2021

Department of Food and Nutrition
Faculty of Science

UNIVERSITY OF KALYANI

Kalyani-741235, West Bengal

Syllabus
For
M.Sc. Programme in Food and Nutrition

- **OVERVIEW:**

It is a great pleasure to share that, the Department of Food and Nutrition started its academic and scientific endeavour since 2019. The primary objective is to provide postgraduate education to students in Food and Nutrition under the University of Kalyani. The department focuses on providing quality education to students and for carrying out cutting edge research and development in the concerned fields. The curriculum of the department is designed in such a manner as to focus that our students get career opportunity in reputed educational and industrial institutes. The department has initiated since its beginning, with a high standard of academic and infrastructural development. Presently, it offers M.Sc. in Food and Nutrition having different areas of specialization, namely, Food Microbiology, Advances in Food Science & Chemistry, Nutraceuticals and Functional Foods, Community Nutrition, Food Preservation, Packaging, and Post-harvest Technology, Food Toxicology, Geriatric, Sports & Space Nutrition, Food product Development, Clinical Nutrition and Processing with internship/industrial training.

The outstanding academic program of the department is enhanced by the quality teaching and research, laboratory experience, as well as community outreach activities, supported by easy access to a department library, computers and other necessary facilities. The well catered curriculum has been expanded to convene the emerging needs and challenges in the area of Food and Nutrition. This has been achieved through not only course work but also with prominence given to research, community work focusing on capacity building of an underprivileged section of the population, seminars, internship/training in hospitals, food industries, and related organizations, educational tours, conferences, and workshops.

To augment the students' perspective, the department holds seminars, workshops, and lectures from time to time by distinguished people working in the field of Nutrition and Food Technology or in collaboration with organizations related to these fields. Apart from this, the students and faculty are encouraged to participate and present papers at various National and International conferences.

The Department of Food & Nutrition have a capacity of admitting twenty graduate students from different domains- Food and Nutrition, Physiology, Microbiology, Biochemistry, Human Development, Home Science, Chemistry, etc.

OBJECTIVES:

The Department of Food and Nutrition aims towards brilliant academic excellence with fundamental scientific research and technological approach for the students aiding for oriental, robust scientific knowledge and development leading to socio-economic and public health welfare.

THE MISSION:

1. Building the knowledge of the students for competing at national and international platforms and making them eligible for successful registered dietitian nutritionist along with other employment avenues in the field of food and nutrition and allied sectors.
2. Continuously practicing the art for making efficient health care professionals.

3. Providing higher education and guidance to create postgraduates leading to the growth and development of successful bright individuals which will finally enhance the scientific merit of the society.

- **THE GOALS:**

1. To development of nutrition concepts in students to assess and develop the nutritional health of communities.
2. To determine and translate nutrient needs into menus for individuals and groups across the lifespan, in diverse cultures and religions, and for different income levels.
3. To plan a community intervention based upon a needs assessment
4. To advocate for a public policy related to nutrition programs or health care.
5. To interpret and apply nutrition concepts in order to evaluate and improve the nutritional health of individuals with medical conditions
6. To apply biological, biochemical, and physiologic scientific principles to nutrition practice
7. To interpret medical terminology and laboratory parameters relating to nutrition
8. To interpret scientific research, apply it to nutrition practices, and document interventions
9. To adopt the various domains of nutritional and food research for health promotion/disease prevention activities or uncomplicated instances of chronic disease of the general population.
10. To development of management principles in students to evaluate human, physical and fiscal resources in organizations.

SEMESTER I

SEMESTER-I

Paper Code	Paper	Theory/ Practical	Internal Assessment	End Term Assessment	Credit	Marks
COR 101-FN	Basic Physiology	Theory	10	40	4	50
COR 102-FN	Food Chemistry	Theory	10	40	4	50
COR 103-FN	Nutritional Biochemistry	Theory	10	40	4	50
COR 104-FN	Integrated Practical: Basic Physiology, Food Chemistry & Nutritional Biochemistry	Practical	10	40	4	50
AECC-FN		Practical	05	20	2	25
Total					18	225

- **Learning Objectives (LOs):**

The objectives of M.Sc. Food and Nutrition (SEMESTER-I) programme are:

1. To impart the understanding of the concepts of basic physiology, nutritional biochemistry, and food chemistry.
2. To enable the students to learn the methods of assessing the different human ailments, basic nutritional requirements, and nutritional assessment.
3. To apply theoretical concepts in laboratory setting as per standard methods in the above mentioned areas
   A. To understand the applications of nutritional sciences in clinical interventions, communication for health promotion, and food science.
   B. To acquire skills to undertake the practical knowledge in system physiology, nutritional biochemistry and food chemistry.

- **Programme Specific Outcomes (PSOs):**

1. Understand the concepts of physiology, biochemistry, and food chemistry
2. Comprehend methods of assessing different clinical parameters associated with different human ailments, clinical biochemistry and food analysis.
3. Apply theoretical concepts in laboratory setting as per standard methods in the above mentioned areas.
4. Understand the applications of nutritional sciences in clinical interventions, communication for health promotion and food science
5. Acquire skills to undertake systematic research in the area of food science and nutrition.

- **INSTRUCTIONS TO THE PAPER SETTERS:**

Question Pattern & Marks Distribution for Semester-I Examination (Theory Paper)

For Each Paper

Sl. No.	Type of Question	Total Number of Questions to be given	Number of Questions to be Attempted	Total Marks
1.	2 Marks	6	4	08
2.	4 Marks	5	3	12
3.	10 Marks	4	2	20
	Grand Total			**40**

Question Pattern & Marks Distribution for Semester-I Examination (Practical Paper/COR 104-FN)

Sl. No.	Type of Question	Total Number of Questions to be given	Number of Questions to be Attempted	Total Marks
1.	5 Marks	5	4	20
2.	Evaluation of Practical Note Book (10 Marks)			10
3.	Viva-voce (10 Marks)			10
	Grand Total			**40**

Question Pattern & Marks Distribution for Semester-I Examination (Practical Paper/AECC)

Sl. No.	Type of Question	Total Number of Questions to be given	Number of Questions to be Attempted	Total Marks
2.	Review of Literature Writing			10
3.	Presentation			10
	Grand Total			**20**

- **Basic Physiology (Course Code: COR 101-FN):**

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: COR 101-FN
1.	***Cellular Organization, Cellular Signaling:*** Membrane structure and function, Structural organization and function of intracellular organelles, Cell Junctions, Cell Division and Cell Cycle, Intercellular communication.
2.	***Stem cell and Developmental biology:*** Basic concept of developmental biology, Gametozenesis, Fertilization and Early development, Morphogenesis and Organogenesis, Developmental model organism, Developmental apoptosis, Aging and Senescence, Definition and types of Stem cell, Genesis and differentiation of Stem cells in different organ, "Placenta as a source of stem cells" and its importance in stem cell research, Stem cell application and future in modern biology and health sciences.
3.	***Gastrointestinal System:*** Evolution of GI system and Anatomy, Histomorphological study, GI secretion and regulation, Role of hepatobilliary systems in gastrointestinal functions, Gastrointestinal hormones and their interplay, The basal or basic electrical rhythm (BER), Gastric motility, Chemistry, and mechanism of action of Defensive and Aggressive factors in GI function, Immune function of GI, Central control of gastrointestinal functions. Pathological Situations of GI.
4.	***Cardiovascular System:*** Blood and its composition, Blood groups, Coagulation of Blood, Structure & function of Heart, Heart rate, Cardiac cycle. Cardiac output. Blood pressure & their regulations, Cardiac enlargement and hypertrophy, Myocardial necrosis and Myocarditis, Cardiac metabolism and cardiac efficiency, Cardiovascular changes during exercise.
5.	***Endocrine and Reproductive System:*** Principles of endocrinology, Chemistry of hormones, Mechanism of hormone action, Hormone in immune responses, Hormonal regulation and metabolism, Structure and function of male and female sex glands and organs. Role of hormones in reproduction, Mechanism of spermatogenesis and hormonal regulation, Physiology of pregnancy.
6.	***Excretory system:*** Structure and functions of the kidney, Bladder, Formation of urine, Role of kidney in homeostasis, Structure, and function of Skin. Regulation of temperature of the body.
7.	***Respiratory System:*** Evolution of the atmosphere and respiratory system, Anatomy of respiratory system, Principles of respiratory mechanisms, Pressure/volume relationship, Respiratory system resistance, Lung function tests, Non-respiratory functions of the lung, Endocrine function of lung, Immune function, Physiology of pulmonary disease, Artificial Ventilation, Lung transplantation.
8.	***Nervous System:*** Neuron & Neuroglia, "Synapse"-Definition, Properties, Electrical signals & its transmission, Resting membrane potential, Graded potential, Generation of action Potential, Propagation of nerve impulses, "Nerve fiber"-Definition & properties, Myelination, Reaction of degeneration & its clinical application, Formation of Spinal nerve, Peripheral nerve, Dermatomes, myotomes, Sclerotomes & its clinical application, Regeneration & repair of nervous tissue, Concept of Neural Plasticity. Elementary anatomy of Nervous System Sympathetic and Parasympathetic nervous System. Special Senses.

- **Food Chemistry (Paper Code: COR 102-FN):**

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: COR 102-FN
1.	***Basic Concept on Food Chemistry:*** Food, Nutrients, Nutrition, Classification of Food, Classification of Nutrients.
2.	***Bio-macromolecules and their principles of Interactions Bonds in Biochemical Reactions:*** Covalent, ionic and hydrogen bonds, Vander Waal's forces, hydrophobic interactions.
3.	***Principles of Biophysics as Applied to Food:*** Colloidal chemistry, pH, maintenance of pH within the cells, thermodynamics, applications
4.	***Carbohydrates*:** Definition, Classification, Structure and Properties.
5.	***Lipids:*** Definition, Classification, Structure and Properties, Fatty acids: Composition, Properties and Types.
6.	***Proteins:*** Definition, Classification, Structure & properties. Amino acids: Classification, Types and functions.
7.	***Nucleic acids and Nucleotides:*** Structure of nucleotides (Major bases- purines and pyrimidines), Ribose and deoxyribose sugars, Concepts of nucleosides (Mono, di, triphosphates), Types of DNA and RNA (Primary and secondary structure of DNA and RNA, organisation of DNA in the cell).
8.	***Dietary Fiber:*** Classification, Sources, Composition, Properties & Nutritional significance**.**
9.	***Minerals & Trace Elements and Vitamins:*** Bio-Chemical and Physiological Role of Iron, Sodium, Potassium, Calcium, Phosphorus, Chloride, Iodine, Zinc, Manganese, Selenium, Molybdenum, Cupper and their bio-availability & requirements, sources, deficiency & excess effects.
10.	***Phytonutrients:*** Polyphenols, Flavonoids, Lignans, Stillbenes
11.	***Enzymes:*** Structural basis of enzyme function: Active sites, Coenzymes, Activators, Inhibitors, Kinetics, Allosteric enzymes and their modulators, Mechanism of enzyme induction and repression, Technical approach to the study of enzyme activities.
12.	***Food Additives:*** Definitions, Classification and functions, Preservatives, Antioxidant, Colours and Flavours, Emulsifiers, Sequestrants, Humectants, Hydrocolloids, Sweetners, acidulants, Buffering salts, Anticaking agents, etc.-Chemistry, food uses and functions in food formulations; Indirect food additives; Toxicological evaluation of food additives.

- **Nutritional Biochemistry (Course Code: COR 103-FN):**

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: COR 103-FN
1.	***Carbohydrate Metabolism:*** • Pathway of glycolysis & its regulation, Energetics & Role of hormone • Pathway of TCA cycle & its regulation, Energetics & Role of hormone

	• Glycogen metabolism & its regulation, Energetics & Role of hormones • HMP Shunt pathway & its regulation • Protein sparing action of carbohydrate • Inborn error of carbohydrate metabolism (galactosemia) • Glycoprotein & Proteoglycan
2.	***Protein Metabolism:*** Deamination, Transamination & Transmethylation, Urea cycle, Protein folding and its problems: Role of chaperons, Inborn error of amino acid metabolism
3.	***Lipid Metabolism:*** Fatty acid synthesis, Lipoprotein synthesis, ß-oxidation & ω-oxidation, Forward cholesterol transportation (LDL & VLDL), Reverse cholesterol transportation (HDL), Disorders of lipid metabolism, Dyslipidemia & Lipid storage disease, Ketosis & Ketone body.
4.	***Nucleic acid Metabolism:*** Metabolism of Purine and Pyrimidines**,** Diseases due to abnormal nitrogen base metabolism**.**
5.	***Bioenergetics:*** • Concepts of free energy and strategies of energy metabolism; • High-energy biomolecules and coupling phenomenon, energy-rich bonds, weak interactions, group transfer • Biological energy transducers and bioenergetics; Oxidative phosphorylation and Photosynthesis • Extramitochondrial electron transport chains; • Oxygen toxicity and superoxide dismutase. • Free radicals, ROS and oxidation • Concept of Antioxidant
6.	***Xenobiotic Metabolism:*** • Types and pathways of metabolic reactions; Involvement of cytochrome P450 – its isoforms and inhibitors of xenobiotic metabolising enzymes, Fate of xenobiotic metabolites, Factors influencing xenobiotic metabolism. • Pharmacologic, toxic, immunologic and carcinogenic effects. • Clinical correlations and biomedical importance.
7.	***Overview of food to energy conversion:*** Electron transport chain: Formation of ATP; Integration of biochemical pathways; Hormones as regulators of biochemical pathways: Introductory concepts.

- **Integrated Practical: Basic Physiology, Food Chemistry and Nutritional Biochemistry (COR 104-FN):**

Sl. No.	COURSE CONTENT (PRACTICAL) COURSE CODE: COR 104-FN
	Lab-Basic Physiology
1.	Estimation of total haemogram (Hb, TC, DC, and ESR), Separtaion of serum and plasma from blood
2.	Nutritional anthropometry (Height, weight, Body mass index (BMI), Body circumferences (waist, hip, and limbs), and Skinfold thickness, Measurement of Blood Pressure, Body composition.
3.	Histological techniques and slide identification: • Histochemical staining of murine tissue (H&E, PAS, Toluidine Blue and Masson's Trichrome)

	• Histological features and identification of different organ from slide.
4.	Immunohistochemistry/Immunofluorescence techniques for the determination of protein localization (Demonstration) • Assay development • Slide preparation • Staining (Nuclear/Intercellular/Surface marker staining with Different Fluorophore-Tagged Antibody).
5.	DNA isolation and estimation by DPA method
6.	Separation of DNA by gel electrophoresis
7.	Separation of Proteins by electrophoresis (SDS-PAGE/Native Gel)
8.	Salting out of proteins from a solution
Lab-Food Chemistry	
1.	Proximate and ultimate analysis of foods: Carbohydrates, Proteins, Fats, Total ash, Moisture content, Volatile and soluble content, Amino acid and Reducing sugar.
2.	Determination of mineral content in food: Calcium, Iron
3.	Determination of vitamins in Food: Ascorbic acid, β-carotene
4.	Estimation of fibre in food including pectin content of fruits
5.	Measurement of viscosity, Surface tension and pH of food
6.	Estimation of gluten content
7.	Estimation of polyphenols
8.	Determination of titratable acidity
9.	Determination of energy value of foods by using bomb calorimeter
Lab-Nutritional Biochemistry	
1.	Preparation of Buffers: Preparation of acidic buffers, Preparation of basic buffers
2.	Determination of Enzyme Activity including protein estimation: Amylase, SGOT and SGPT
3.	Determination of biochemical constituents in serum: Glucose, Urea, Uric Acid, Total Cholesterol, HDL Cholesterol, LDL Cholesterol, Triglyceride, Phospholipid, Calcium

- **Skills of Technical and Scientific Writing (AECC-FN):**

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: COR 104-FN
	Skills in Technical and Scientific Writing • Learn the nuances of select technical writing styles/ guides • Analyze technical posters of researches in the fields
	Review of Literature • Prepare a literature review on a select topic using an approved style guide • Conduct Plagiarism check of document prepared • Present an oral seminar on the topic

SEMESTER II

SEMESTER-II

Paper Code	Paper	Theory/ Practical	Internal Assessment	End Term Assessment	Credit	Marks
COR 205-FN	Molecular Nutrition	Theory	10	40	4	50
COR 206-FN	Therapeutic Nutrition	Theory	10	40	4	50
COR 207-FN	Food Microbiology	Theory	10	40	4	50
COR 208-FN	Integrated Practical: Molecular Nutrition; Therapeutic Nutrition; Food Microbiology	Practical	10	40	4	50
GEC (CBCS)	Basics of Nutrition	Theory	10	40	4	50
Total					20	250

- **Learning Objectives (LOs):**

The objectives of M.Sc. Food and Nutrition programme (SEMESTER-II) are:

1. To impart the understanding of the concepts of molecular nutrition, therapeutic nutrition and food microbiology.
2. To enable the students to learn the methods of assessing the different human ailments, basic nutritional requirements for different ailments, and nutritional assessment.
3. To apply theoretical concepts in laboratory setting as per standard methods in the above mentioned areas
   C. To understand the applications of nutritional sciences in clinical interventions, communication for health promotion, and disease control.
   D. To acquire skills to undertake the practical knowledge in molecular nutrition, therapeutic nutrition and food microbiology.

- **Programme Specific Outcomes (PSOs):**

1. Understand the concepts of molecular nutrition, therapeutic nutrition and food microbiology.
2. Comprehend methods of assessing different clinical parameters associated with different human ailments.
3. Apply theoretical concepts in laboratory setting as per standard methods in the above mentioned areas.
4. Understand the applications of nutritional sciences in clinical interventions, communication for health promotion.
5. Acquire skills to undertake systematic research in the area of molecular nutrition, genomics, proteomics & food microbiology.

- **INSTRUCTIONS TO THE PAPER SETTERS:**

Question Pattern & Marks Distribution for Semester-II Examination (Theory Paper)

For Each Paper

Sl. No.	Type of Question	Total Number of Questions to be given	Number of Questions to be Attempted	Total Marks
1.	2 Marks	6	4	08
2.	4 Marks	5	3	12
3.	10 Marks	4	2	20
	Grand Total			**40**

Question Pattern & Marks Distribution for Semester-II Examination (Practical Paper/COR 208-FN)

Sl. No.	Type of Question	Total Number of Questions to be given	Number of Questions to be Attempted	Total Marks
1.	5 Marks	5	4	20
2.	Evaluation of Practical Note Book (10 Marks)			10
3.	Viva-voce (10 Marks)			10
	Grand Total			**40**

- **Basics of Nutrition (Course Code: GEC (CBCS):**

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: GEC (CBCS)
1.	***Introduction to Nutrition:*** • Food as source of nutrients, functions of food, definition of nutrition, nutrients & energy, adequate, optimum & good nutrition, malnutrition, Food guide- Basic five food groups How to use food guide (according to R.D.A.) • Interrelationship between nutrition & health: Visible symptoms of goods health • Use of food in body - Digestion, Absorption, Transport & Utilization • Role of fibres in human nutrition. • Minerals - Macro & Micronutrients- Functions, Sources. • Vitamins (Water & fat soluble) - Definition, Classification & Functions.
2.	***Basic Concept of Diet Therapy:*** • Therapeutic adaptations of normal diet, principles and classification of the therapeutic diets. • Routine Hospital Diets: Regular, light, soft, fluid, parenteral and enteral feeding. • Diets for different febrile conditions: influenza, malaria and typhoid. • Etiological factors, symptoms, and management of common diseases of stomach-Gastritis and Peptic ulcer. • Etiology, symptoms, and management of intestinal diseases: Diarrhoea, Steatorrhea, Diverticular disease, inflammatory bowel disease, Ulcerative Colitis, Flatulence, Constipation, Irritable Bowel Syndrome. • Diseases of the liver and Biliary System: Liver function tests. Etiology, symptoms, dietary care and general management of Viral Hepatitis and Cirrhosis of liver. Dietary care and management of Gall Bladder diseases –Cholecystitis and Cholelithiasis. • Anaemia: General concept, aetiology, classification, and dietary management of Nutritional anaemia. • Diet in disease of the endocrine pancreas: Diabetes Mellitus: Classification, symptoms, diagnosis, management -insulin therapy, oral hypoglycaemic agents, glucose monitoring at home, dietary care and nutrition therapy, meal plan (with and without insulin), special diabetic foods and artificial sweeteners. • Hypertension: classification, aetiology, symptoms and dietary management. Diseases of the cardiovascular system: Definition of infarct, ischemia, angina pectoris, myocardial infarction, heart attack and stroke. Atherosclerosis and Hyperlipidemia – classification, symptoms, dietary and lifestyle management. Prevention of cardiovascular diseases. • Renal Diseases: Etiology, symptoms and dietary management of acute and chronic Glomerulonephritis. Nephrotic syndrome - dietary management. Uraemia – dietary Nephrolithiasis - dietary management. Use of sodium and potassium exchange list.
3.	***Food Processing and Preservation:*** • Food preservation and adulteration: definition, objectives and principles of food preservation. Different methods of food preservation. • Food Standards: ISI, AGMARK, FPO, MPO, PFA, FSSAI.
4.	***Geriatric Nutrition:*** • Definition of Ageing, Senescence, Old age or Aged people, Gerontology, Geriatrics, and

	Geriatric nutrition. Classification of old population. • Nutritional requirements and general dietary guidelines for elderly • Major nutritional and health problems during old age
5.	***Sports Nutrition:*** Definition of physical activity, exercise, physical fitness, sports physiology and sports nutrition.
6.	***Phytonutrients And Nutraceuticals:*** Antioxidants, Functional foods and Nutraceutical

• Molecular Nutrition (Course Code: COR 205-FN):

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE:COR 205-FN
1.	***Nutritional needs in Special Conditions:*** Nutrition needs in extreme environmental temperature: Factors, Criteria and Regulation, Nutritional needs in high altitude: Factors, Criteria and Regulation. Nutritional needs in flood & famine: Factors, Criteria and Regulation.
2.	***Nutritional Immunology:*** Innate Immunity, Antigens capture and presentation, Antigenicity & Immunogenicity, Cell Mediated Immune Response, Humoral Immune Response, Structure & Function of Antibody, Primary & Secondary Immune Modulation: Role of cytokines, Chemokines & Complement system, Infection & Immunity, Vaccine Development, Immunonutrition-Modulation of immune function by food components, Immunologic effect and mechanism of different micronutrients, Clinical relevance of micronutrients.
3.	***Concept of Key Cellular Processes, Proteomics, Metabolomics and relation with Nutrition*:** Genetic Element and its evolution: Fundamental aspects: law of DNA constancy and C-value paradox, Eukaryotic Chromosome Organization, DNA Replication and its regulation, Mutation, Gene Transcription, Translation, Recombination, Transposition, Apoptosis and Autophagy, and the effect of nutrients on these processes, Fundamental and applied aspects of Genomics and Proteomics, Molecular mechanisms of nutrients and diet on transcriptome, proteome and metabolome, Application of common laboratory methods applied in transcriptome, proteome and metabolome profile.
4.	***Enzyme Technology:*** Review of nomenclature, properties and isolation, Nature of enzymes, stability and action, Factors influencing enzymes- enzyme inactivation and control, Enzymes in food processing and modification- Proteolytic enzymes, oxidases, lipases, enzymes decomposing carbohydrates and applications, Immobilised enzymes in food processing, Enzymes in waste management, Enzymes and health/nutrition/food issues, Structured lipids, Synthesis of value added products, Application of proteases, Amylases and Lipases, SCP, SCL, Oleaginous
5.	***Nanotechnology & Food:*** Introduction to Nanotechnology: Characteristic scale for quantum phenomena, Nanoparticles, Nanoclusters, Nanotubes, Nanowires and Nano dots. Nanobiotechnology: Nanoparticles and nucleic acid and protein based recognition groups-Application in optical detection methods, Nanoparticles as carrier for genetic material, Nanobioelectronic devices and polymer nanocontainers, Microbial production of inorganic nanoparticles, Magnetosomes, Biosynthesis of Nanoparticles: Biomineralization, Microbial Nanoparticle production. Biofunctionalizaion of gold nanoparticles, phospholipids polymer nanoparticles, Magnetic nanoparticles, Metallic nanoparticle, Application of

	nanotechnology in food Science in brief: Nanosensors for microbial, chemical contaminants; Foods incorporated with nanoscale antimicrobial compounds, antioxidants and flavors which would improve shelf-life or sensory characteristics such as flavour, odour.

▪ Therapeutic Nutrition (Course Code: COR 206-FN):

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: COR 206-FN
1.	***Nutrition Assessment and Nutrition Therapy in Patient Care:*** • Nutrition care process • Role of nutrition in clinical care: Nutritional status, Malnutrition • Nutrition screening and assessment: Anthropometric measurement, Laboratory Measurements, Physical assessment, Dietary assessment • Nutrition diagnosis • Nutrition intervention: Food plan and management: Basic concepts of nutrition therapy, Routine house diets, Managing the mode of feeding • Evaluation: Quality patient care: • Nutrition Support: Enteral and Parenteral nutrition • Therapeutic modification of the normal diet: Diet prescription. Routine Hospital diet - regular diets, clear fluid diet, full fluid diet, soft diet, modifications of food and nutrient intake.
2.	***Diseases of the Heart, Blood Vessels, and Lungs:*** • Atherosclerosis: Underlying disease process, Involvement of cholesterol, lipids and lipoproteins, Functional classification, Principles of nutrition therapy, General approaches to therapeutic lifestyle changes, Pharmacological therapy, Nutritional management. • Myocardial Infarction: Pathophysiology, Medical treatment, Nutritional management. • Congestive Heart Failure: Etiology, Diagnosis, Medical therapy, Nutritional management • Cardiac Cachexia: Etiology, Nutritional management. • Hypertension: Pathophysiology, Pharmacological treatment, Nutritional management. • Cerebrovascular accident: Nutritional Management • Peripheral Vascular Disease (PVD): Symptoms & complication, Pathophysiology, Treatment • Chronic Obstructive Pulmonary Disease (COPD): Pathophysiology, Clinical characteristic, Nutritional management. • Pneumonia: Pathophysiology, Sign & symptoms, Treatment, Nutritional management. • Tuberculosis: Pathophysiology, Sign & symptoms, Treatment, Nutritional management.
3.	***Renal Diseases:*** • Basic functions of kidney • Glomerulonephritis: Pathophysiology, Diagnosis, Pharmacological management, Nutritional management. • Chronic Kidney Disease (CKD): Pathophysiology, Classification, Diagnosis, Pharmacological management, Nutritional assessment process, Nutritional management • Acute Renal Failure (ARF): Pathophysiology, Clinical symptoms, Treatment process, Nutritional management. • Urolithiasis: Disease process, Classification of stones, Clinical symptoms, Treatment strategy, Nutrition therapy. • Polycystic Kidney Disease (PKD): Pathophysiology, Diagnosis, Pharmacological management,

	Nutritional management. • Urinary Tract Infection (UTI): Disease process, Clinical symptoms, Treatment strategy, Nutrition therapy.
4.	***Neurological Disorders:*** • Neurological disorders attributed to nutritional etiologies (Wernicke-Korsakoff syndrome and Stroke), Nutrition therapy • Neurological disorders attributed to non-nutritional etiologies (Parkinson's disease, epilepsy, Huntington's chorea, Amyotrophic lateral sclerosis, multiple sclerosis, myasthenia gravis, Alzheimer's disease and Wilson's disease), Nutrition therapy
5.	***Metabolic & Eating Disorders:*** • Diabetes Mellitus: Pathophysiology, General management of diabetes, Rational of diabetes nutrition therapy, Implementing nutrition therapy, Issue related to medical therapy, Nutrition therapy, Diabetes education program. • Obesity: Classification, Pathophysiology, Cause, Assessment, Complications, Pharmacotherapy, Nutrition therapy. • Dyslipidemia:, Cause, Assessment, Complications, Pharmacotherapy,. • Inborn Errors of Metabolism (Carbohydrate, Protein & Fat): Pathophysiology, Nutrition therapy • Anorexia nervosa, Bulimia nervosa, Binge-eating Disorder: Pathophysiology, Nutrition therapy
6.	***Gastrointestinal & Hepatobiliary Diseases:*** • Digestive process: Carbohydrate, Protein, Lipid: Digestion, Absorption, Utilization • Problems of the mouth and esophegus: Oral tissue inflammation (Gingivitis, Stomatitis, Glossitis, Cheilosis), Dental problems, Disorders of salivary glands and salivation (Xerostomia), Swallowing disorders (Dysphagia), Central problems in esophagus, Lower esophagus sphincter problem, Achalasia, Gastroesophageal Reflux Disease (GERD), Hiatal Hernia- Pathophysiology, Causes, Sign & symptoms, Diagnosis & detection, Pharmacological & nutritional management • Problems of the stomach and duodenum: Gastritis, Gastroenteritis, Gastroparesis, Non-ulcer dyspepsia, Peptic Ulcer Disease (PUD), Stomach cancer- Pathophysiology, Causes, Sign & symptoms, Diagnosis & detection, Pharmacological & nutritional management • Disorders of the small intestine: Diarrhea, Malabsorption, Celiac disease, Cystic fibrosis, Inflammatory Bowel Disease (Crohn's disease & Ulcerative colitis), Short-Bowel syndrome- Pathophysiology, Cause, Sign & symptoms, Diagnosis & detection, Pharmacological & nutritional management. • Disorders of the large intestine: Flatulence, Irritable Bowel Syndrome (IBS), Diverticular disease, Constipation, Colon cancer- Pathophysiology, Cause, Sign & symptoms, Diagnosis & detection, Pharmacological & nutritional management. • Diseases of the gastrointestinal accessory organs: Viral hepatitis, Cirrhosis, Hepatic encephalopathy, Liver transplantation, Gallbladder disease, Pancreatitis- Pathophysiology, Cause, Sign & symptoms, Diagnosis & detection, Pharmacological & nutritional management.
7.	***Nutritional anaemia*** • Epidemiology, pathophysiology causes & dietary management.
8.	***Cancer:*** • Process of cancer development, Different carcinogens, Relationship of the cell cycle to cancer, Molecular control of the cell cycle, "Cancer are Genetic Diseases", Genes & Cancer (Proto-oncogene & Tumor Suppressor Gene, MicroRNA genes, Mutator genes)- Mode of action, regulation in disease progression. Telomere shortening, Telomerase, and human cancer.

	• Public health guidelines for cancer risk reduction, Cancer-related health disparities, Population-based screening recommendations for cancers, Postdiagnostic staging of cancer, Practice guidelines for treatment of cancer. • Treatment of cancer: Surgery, Radiation therapy, Chemotherapy, Biological therapy • Medical nutrition therapy for patients with cancer: Nutrition care process, Nutritional needs, Therapy of surgery oncology patient, radiation oncology patient, and chemotherapy patient. • Alterations in Nutritional status associated with neoplastic disease process.
9.	***Immunodeficiency & Rheumatic diseases:*** • AIDS: Pathophysiology, Medical management, Dietary management, Goals of nutrition therapy • Arthritis: Epidemiology, Pathophysiology, Cause &dietary management • Osteoarthritis: Epidemiology, Pathophysiology, Cause & dietary management • Lupas arthritomatosis: Epidemiology, Pathophysiology, Cause & dietary management.

- **Food Microbiology (Course Code: COR 207-FN):**

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: COR 207-FN
1.	***Overview of Basic Microbiology*:** • Definition, Scope of Food Microbiology • An introduction to microbial world: Bacteria, Fungi, Yeast, Viruses • Bacterial groups based on their morphology: Gram +Ve/Gram -Ve bacteria, Motile/Non-motile bacteria, Sporulating/Non-Sporulating bacteria • Bacterial groups based on their physiological growth factors: Temperature, pH, water activity, availability of oxygen. • Fungi and Yeast: General features & their importance in food Microbiology • Viruses and Bacteriophages: Definition, their general characteristics & multiplication • Factors affecting the survival and growth of microorganisms in food- Intrinsic and Extrinsic parameters that affect microbial growth, Intrinsic factors for growth- Generalized, nutrient effect, pH, buffer, anaerobic/aerobic conditions, moisture content, temperature, gaseous atmosphere, Implicit factors- properties of microorganisms-response
2.	***Microbiological Analysis:*** Determination of microorganisms and their products in food: Sampling, sample collection, transport and storage, sample preparation for analysis. Microscopic and culture dependent methods- Direct microscopic observation, culture, enumeration and isolation methods; Chemical and Physical methods-Chemical, immunological and nucleic acid based methods; Culture independent techniques- PCR Based, DGGE, Metagenomics, etc.; Analytical methods for microbial metabolites-microbial toxins and metabolites.
3.	***Food Borne Microbial Diseases:*** • Investigation of a Foodborne disease, Foodborne disease outbreak, Incidence of food borne disease outbreak, Types of Microbial foodborne disease- Intoxication, Infection, Toxico-Infection, Predominant food types-associated with food borne diseases of bacterial and viral origin, Human factors in foodborne disease symptoms. • Foodborne intoxication- (*Staphylococcus aureus, Clostridium botulinum*)-Importance, Organism, Growth, Habitat, Toxins and toxin production, Disease and symptoms, Mechanism of pathogenesis, Food association, Prevention of disease, Identification methods. • Foodborne bacterial infections- (*Salmonella enterica, Listeria monocytogenes, Escherichia coli,*

	Campylobacter Species, *Shigella* Species, *Vibrio* Species)- Importance, Organism, Growth, Habitat, Toxins and toxin production, Disease and symptoms, Mechanism of pathogenesis, Food association, Prevention of disease, Identification methods. • Foodborne toxico-infections- *Clostridium perfrigens, Vibrio cholerie, Bacillus cereus*)- Importance, Organism, Growth, Habitat, Toxins and toxin production, Disease and symptoms, Mechanism of pathogenesis, Food association, Prevention of disease, Identification methods. • Opportunistic bacterial pathogens, Molds and Mycotoxins, Viruses, Parasites and Fish and Shellfish toxins- *Aeromonas hydrophila*, *Plesiomonas shigelloids*, Non-Escherichia coli coliforms, Norwalk virus, Norovirus, Reovirus, Rotavirus, Astrovirus, Adenovirus, Parvovirus, Hepatitis A Virus, Giardiasis, Amebiasis, Toxoplasmosis, Sarcocystosis, Cryptosporidiosis. Cysticercosis/Taeniasis. Roundworm-Trichinosis, Anisakiasis. Mycotoxins: Aflatoxicosis, Deoxyni valenol Mycotoxicosis, Ergotism, Puffer fish poisoning, Ciguatera fish poisoning, Paralytic shellfish poisoning)- Importance, Organism, Growth, Habitat, Toxins and toxin production, Disease and symptoms, Mechanism of pathogenesis, Food association, Prevention of disease, Identification methods.
4.	***Microorganisms in Human Welfare:*** • Importance of normal flora, prebiotics and probiotics, Single cell proteins, Fermented food products, Importance of microbes in food biotechnology: genetically engineered organisms.
5.	***Microbial Food Spoilage & Control of Microorganism in Food:*** • Food spoilage: characteristic features, dynamics and significance of spoilage of different groups of foods - Cereal and cereal products, vegetables and fruits, meat poultry and sea foods, milk and milk products, packed and canned foods. • Control of access of Microorganisms: Cleaning, Sanitation, and Disinfection, Control by physical removal, Thermal processing, Control by low temperature, Control by reduced water activity and drying, Control by low pH and organic acids, Control by antimicrobial preservatives, Control by irradiation
6.	***Food Safety and Quality Control:*** • Indicator micro-organisms • Concept of Food Safety Management System, GHP and GMP • HACCP, ISO 22000 • Food Laws, Regulations and Standards

- **Integrated Practical: Molecular Nutrition, Therapeutic Nutrition and Food Microbiology (Course Code: COR 208-FN):**

Sl. No.	COURSE CONTENT (PRACTICAL) COURSE CODE: COR 208-FN
	Lab-Molecular Nutrition
1.	Determination of blood groups
2.	Separation and characterization of human lymphocyte, monocyte and neutrophils from whole blood
3.	Separation of splenic lymphocyte, characterization and cell counting
4.	Separation of peritoneal macrophages and staining
5.	Assessment of apoptosis, necrosis and autophagy using immunostaining/ immunofluorescence
6.	Immunodigonistics (Using commercially available kits)

7.	Assessment of gene expression using PCR
8.	Assessment of protein expression using immunoblotting
9.	Planning and preparation of diet in special conditions
10.	Preparation of probiotic food
11.	Preparation of competent cells
12.	Isolation of plasmid DNA
13.	Transformation
14.	Restriction enzyme digestion
15.	Ligation
16.	Separation of DNA and RNA, Estimation of RNA by spectrophotometric method
17.	Preparation of cDNA, Polymerase chain reaction, qPCR
18.	Preparation of structured lipids both chemically and enzymatically
19.	Preparation of microencapsulated and nanoencapsulated food product and its characterization
20.	Preparation of oleo gel and hydrogel
21.	Changes of Quality of Food due to cooking
22.	Visit to food processing industries
Lab-Therapeutic Nutrition	
1.	Planning, preparation, service and evaluation of therapeutic diets covered in theory
2.	Determination of different biochemical constituents from serum/plasma for disease assessment.
3.	Dietary counselling & Case study preparation of patients for CVD, diabetes, liver disease, renal disorders, and gastrointestinal disorder. A minimum of two case histories should be done by each student.
4.	Visit to hospitals
Lab-Food Microbiology	
1.	Preparation of media, Preparation of nutrient agar slant, Autoclave handling, and Laminar airflow handling, Observation: Bacteria, Yeast, Fungus.
2.	Inoculation of bacteria in nutrient agar slants. Preparation of media for slants and endospore preparation. Streaking for Single colony isolation.
3.	Simple staining of the bacteria and yeasts (budding and fission yeast), Gram staining of bacteria, Endospore staining, Repeat gram staining.
4.	Estimation of viable cells in a bacterial suspension: “Pore Plate and Spread Plate” technique, Preparation of media for biochemical tests, Inoculation of bacteria for biochemical tests: Indole production, Acetyl methyl carbinol formation, Methyl red test, Starch hydrolysis. Inoculation of Molds.
5.	Comparative growth kinetics with respect to bacterial isolates and different media composition.
6.	Microbiological analysis of Water, Milk, Canned product, Fruit juices and Street foods. Phosphatase test for pasteurization of milk, Gradation of milk by methylene blue reduction test, Coliform bacteria isolation from different water sources; MIC test for antibiotics against Gram-positive and Gram-negative bacteria.
7.	Microbiological examination of water
8.	Partial identification of some given Gram +Ve and Gram -Ve bacterial isolates.
9.	Antibiotic susceptibility test by disc diffusion assay method.

SEMESTER III

SEMESTER-III

Paper Code	Paper	Theory/ Practical	Internal Assessment	End Term Assessment	Credit	Marks
COR 309-FN	Contemporary Instrumentation and Techniques for Nutritional Research	Theory	10	40	4	50
COR 310-FN	Research Methodology and Biostatistics	Theory	10	40	4	50
COR 311-FN	Community Nutrition and Public Health	Theory	10	40	4	50
COR 312-FN	Community Visit/Academic Excursion	Practical		25	2	25
COR 313-FN	Integrated Practical: Contemporary Techniques for Nutritional Research; Statistical Analysis; Community Nutrition	Practical	10	40	4	50
DSE 301-FN	Food Toxicology (DSE 301.1-FN)	Theory	10	40	4	50
	Nutraceuticals & Functional Foods (DSE 301.2-FN)					
	Food Processing and Preservation Technology (DSE 301.3-FN)					
SEC-FN	Industrial Training and Skill Development	Practical		25	2	25
Total					24	300

- **Learning Objectives (LOs):**

The objectives of M.Sc. Food and Nutrition programme (SEMESTER-III) are:

1. Understand the principles and applications of biochemical techniques used in the field of foods and nutrition.
2. To understand the basic concepts of research methodology, theories and methods in statistics, learn basic statistical procedures for research and understand applications of statistical techniques for analysis and interpretation.
3. To provide students understandings about the basic concepts, approaches and methods in conducting research thereby enabling them to appreciate and critique the nuances of designing a research study as well the ethical dimensions of conducting researches.
4. To understand the basic concepts, theories and methods in statistics, learn basic statistical procedures for research and understand applications of statistical techniques for analysis and interpretation.
5. This Course will familiarize the students with the concepts of Public Health Nutrition, health care of the community, and food and nutrition security. The students will acquire knowledge about the causes, consequences and preventive strategies for nutritional problems in the community and also strategies for improving the nutritional and health status of communities.
6. To gain the knowledge of food packaging and its interaction with food products.
7. To understand the concept of food toxicology, pharmacology, nutraceuticals and different functional foods.

- **Programme Specific Outcomes (PSOs):**

1. Choose appropriate strategies and instrumentation for analysis of different sample types.
2. Get familiarity with the analytical instruments through an understanding of the working principles and applications.
3. Demonstrate a comprehensive understanding of the theory and usage of state of the art techniques and their application in biological sciences and food preservation.
4. Demonstrate knowledge of the scientific method, purpose and approaches to research.
5. Compare and contrast quantitative and qualitative research.
6. Differentiate between the qualitative and quantitative methods of analysis of data.
7. Suitably apply data reduction strategies and illustrate data using various graphical methods
8. Use appropriate parametric and non-parametric statistical tests
9. Draw conclusions and interpretations from the analysis of data using various statistical software's.
10. Become familiar with the concept of public health nutrition and health care of the community.
11. Understand the causes, consequences and preventive strategies for nutritional problems in the community.
12. Comprehend the strategies for improving nutrition and health status of communities.
13. Acquire knowledge about the concept of food and nutrition security and the various programmes for improving food and nutrition security. Apply theoretical concepts in laboratory setting as per standard methods in the above mentioned areas.
14. Understand the concept of food toxicology, nutraceuticals and functional food for health promotion.
15. Acquire skills to undertake systematic research in the area of food packaging technology.

- **INSTRUCTIONS TO THE PAPER SETTERS:**

Question Pattern & Marks Distribution for Semester-III Examination (Theory Paper)

For Each Paper

Sl. No.	Type of Question	Total Number of Questions to be given	Number of Questions to be Attempted	Total Marks
1.	2 Marks	6	4	08
2.	4 Marks	5	3	12
3.	10 Marks	4	2	20
	Grand Total			**40**

Question Pattern & Marks Distribution for Semester-III Examination (Practical Paper/COR 313-FN)

Sl. No.	Type of Question	Total Number of Questions to be given	Number of Questions to be Attempted	Total Marks
1.	5 Marks	5	4	20
2.	Evaluation of Practical Note Book (10 Marks)			10
3.	Viva-voce (10 Marks)			10
	Grand Total			**40**

- **Contemporary Instrumentation and Techniques for Nutritional Research (Course Code: COR 309-FN):**

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: COR 309-FN
1.	***Principles of Genetic Engineering & Recombinant DNA Technology:*** • Molecular Cloning: Vectors, Host, Restriction Enzymes, Transformation, Detection • PCR and Real Time PCR, Site-directed mutagenesis • Hybridisation, Northern Blotting, Southern Blotting, DNA micro-array relevant Technique • DNA Sequencing, Classical and Modern, and relevant conventional techniques and the principles. • Regenerative Medicine, Gene Therapy
2.	***Immunotechnology and Immunodiagnostics:*** • Antibody Generation • ELISA, RIA • Western Blotting/Immunoblotting, • Immunoprecipitation • Flow Cytometry • Immunofluorescence Microscopy, *In Situ* Localization Techniques (FISH/Flow FISH)
3.	***Cell & Tissue Culture Techniques:*** • Cell separation by different techniques. *In vitro* cell culture, properties of transformed cells. • Cell line, cell clone, cell fusion. Cell and Tissue culture media. • Gene transfer method in animal cells. Transgenic biology. • Tissue culture: Principle and its practical application. Tissue transplantation technique. • Microscopy, Light, Fluorescence, Scanning & Transmission Electron Microscopy • Fixation & Staining Techniques for EM, Freeze Etch and Freeze Fracture methods for EM, Confocal Microscopy • Image processing methods in Microscopy
4.	***Techniques in Biophysical Chemistry:*** • Electromagnetic spectrum- interaction with non-living and living matters. • UV-Vis Absorption Spectroscopy, Fluorescence spectroscopy, Infrared spectroscopy, Circular Dichroism. • Atomic Absorption Spectroscopy; Mass-Spectrometry, Plasmon resonance spectroscopy. • Separating techniques- Electrophoresis, Chromatography (HPLC/LC/GC). • Radioisotopes, their detection and application.

- **Research Methodology and Biostatistics (Course Code: COR 310-FN):**

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: COR 310-FN

1.	***Research Ethics & Methods:*** Ethical issues relating to research participants and the researcher- Rights, Dignity, Privacy and Safety of participants- informed consent, Confidentiality, Anonymity of respondents, Voluntary participation, Harm avoidance- Conflicts of interest or bias, Use of inappropriate research methodology, Proper guidelines of research ethics, Plagiarism, Falsification, Duplication, Research Integrity, Scientific misconduct, Ethical vetting of research
2.	***Types of Research:*** • Historical • Descriptive, Experimental • Case study • Social research • Participatory research
3.	***Definition & Identification of Research Problem:*** • Selection of research problem • Justification • Theory • Hypothesis • Basic assumption
4.	***Limitation & Delimitation of the Problems:*** • Types of variables • Basic principle of research design • Purpose of research design/ fundamental • Application of research design • Limitations of Experimental and Descriptive research with the help of case studies
5.	***Biostatistics:*** • Orientation to qualitative and quantitative analysis. • Introduction to quantitative procedures. • Basic principles and concepts in statistics • Descriptive statistics and its applications • Applications of descriptive statistics • Characteristics of distributions: Skewness, Kurtosis • Parametric tests of difference: T test, ANOVA and post hoc analysis of significance, Application to food quality assessments, Multivariate statistics: MANOVA • Non-parametric tests of difference: Mann-Whitney, Sign, Median, and Kruskal-Wallis, • Chi square test • Interpreting results- Statistical inference Research Conclusion and Recommendation
6.	***Computer Application:*** Programming languages and biological application, Statistical Software's (OriginPro/SAS/SPSS), Reference editing software (Reference Manager, EndNote), Image processing software (ImageJ)

- **Community Nutrition and Public Health (Course Code: COR 311-FN):**

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: COR 311-FN
1.	• Meaning of community and Community Nutrition, Concept and scope of public health nutrition - Health - definition, dimensions, determinants and indicators of health and nutrition (IMR, CBR, Fertility rate, MMR, U5MR), vital link between health and nutrition - Review - concept of adequate nutrition and malnutrition. Health care facility - role of public nutritionists in the health care delivery system, primary Health Centre - Concept, functions, organization, current status in India and delivery of service, Taluk level hospital, and immunization. Anganwadi - its management, duties of public nutritionist in anganwadis. Demographic profile - population trends in India, density of population, demographic transition, population structure, sex ratio, family size, literacy and education, morbidity rate and life expectancy.
2.	• Assessment of nutritional status of individuals and population - Significance nutritional assessment of community, methods for assessing nutritional status., Direct methods- Anthropometry, biochemical, clinical, dietary and functional methods of assessments. Indirect methods - demography, population dynamics and vital statistics. Nutrition during life span – pregnancy, lactation, infancy, preschool age, school going and adolescents, adults and old age.
3.	• Nutritional surveillance system (NSS) - Objectives, initial assessment indicators for use in nutritional surveillance, Triple A approach. Nutrition in emergencies and disasters - Natural and manmade disasters resulting in emergency situation. Macro and micronutrient deficiencies and Infection in emergencies. Scope for malnutrition assessment, indicators and simple screening methods. Nutritional relief and rehabilitation - Assessment of food needs, food distribution strategy, targeting food aid, mass and supplementary feeding, special foods/rations for nutritional relief, transportation and storage, feeding centres, sanitation and hygiene and ethical considerations
4.	• Prevalence of malnutrition in India - Common nutritional problems - causes and preventive measures - PEM, VAD, IDA, IDD, VDD, Obesity and fluorosis. Approaches and strategies for improving nutritional status and health – Intervention Programmes - Nutrition policy and programmes, role of national and international organizations to combat malnutrition. Health based interventions. Food based interventions. Perspectives in food and nutrition security – basic concepts, production, distribution, access, availability, losses and consumption, food and nutrition security at national, household and individual levels. Food Security Programmes- Public Distribution System (PDS), Antyodaya Anna Yojana (AAY), Annapurna Scheme, Food for Work Programme.
5.	• Information Education Communication approaches to improve health and nutrition: Concepts – Scope- Elements- Models of communication - Communication Process - Approaches and Barriers to communication, Communication for Extension Education and Development - Introduction to IEC Aims and Objectives, Importance of IEC, relevance to programmes - Nutrition education for behaviour change – Rationale, Planning Execution and evaluation of Intervention Programmes Different Media, their characteristics and use- IEC for different target group

- **Community Visit/Academic Excursion (Course Code: COR 312-FN):**

Sl. No.	COURSE CONTENT (PRACTICAL) COURSE CODE: COR 312-FN

1.	• Field visits to different communities, Anganwadi, ICDS Centre's in state/national level. • To understand institutional provisions for development of Adolescents; school, children homes, rehabilitation centre and skill development provisions. • Practical assignments. • Report writing and power point presentations.

- **Integrated Practical: Contemporary Techniques for Nutritional Research; Statistical Analysis; Community Nutrition (Course Code: COR 313-FN):**

Sl. No.	COURSE CONTENT (PRACTICAL) COURSE CODE: COR 313-FN
	Lab-Contemporary Techniques for Nutritional Research
1.	Spectrophotometric analysis of protein/standard curve preparation, lipid peroxidation, endogenous antioxidants
2.	Immunophenotyping using flow cytometry
3.	Assessment of cytokines using ELISA
4.	Assessment of gene expression by PCR
5.	Assessment of protein expression by Western Blot
6.	Determination of protein localization by immunofluorescence (Fluorescence (Fluorescence Microscopy/Confocal Microscopy)/immunohistochemistry and image analysis.
7.	Practical demonstration on spectroscopy, Atomic Force Microscopy, Scanning & Transmission Electron Microscopy.
8.	Demonstration of the tissue culture facility---description of the theoretical aspect---showing growing cells in a T-flask under phase contrast microscope, DAPI staining of nuclei using cells growing on cover slips.
9.	Evaluation of free-radical scavenging and *in vitro* antioxidant activities of different plant extract/food components.
10.	*Analytical systematic in food toxicology:* a. Types and sample preparation in the analysis of toxic substances in food. b. Extraction of toxics in food samples. c. Techniques used in the analysis of toxics present in foods: basis and applications
11.	Analysis of food contaminants: Preparation of a sample, extraction, analysis calculations. Interpretation of results.
12.	Development experimental murine toxicity model
13.	Assessment of different toxicity parameters-related to disease occurrence.
14.	Qualitative/Quantitative assessment of some food adulterants in foods.
	Lab-Statistical Analysis
1.	Review of Measurement tools/tests/procedures: Standardisation, Reliability, Validity
2.	Data reduction strategies and Coding of quantitative and qualitative data

3.	Analysis of data using appropriate statistical software (Qualitative and quantitative open source software)
4.	Data Visualization, Data Interpretation and report writing
	Lab-Community Nutrition
1.	Development of a plan for conducting nutrition education programmes in the community. Preparation of communication aids for different groups
2.	Development of low cost recipes for infants, pre-schoolers, adolescents, pregnant and lactating mothers
3.	Planning and preparation of diet/ dishes for Protein Energy Malnutrition (PEM), Vitamin A Deficiency (VAD), Iron Deficiency Anaemia (IDA), obesity, hypertension, diabetes
4.	Field visits to ongoing national nutrition programmes.
5.	Identification of the type of nutritional problems and their determinants in different population groups based on National/regional level Nutrition and Health Surveys- Secondary data analysis

- **Elective Course (Course Code: DSE 301-FN):**
- **Food Toxicology (Course Code: DSE 301.1-FN):**

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: DSE 301.1-FN
1.	• Principles of Toxicology: classification of toxic agents; characteristics of exposure; spectrum of undesirable effects; interaction and tolerance; Biotransformation and mechanisms of toxicity. Nutrigenetics, Nutridynamics, Nutrikinetics Cellular and molecular basis of drug action. Molecular models of Drug receptor interaction Stimulus response mechanisms. Evaluation of toxicity: risk vs. benefit: experimental design and evaluation: prospective and retrospective studies: Controls: Statistics (descriptive, inferential): animal models as predictors of human toxicity: Legal requirements and specific screening methods as per OECD guidelines *in vitro* and *in vivo* studies; clinical trials.
2.	• Natural toxins in food: natural toxins of importance in food- toxins of plant and animal origin; microbial toxins (e.g., bacterial toxins, fungal toxins and Algal toxins), natural occurrence, toxicity and significance, determination of toxicants in foods and their management. Toxin poisoning ion channels: Tetrodotoxin, Saxitoxin, α-Bungarotoxin, Conotoxin, Arecoline. Neurotoxins: α-agatoxin, NSTX-3, Jorotoxin, β-philanthotoxin, Stychnines, Organophosphorus compounds. Food-related neurotoxin-Lead, Mercury, Arsenic.
3.	• Food allergies and sensitivities: natural sources and chemistry of food allergens; true/untrue food allergies; handling of food allergies; food sensitivities (anaphylactic reactions, metabolic food disorders and idiosyncratic reactions); Safety of genetically modified food: potential toxicity and allergenisity of GM foods. Safety of children consumables.
4.	• Environmental contaminants and drug residues in food: fungicide and pesticide residues in foods; heavy metal and their health impacts; use of veterinary drugs (e.g. Malachite green in fish and β-agonists in pork); other contaminants in food, radioactive contamination of food, Food adulteration and potential toxicity of food adulterants. Endocrine disrupters in food.

5.	• Food additives and toxicants added or formed during food processing: safety of food additives; toxicological evaluation of food additives; food processing generated toxicants: nitroso-compounds, heterocyclic amines, dietary Supplements and toxicity related to dose: common dietary supplements; relevance of the dose; possible toxic effects.
6.	• State of the art molecular toxicological assays measurement of intracellular Ca^{2+} levels by fluorescence probes, measurement of membrane potential by fluorescence probes.

- **Nutraceuticals and Functional Foods (Course Code: DSE 301.2-FN):**

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: DSE 301.2-FN
1.	• Nutraceuticals and functional Foods– Definition, concept, history and market; Evolution of nutraceuticals and functional foods market. Classification of nutraceuticals and functional foods. Significance and relevance of nutraceuticals and functional foods in the management of diseases and disorders.
2.	• Natural occurrence of certain phytochemicals- Antioxidants and flavonoids: omega – 3 fatty acids, carotenoids, dietary fibre, phytoestrogens; glucosinates; organosulphur compounds. Dosage for effective control of disease or health benefit with adequate safety; studies with animals and humans; acute and chronic studies. Regulatory issues.
3.	• Isolation of phytochemicals from plant materials: Care in handling and storage of raw materials with minimal damage to sensitive bioactive compounds; Extractive methods for maximum recovery and minimal recovery and minimal destruction of active material; stability studies. Recent developments in the isolation, purification and delivery of phytochemicals
4.	• Prebiotics, probiotics and symbiotics- Probiotics: Definition, types and relevance; Usefulness in gastro intestinal health and other health benefits; development of a probiotic products; recent advances in probiotics; Challenges and regulatory issues related to probiotic products. Prebiotics: Prebiotic ingredients in foods; types of prebiotics and their effects on gut microbes; health benefits of prebiotics; recent development in prebiotics. Synbiotics.
5.	• Functional foods - Definition, development of functional foods, use of bioactive compounds in appropriate form with protective substances and activators; Effect of environmental condition and food matrix; Effects of processing conditions and storage; Development of biomarkers to indicate efficacy of functional ingredients; Research frontiers in functional foods; delivery of immunomodulators /vaccines through functional foods. Nutrigenomics - concept of personalized medicine.

- **Food Processing and Preservation Technology (Course Code: DSE 301.3-FN):**

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: DSE 301.3-FN
1.	• Principles of fresh food storage: Nature of harvested crop, plant, animal; product storage; effect of cold storage and quality – storage of grains
2.	• Processing and preservation by heat: Blanching, pasteurization, sterilization and UHT processing, canning, extrusion cooking, dielectric heating, microwave heating, baking, roasting and frying. Retort processing of Ready to eat (RTE) products. Newer methods of thermal processing – batch and continuous.

3.	• Processing and preservation by low Temperature: refrigeration, freezing, CA, MA, and dehydro freezing. Food irradiation, history and mechanism, the electro-magnetic spectrum, forms of radiant energy. Principles of using electromagnetic radiation in food processing, ionizing radiations and non-ionizing radiations, advantages and disadvantages. Controlling undesirable changes in food during irradiation.
4.	• Processing and preservation by drying, concentration and evaporation: Drying – water activity, microbial spoilage due to moisture. Dehydration of fruits, vegetables, milk, animal products. Various methods employed in production of dehydrated commercial products, selection of methods based on characteristics of foods to be produced, advantages and disadvantages of different methods, sun drying, tray or tunnel drying, spray drying, drum drying, freeze drying, fluidized bed drying. Physical and chemical changes during drying control of chemical changes, desirable and undesirable changes. Packaging and storage of dehydrated products .Food Concentration- methods of food concentration, freeze concentration, Ultra-filtration, reverse osmosis.
5.	• Processing and preservation by non-thermal methods: High pressure, pulsed electric field, hurdle technology. GRAS and legal aspects for gamma irradiation. Permissible limits for chemical preservatives. Use and application of enzymes and microorganism in processing and preservation of foods; food fermentations, pickling smoking; Food additives; Definition, types and functions, permissible limits and safety aspects. Chemical Preservatives- type I and type II.

- **Industrial Training and Skill Development (SEC-FN):**

Sl. No.	COURSE CONTENT (PRACTICAL) COURSE CODE: SEC-FN
1.	Training on Quality and Management System 17025:2017
2.	Study of FDA/ISO/FSSAI Certification
3.	Good Laboratory Practices
4.	Food laboratories visit/Training
5.	Research Methodology-Bioactivity-guided fractionation of different active components from specific plant extract, *In-vitro* antioxidant activity evaluation, *In vitro*, *In vivo*, *Ex vivo* experimental model development, Various Nutrient application on experimental disease model, Novel Functional Food Development, Development of Phytonutrients Products.

SEMESTER IV

SEMESTER-IV

Paper Code	Paper	Theory/ Practical	Internal Assessment	End Term Assessment	Credit	Marks
DSE 402-FN	Food Technology (DSE 402.1-FN) Food Product Development & Quality Evaluation (DSE 402.2-FN)	Theory	10	40	4	50
DSE 403-FN	Food Packaging & Post-Harvest Technology (DSE 403.1-FN) Food Economics & Food Security (DSE 403.2-FN)	Theory	10	40	4	50
DSE 404-FN	Future Nutrition Research (DSE 404.1-FN) Nutritional Epidemiology (DSE 404.2-FN)	Theory	10	40	4	50
DSE 405-FN	Sports Nutrition (DSE 405.1-FN) Nutrition Communication & Diet Counselling (DSE 405.2-FN)	Theory	10	25	4	50
PD 401-FN	Project/Dissertation	Practical	00	100	8	100
Total					24	300

- **Learning Objectives (LOs):**

The objectives of M.Sc. Food and Nutrition programme (SEMESTER-IV) are:

1. Understand the principles and applications of food technology and product development used in the field of foods and nutrition.
2. To understand the basic concepts of research methodology, theories and methods in food economics and food security, learn basic procedures for nutritional research and understand applications of epidemiological techniques for analysis and interpretation.
3. To provide students understandings about the basic concepts, approaches and methods in conducting research thereby enabling them to appreciate and critique the nuances of designing a research study as well the ethical dimensions of conducting researches.
4. This Course will familiarize the students with the concepts of sports and geriatric nutrition. The students will acquire knowledge about the causes, consequences and preventive strategies for nutritional problems in the athletics and also strategies for improving the nutritional and health status of elderly.

- **Programme Specific Outcomes (PSOs):**

The students will be able to:

1. Gain knowledge on the basics of communication strategies and best suited methods of communicating with individuals to select appropriate strategies presented with dietary problems.
2. Understand the importance of BCC in managing nutrition related problems.
3. Draw out a complete counselling plan for individuals based on their physiological conditions using the appropriate tools.

4. Understand how best to maintain adherence to changed dietary practices for specific physiological conditions.
5. Gain knowledge on traditional and alternate methods to manage disorders.
6. Understand concepts of fitness, its assessment and exercises for physical fitness training.
7. Function effectively as a sports dietitian, with knowledge and skills, to support recreational and competitive athletes
8. Exhibit knowledge of the metabolism and bioenergetics of exercise and continuum in various sports
9. Successfully plan, implement and monitor sport-specific diets for athletes through all age groups Provide diet and nutritional care in terms of nutrition education, diet plans and counselling to special groups of athletes

- **INSTRUCTIONS TO THE PAPER SETTERS:**

Question Pattern & Marks Distribution for Semester-IV Examination (Theory Paper)

For Each Paper

Sl. No.	Type of Question	Total Number of Questions to be given	Number of Questions to be Attempted	Total Marks
1.	2 Marks	6	4	08
2.	4 Marks	5	3	12
3.	10 Marks	4	2	20
	Grand Total			**40**

- **Food Technology (Course Code: DSE 402.1-FN):**

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: DSE 402.1-FN
1.	***Cereal and cereal products technology:*** • Cereals: Wheat, rice, maize, barely, oat, rye- Structure, main ingredients and their properties. • Milling process: Complete milling process, break rolls, reduction rolls, milled products and their nutritive value and applications. • Baking technology: Bread, biscuits/ Cookies and cake, Principles of baking, Ingredients and their functions, methods of preparation, in-process control, faults, causes and remedies, methods of leavening: physical, biological and chemical, scoring of quality parameters.
2.	***Meat, fish, poultry, egg and its products technology:*** • Meat: Composition, variety, slaughtering and related practices, pre-slaughter handling, grading, ageing, curing, smoking and tenderizing of meat, meat pigments and color changes, cooking, storage, methods of preservation for value addition and spoilage. • Poultry: Production considerations, Processing plant operations (slaughter and bleeding, scalding, DE feathering, eviscerating, chilling and packaging), cooking, tenderness, and flavor and color changes. • Eggs: Composition, quality factors, storage, bacterial infection and pasteurization, freezing, drying and egg substitutes. • Fish: Composition, onboard handling & preservation, drying and dehydration, salt curing, smoking, marinades, fermented products, canning, Modified Atmosphere Packaging, and quality factors. Public health hazards due to microbial contamination of foods: Important food borne infections and intoxications due to bacteria, moulds, viruses (*Salmonella typhi*, *Helicobacter pylori*, *Campylobacter jejuni*, *Yersinia enterocolitica*, Bacillus cereus, *Staphylococcus aureus*, *Clostridium botulinum*, *Escherichia coli*, Mycotoxins, Hepatitis A virus & Rota virus)-Symptoms, mode of transmission and methods of prevention. Assessing the microbiological quality of food: indicator organisms, microbiological standards, principles of GMP & HACCP in food processing. Safety management at household and industrial level.
3.	***Dairy technology:*** • Introduction to market milk: Indian standards, Composition, factors affecting composition of milk, physico-chemical properties of milk and its constituents. • Milk processing: Clean milk practices, buying and collection, platform tests, pre-heating, filtration, clarification, standardization, bactofugation, homogenization, pasteurization, cooling, packaging and storage. Cleaning and sanitization of dairy equipment including CIP and COP. • Milk products (Cream, butter, ice cream, curd, cheese, khoa and ghee)-Introduction, definition, classification, methods of manufacture, quality aspects.

- **Food Product Development & Quality Evaluation (Course Code: DSE 402.2-FN):**

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: DSE 402.2-FN
1.	***Food needs & consumer preference:*** Market survey and its importance in; designing a questionnaire to find consumer needs for a product

	or a concept. Developing a Product to Meet the Requirements. Product life cycle. Creating brand value for the Product. The SWOT analysis
2.	***Designing of new products:*** New Food Product Development (NPD) process and activities, The Stage-Gate model NPD success factors, new product design, food innovation case studies, market-oriented NPD methodologies, organization for successful NPD; Recipe Development; use of traditional recipe and modification; involvement of consumers, chefs and recipe experts; selection of materials/ingredients for specific purposes; modifications for production on large scale, cost effectiveness and return on investment, nutritional needs or uniqueness; use of novel food ingredients and novel processing technologies.
3.	***Standardization & large scale production:*** Process design, equipment needed; establishing process parameters for optimum quality; Sensory Evaluation; Lab requirements; different techniques and tests; statistical analysis; application in product development and comparison of market samples; stages of the integration of market and sensory analysis.
4.	***Quality, safety & regulatory aspects:*** Product Stability; evaluation of shelf life; changes in sensory attributes and effects of environmental conditions; accelerated shelf life determination; developing packaging systems for maximum stability and cost effectiveness; interaction of package with food; Regulatory Aspects; whether standard product and conformation to standards; Approval for Proprietary Product.
5.	***Product commercialization, launch, evaluation & case studies:*** Outcomes and activities in product commercialization, Pre-launch trial, Steps in product launch, Evaluation of the Launch, product performance testing, developing test market strategies, Case Studies of some successes and failures, food choice models and new product trends.

• Food Packaging & Post-harvest Technology (DSE 403.1-FN):

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: DSE 403.1-FN
1.	***Introduction to food packaging:*** • Functions of food packaging, Packaging environment. Characteristics of food stuff that influences packaging selection.
2.	***Packaging Systems and methods:*** • Vacuum Packaging, Controlled atmospheric packaging, Modified atmospheric packaging, Aseptic Packaging, Retort processing, Microwave packaging, Active Packaging, intelligent packaging, Edible packaging, Shrink and stretch packaging.
3.	***Packaging material and their properties:*** • Glass, Paper and paper board, Corrugated fibre board (CFB), Metal containers: Tin Plate and Aluminium, Composite containers, Collapsible tubes, Plastic Films, Laminations, Metalized films, Co extruded films, Testing of packaging material.
4.	***Packaging of fresh and processed foods:*** • Packaging of Fruits and vegetables, Fats and Oils, Spices, meat, Poultry and sea foods, Dairy Products, Bakery, beverages, Dehydrated and frozen foods. Liquid and powder filling machines.
5.	***Packaging Design & Environmental Issues in Packaging:***

	• Coding and marking including bar coding; Packaging Laws and regulations, safety aspects of packaging materials; sources of toxic materials and migration of toxins into food materials; Environmental & Economic issues, recycling and waste disposal.

• Food Economics & Food Security (DSE 403.2-FN):

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: DSE 403.2-FN
1.	• Statistical profile of the world food economy. The Structure of the World Food System. Early human food systems and subsistence agriculture. Semi-subsistence food systems and commercial, market-oriented food systems. Global supply-demand balance and projections
2.	• Statistical profile of the Indian economy Agricultural production and the supply of food. Economic causes and consequences of resource degradation. Components of Indian Food Systems, Food Policies in India :Food and agricultural policies, Supply side policies, Agricultural research and development Infrastructure and production policies, Demand side policies, Income support and redistribution Food assistance programs.
3.	• Global Institutions and the WTO, World food systems: food security, food self-sufficiency and the role of trade. Foreign aid, food aid and development. Global sustainability: environmental impacts of the world food system. Hunger, conflict, government failure and international intervention. Globalization of the food system.
4.	• Food security: Hunger and malnutrition, Definition and measurement. Food security model, Food availability. Foreign aid, food aid and development. Global sustainability: environmental impacts of the world food system. Hunger, conflict, government failure and international intervention. Globalization of the food system.
5.	• Food and agricultural policies including Supply side policies, Agricultural research and development, Infrastructure and production policies, Demand side policies, income support and redistribution, Food assistance programs.

• Future Nutrition Research(Course Code: DSE 404.1-FN):

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: DSE 404.1-FN
1.	• Nutrigenomics: Omics in nutrition, Nutrigenome • Nutriproteomics: Definition, Goal, Tools for evaluation, future prospects • Genetics, Measure of nutritional phenotype, Epigenetics and Nutritional Epigenomics, Nutrients and tis effect on gene regulation. • Technologies in Nutrigenomics: Different sequencing approaches, Microarray, SNP genotyping, PCR and RT-PCR techniques, Proteomics Techniques:1-D, 2-D gel electrophoresis, Differential gel electrophoresis (DIGE), novel peptide identification, peptide sequencing methods, Metabolic techniques: Chromatography and mass spectrometry techniques, Discovery and validation of biomarkers for important diseases and disorders • Nutrient sensing: The role of sensing transcription factors and dietary signalling routes • Drug-nutrient interaction

	• Basic bioinformatics, Concept of Molecular docking for analysing drug/nutrient-protein/target interaction. • Research methodology for the development of different disease model in murine system and their modulation by the application several micronutrients. • Global food policies and food security: Definition and Dimensions of Health, Morbidity, Mortality and Life Expectancy; Occupational Health Hazards; Determinants of Nutrition and Mal-Nutrition. Concepts of Infant Mortality Rate, NMR BMI, CMR, TFR, DALYs. • Structural dimensions of Nutrition Policy, Nutritional Impact of Economic Shocks and Policies, Multiple Sectors linkages in determining Nutritional Goals, Nutrition-sensitive food and agriculture policies and programmes, Concepts of nutrition knowledge, nutrition labelling, food safety, food losses. Framework sketch: Sustainable development, Dietary diversity, Food Security, Nutrition Security and Nutrition Value Chains.

• Nutritional Epidemiology (DSE 404.2-FN):

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: DSE 404.2-FN
1.	***Basic epidemiology concepts and methods:*** Definition, scope and purpose of epidemiology, Basic measurements in epidemiology, Measurement of mortality, morbidity and disability- rates, ratios and proportions, Comparison of disease occurrence- absolute and relative comparisons, Epidemiologic study methods- observational and experimental studies, Observational epidemiology- descriptive and analytical studies – ecological, cross-sectional, care-control and cohort, Experimental epidemiology- experimental and quasi experimental trials, Randomized control trials, Field trials and community trials, Population, sampling, sample size and power, Introduction to nutritional epidemiology: Definition, scope and significance of nutritional epidemiology in public health nutrition. Design, steps in conducting the studies, data analysis and interpretation, Association and causation in epidemiology, Potential errors in epidemiologic studies- Measurement error and bias & Internal and external validity
2.	***Epidemiologic approaches to diet-disease relationships:*** Measuring diet –disease associations- Type of measurement , time trends, correlation and regression, risk assessment, Design of nutritional epidemiological studies, Strengths and weaknesses of various designs in estimation of diet disease relationships, interpretation of epidemiologic research, multi variate relationship of diet and disease, Genetics in nutritional epidemiology- genetic variation and epigenetics in nutritional epidemiology- Gene diet interactions. Ethical aspects of research in nutritional epidemiology
3.	***Measurements of exposure and outcomes in Nutritional epidemiology:*** • Nutritional exposures- Relevant direct and indirect measures of nutrition and health assessment • Critical review of diet assessment methods- assessment of food consumption at different levels, measurement errors, strengths and limitations, reproducibility and validity of methods measuring food consumption of individuals- 24 dietary recall, diet record and food frequency methods/Analysis of dietary patterns. Analysis and interpretation of dietary data. • Nutritional status assessment: Critical review of anthropometric and various direct measures pf nutritional status- clinical, biochemical, biophysical and measures of body composition. Sources of errors, strengths and limitations of various measures. Relevance and use of various indices and indicators of nutritional status for risk assessment. • Biomarkers in nutritional epidemiology: Uses and limitations of biomarkers as measures of

	nutritional status and in dietary validation studies. • Physical activity assessment and interpretation: Strength and weaknesses of subjective and objective methods. • Ecological assessment of nutritional status, socio-economic, demographic, cultural and political factors.
4.	***Role of Epidemiological research in development of nutrition related policies and their evaluation***: Generating evidence for policy making, strengthing implementation of nutrition and health interventions and programmes, evaluation of the effectiveness of such interventions. Examples of use of epidemiological research data for improvement of nutrition and health interventions or national programmes.

• Sports & Geriatric Nutrition (Course Code: DSE 405.1-FN):

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: DSE 405.1-FN
1.	***Introduction to physical fitness:*** Definition of physical fitness, Components of physical fitness, Methods of assessing physical fitness, Approaches to achieving physical fitness through the life cycle
2.	***Fundamentals of Sports Nutrition:*** Integrated approach to care for athletes, Assessment of Sports performance, Bioenergetics and body metabolism of physical activity and sports, Macro- and micro nutrients for sport performance, Temperature regulation, fluid balance, fluid requirements of athletes and rehydration strategies for sports
3.	***Nutrition for high performance athletes:*** • Recommended allowances and nutritional guidelines for different categories of high performance sports • Nutritional care during Training, weight management and day-today recovery • Nutrition for the Pre-competition, Competition and post competition recovery phase • Supplements in Sport :performance enhancing substances ,drugs, ergogenic aids and herbs in sports performance
4.	***Challenges in Sports Nutrition:*** Nutritional care for children and adolescent athletes, Athletes with special needs- Paralympics & special Olympics, vegetarian athletes, Athletes with eating disorders, athletes with diabetes and other medical conditions , management of Red-S.
5.	***Geriatric Nutrition:*** • The ageing process • Physiological changes accompanying the ageing process • Nutrients needs during ageing • Special healthy eating pattern related to age-related changes of elderly • Common health problems during old age & their nutritional management • Factors influencing longevity and health

- **Nutrition Communication & Diet Counselling (Course Code: DSE 405.2-FN):**

Sl. No.	COURSE CONTENT (THEORY) COURSE CODE: DSE 405.2-FN
1.	***Basics of Communication:*** • Meaning of Communication, Forms of communication: Verbal and Non-verbal Communication • Communication methods • Traditional, Current and Emerging methods/tools of communication • Characteristics of effective communication, Skills and attributes of a communicator • Approaches in communication • Barriers to effective communication
2.	***Nutrition Counselling:*** • Concept and importance of counselling in the nutrition care process • Understanding dietary patterns and food choices and their impact on counselling • Behaviour Change Communication and Models for behaviour change • Counselling strategies • Factors to be considered for counselling • Conventional and non-conventional tools in counselling
3.	***Processes involved in dietary counselling:*** • Managing resources of the communicator/counsellor • Designing of counselling plans – goals & objectives, evaluation instruments. • Implementation: facilitating self-management of disease condition • Evaluation: evaluating adherence to dietary changes • Counselling approaches after evaluation
4.	***Dietary counselling through the life span:*** • Considerations for counselling plans for: Prenatal and pregnant women, Lactating women • Childhood nutrition problems like SAM, weight management, vitamin and mineral deficiencies, School children, adolescents, young adults fitness, weight management, eating disorders • Managing diet related chronic diseases in adults: Obesity, Diabetes, Dyslipidaemia, Hypertension Cancer risk prevention, Renal disease, Liver disorders, Geriatric counselling
5.	Nutritional/medicinal role of traditional foods: traditional food beliefs, role of Ayurveda, Naturopathy, Yoga and other traditional medicines in disease management

- **Project/Dissertation (Course Code: PD 401-FN):**

Sl. No.	COURSE CONTENT (PRACTICAL) COURSE CODE: PD 401-FN
1.	Students will work on specific project attached to a supervisor and submit a thesis at the end of the semester. The assessment will be based on the midterm evaluation, evaluation of final report and viva-voce examination.