Child Dev. Ministry of Human Resource Dev. Govt. of India Press New Delhi.
23. Maclaren, D.S. 1986. Nutrition in the Community 2nd Ed. John Willey and Sons, New York
24. Obert, J.C. 1986. Community Nutrition. Mac Millan New York
25. Park, K.2000. Park's Text Book of Preventive and Social Medicine 22th Ed. M/s Banarsidas Bhanot Pub. Jabalpur, India
26. Sri Lakshmi, B. 2000 Nutrition Science. New Age International (P) Ltd. Pub. Ansari Road Daryaganj. New Delhi
27. Swaminathan, M.1995. Food Chemistry and Experimental Foods Bappco, Bangalore
28. Belle and Lowe., Experimental Cookery. John Willey & Sons, 1937 **OR** latest Ed.
29. H.C. Meyer, Food Chemistry. CBS Pub. & Distributors 1960. Litton Educational Pub. Inc. OR latest Ed.
30. M.Shadaksharaswany; N.Shakuntala Manay. Food Facts and Principles, Mohindra Singh Sejwal for Wiley Eastern Limited, Ansari Road Daryaganj, New Delhi
31. Moor, M.L; Irmitu,T.F.1970.Introductory Foods Laboratory Manual of Food Preparation and Evaluation, London Mac Millian
32. Eastwood, M. A. and Passmore, R. 1987. Human Nutrition and Dietetics. VIII Ed. ELBS Churchill Livingston, London.
33. Bamji, M.S; Rao, N.P and Reddy, V. 1996. Textbook of Human Nutrition. Oxford & IBH Publishing Co Pvt. Ltd. Delhi.
34. ICMR.2010. Nutrient Requirements and Recommended Dietary Allowances for Indians, NIN, ICMR. New Delhi.

35. Methodology and Techniques of Social Research. Bandarkar P .L., Wilkinson T.S. Himalaya Publishing House, 2000.
36. Theory and Practice in Social Research. Hans Raj SUljit Publications. New Delhi.
37. Methodology of Research in Social Sciences. Krishnassamy O.R. Himalaya Publishing House.

38. Research Methods in extension Education. Sumati M and Sabarathanam V.E. New Delhi.
39. Basis of Qualitative Research. Strann A and Corbin J Grohnded Theory Procedures and Techniques.
40. Gupta, S. (2001) "Research Methodology and Statistical Techniques", Deep and Deep, New Delhi,
41. Genomics and Proteomics in Nutrition. Berdaniet., Nima Moustid-Moussa, Edited by Carolyn D. Berdanier Publisher: Marcel Dekker Inc.
42. Nutrient and gene interaction in Health and Disease. By Moustaid-moussa N, Berdanier C.D., CRC Press.
43. Food Medication Interaction. By Pronsky Z.M. Birchrunville.
44. The science and practice of Pharmacology. By Tischio J.P., Mark Publishing Company.
45. Metabolomics: Methods and Protocols. By Wolfram Weckwerth (Editor), Pub: Human Press.
46. Metabolomics in Toxicity Assessment. By Donald G. Robertson (Editor), John Lindon (Editor), Jeremy K. Nicholson (Editor). Elaine Holmes (Editor)~ Pub: CRC group, Taylor and Francis.
47. The Handbook of Metabolomics. Editor: Lindon, John C, Nicholson, Jermy K., Editor: Holmes, Elaine, Pub: Eisvier Sc.
48. Williams, S.R. (1993): Nutrition and Diet Therapy, 7th Edition, Times Mirror/Mosby College Publishing.
49. Davis, J. and Sherer, K. (1994): Applied Nutrition and Diet Therapy for Nurses, 2nd Edition, W.B. Saunders Co.
50. Walker, W.A. and Watkins, J.B. (Ed) (1985): Nutrition in Pediatrics, Boston, Little, Brown & Co.
51. World Cancer Research Fund (1997). Food, Nutrition and the Prevention of Cancer-A Global perspective, Washington E.D. WCRF.
52. Davis, J. and Sherer, K. (1994): Applied Nutrition and Diet Therapy for Nurses, 2nd Edition, W.B. Saunders Co.
53. Marian C Spears; Food Service Organisation; III Edition, Prentice Hall Inc., USA. 1995
54. Dubey and Maheswari, A Text Book of Food Microbiology. S Chand Company, Kolkata.
55. Watson, R. R. (ed) (2000) Handbook of Nutrition in the Aged. 3rd edition. CRC Press. Boca Raton
56. Nutrition Screening Initiative (1991 and 1992). Nutrition Screening Manual for Professionals Caring for Older Americans. Washington, D.C. Green Margolis, Mitchell, Burns and Associates
57. Chernoff, R. (ed) (1991). Geriatric Nutrition: *The* Health Professionals' Handbook, Gaithersburg, MD: Aspen