SNDT Women's University, Mumbai

Master of Science

(Clinical Nutrition & Dietetics)

M. Sc.

(Clinical Nutrition & Dietetics)

As per NEP-2020

Syllabus

(2023-24)

Programme Template

M.Sc. Clinical Nutrition & Dietetics

SN	Courses	Type of Course	Credits	Marks	Int	Ext
Semester I						
114411	Physiological Biochemistry (Th)	Major (Core)	4	100	50	50
114412	Human Physiology and Pathophysiology (Th)	Major (Core)	4	100	50	50
114413	Medical Nutrition Therapy - I Th.	Major (Core)	4	100	50	50
114424	Medical Nutrition Therapy - I Pr.	Major (Core)	2	50	50	0
124411/ 124412/ 124413	*Introduction to Entrepreneurship / Clinical Diagnostics/ Advanced Nutrition I (Macronutrients & Water)	Major (Elective)	4	100	50	50
134411/ 134431	Research Methodology (MSc)	Minor Stream (RM)	4	100	50	50
End of Semester I			**22**	**550**	**300**	**250**
Semester II						
214411	Advanced Nutrition II (Micronutrients)	Major (Core)	4	100	50	50
214412	Nutritional Assessment	Major (Core)	4	100	50	50
214413	Medical Nutrition Therapy - II Th.	Major (Core)	4	100	50	50
214424	Medical Nutrition Therapy - II Pr.	Major (Core)	2	50	0	50
224411/ 224412	*Hospital, Personnel and Food Service Management / Food Safety OR Nutrition for Exercise and Fitness	Major (Elective)	4	100	50	50
244441	Internship**	OJT	4	100	50	50
Exit with PG Diploma in Dietetics (* recommend to undertake 6 months'internship)			**22**	**550**	**250**	**300**

Exit option: (44 credit) after Three-Year UG Degree

Year II

Sr.No.	*Courses*	*Type of Course*	*Credits*	*Marks*	*Int*	*Ext*
Semester III						
314411	Statistical Application in Research	Major (Core)	4	100	50	50
314412	Pediatric Nutrition	Major (Core)	4 (2+2)	100	50	50
314413	Geriatric Nutrition	Major (Core)	4	100	50	50
314414	Nutrition in Critical Care	Major (Core)	2	50	0	50
324421/ 324422	Functional Foods and Nutraceuticals / Drug Nutrient Interaction	Major (Elective)	4	100	50	50
354431	Research Project	RP	4	100	50	50
End of Semester III			**22**	**550**	**250**	**300**
Semester IV						
414411	Nutrigenetics and Nutrigenomics	Major (Core)	4	100	50	50
414412	Nutrition, Diet and Microbiome	Major (Core)	4	100	50	50
414413	Dietetic Techniques and Patient Counseling	Major (Core)	4 (2+2)	100	50	50
424411/ 424412	*Principles of Ayurvedic Dietetics / Public Nutrition and Health	Major (Elective)	4	100	50	50
454431	Dissertation	RP	6	150	100	50
End of Semester IV			**22**	**550**	**300**	**250**

*Elective subjects will be offered only if there are a minimum of 10 students for the respective selected course.

#Nutrition in Diabetes Care / Cardiometabolic Health / Renal Nutrition/ Nutrition in Cancer will be offered as value-added course.

Syllabus Contents

Semester I

1.1 Major (Core)

Course Title	**Physiological Biochemistry**
Course Credits	4
Course Outcomes	After going through the course, learners will be able to -
	1.Discuss the mechanisms adopted by the human body for regulation of metabolic pathways
	2. Describe biochemical pathways relevant in nutrient metabolism.
	3. Develop an insight into interrelationships between various metabolic pathways.
	4. Discuss the integration of cellular level metabolic events to nutritional disorders and imbalances.
	5. Review biochemical techniques that are relevant for the investigation of nutrient metabolism.
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to-
	1. Define and differentiate the structure, composition of Membrane
	2. Illustrate the cell signalingpathways
Content Outline	1. Membrane structure, composition and transport of metabolites acrossmembranes 2. Acid base balance and its regulation 3. Enzymes . Kinetics of monosubstrate and bisubstrate catalysed reactions (including inhibition) . Enzyme specificity, regulation of enzyme activity and synthesis . Enzymes in clinical diagnosis. Detoxification in the body-metabolism of xenobiotics (Phase I and Phase II enzymes) 5. Cell Signalling pathways- Overview of extracellular cell signalling, G protein couple receptors and their effectors, enzyme linked receptors and their effectors, second messengers, map kinase pathways 6. Free radicals, ROS and oxidative damage
Module 2 (Credit 1)	

Learning Outcomes	After learning the module, learners will be able to -
	1. Discuss the metabolism of carbohydrates, lipids and protein
Content Outline	1. Carbohydrate Metabolism- a. Intestinal transport of carbohydrates, Transport of glucose across various cells, Cellular metabolism of carbohydrates Glycogen metabolism Regulation of carbohydrate metabolism at substrate level, enzyme level, hormonal level and organlevel, b. Disorders of carbohydrate metabolism. c. Definition, classification, structure and properties of glycoproteins and proteoglycans 2. Metabolism of Lipids- a. Metabolism is to be discussed with reference to: Intestinal transport of lipids, Cellular uptake and metabolism of lipids (beta-oxidation, de novo synthesis of fatty acids, synthesis and breakdown of unsaturated fatty acids, cholesterol, phospholipids and triacylglycerol) Lipoprotein metabolism, VLDL and LDL ('Forward' Cholesterol transport) VLDL and LDL (Endogenous TAG transport), HDL ('Reverse' Cholesterol transport), b. Regulation of lipid metabolism at substrate level, enzyme level, hormonal level and organ level, Disorders of lipid metabolism, Dyslipidaemias, Lipid storagediseases 3. Protein Metabolism- a. Metabolism of amino acids- biosynthesis and catabolism - energy, glucose and ketone bodies, protein amino acids, non-protein amino acids (including urea cycle, transamination, one-carbonmetabolism), b. Creatine and creatinine, c. Plasma proteins – Nature, properties andfunctions, d. Biologically active peptides, polypeptides and transport proteins, Inborn errors of amino acidmetabolism
Module 3 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to -
	1. Describe the intermediary metabolism of human body.
	2. Define biological oxidation.
Content Outline	1. Intermediary Metabolism- a. Review of regulation of intermediary metabolism- equilibrium and non-equilibrium reactions, committed steps, allosteric modifications, covalent modulation, hormonal induction and repression, crossover theorem, starve-feed cycle, caloric homeostasis and futile cycles, Tricarboxylic acid cycle 2. Biological Oxidation: Electron transport chain and oxidative phosphorylation
Module 4 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to –

	1. Define the metabolism of purine and pyrimidines. 2. Analyze the metabolism of DNA, RNA.
Content Outline	1. Biochemical aspects of purine andpyrimidines- a. Metabolism ofpurines b. Metabolism ofpyrimidines c. Role of purine and pyrimidine nucleotides inmetabolism. 2. Biochemistry of Nucleic Acids- a. Metabolism ofDNA b. Metabolism ofRNA c. DNA replication, mutation, repair and recombinationconcepts d. Disorders of nucleic acidmetabolism 3. Protein Biosynthesis- a. Gene expression and its regulation, transcription, translation, post-translational modification b. Inhibitors of proteinbiosynthesis c. Gene expression inmitochondria Systems Biology including Metabolomics andProteomics
Assignments/Activities towards Comprehensive Continuous Evaluation (CCE): • Illustrate macronutrient metabolism in the form of flow chart • Library review assignment and reading of research papers • Creating communication material about metabolism and related topics and making presentation.	

Bibliography

- Conn, E.E., Stumpf, P.K., Bruening, G. and Doi, R.H. (2009): 5th Ed. Outlines of Biochemistry, John Wiley andSons.
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- Nelson, D.L. and Cox, M.M. (2008): Lehninger's Principles of Biochemistry, Macmillan WorthPublishers.
- Plummer, D.T. (1987). 3rd ed. An Introduction to Practical Biochemistry. McGraw-Hill BookCo.
- Stryer, L. (2002): Biochemistry, WH Freeman andCo.
- Tietz, N.W. (1996) Fundamentals of Clinical Chemistry. WB SaundersCo.
- Voet, D. Voet, J.G. and Pratt, C.W. (2016). Fundamentals ofBiochemistry.

1.2 Major (Core)

Course Title	**Human Physiology and Pathophysiology**
Course Credits	**4**
Course Outcomes	After going through the course, learners will be able to
	1. Explain the pathophysiological changes in different organs, tissues and systems in different disease conditions across the lifespan.
	2. Discuss the metabolic changes occurring in disease conditions.
	3. Comprehend the implications of functional interrelationships in a diseased body.
	4. Interpret the various diagnostic indicators/parameters
	5. Apply this knowledge for planning nutritional care of individuals.
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to -
	1. Analyze the concepts of pathophysiology
Content Outline	● Basic concepts of pathophysiology and metabolism of adaptation a. Altered cellular and tissuebiology b. Fluid and electrolyte, acids andbases c. Immunity d. Inflammation e. Hypersensitivity, infection andImmunodeficiency f. Stress andDisease g.Musculoskeletal system-Biochemistry and Pathophysiology, Osteoporosis, Osteomalacia, Osteoarthritis ● Cellular Proliferation and Cancer a.Biology ofCancer b.Tumor spread and treatment **a.** c.Clinical manifestations of cancer
Module 2 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Discuss the metabolic derangements leading todiseased condition 2. Interpret themarkers

Content Outline	• EndocrineSystem a. Mechanisms of hormoneregulation b. Alteration of hormonal regulation c. Hypo and Hyperfunctions of Pituitary, Adrenal cortex andmedulla, Hypo and Hyperthyroidism d.Type I, Type II and other types of Diabetes • Markers used and itsinterpretation
Module 3 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to -
	1. Illustrate the pathophysiology of the digestive system andtheir functionalinterrelationship 2.Interpret themarkers
Content Outline	• Digestive system: Biochemistry andPathophysiology a. Manifestations of gastrointestinal dysfunction, b. Acute and chronic gastritis,Ulcers c. Malabsorptionsyndrome d. Pancreatic insufficiency andPancreatitis e. Liver dysfunction, Hepatitis, Cirrhosis,Cholelithiasis f. Ulcerative colitis, Crohn'sdisease • Renal and Urological Biochemistry andPathophysiology a. Alteration of renal and urinary tractfunction b. Urinary tract obstruction, kidneystones, c. Cystic pyelonephritis, glomerulonephritis, nephriticsyndrome, renalfailure. • Markers used and itsinterpretation
Module 4 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to -
	1. Describe the hematological function and interpret themarkers 2. Explain the pathophysiology of cardiovascularsystem 3. Interpret the markers and the healthimplications
Content Outline	• Alterations of Haematologicfunctions a) Anemias and clinicalmanifestations b) Thalasemia, sickle cellanemia • Cardiovascular, lymphatic and pulmonarysystem a) Alteration of cardiovascular functions, atherosclerosis, arteriosclerosis, Thrombus, embolus, dysrhythmias Myocardial ischemia, Myocardial infarction, Heart failurestroke b) Hypertension c) Dyslipidemias d) Alterations of pulmonary function- signs and symptoms of pulmonary disease Respiratory distress syndrome in adults and newborn, Obstructive pulmonary diseases Asthma and cysticfibrosis. • Markers used and itsinterpretation

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE) :

- List down the diagnostic criteria for types of diabetes.
- Assessment of prevalence of anaemia in specific population.
- Carry out a survey to assess awareness about anaemia in the society.

Bibliography

- Barrett, Barman, Boitano, Brooks. 2010. Ganong's Review of Medical Physiology. 23rd ed. Lange / Tata McGrawHill
- Drake, Vogl, Mitchell. 2009. Dorland's/Gray's Pocket Atlas of Anatomy. Churchill Livingstone
- Guyton and Hall. Textbook of Medical Physiology. 12th ed. Saunders
- Keele, Neil et al. Samson Wright's Applied Physiology. 13th ed. Oxford University Press,Delhi
- Tortora, Derrickson. Principles of Anatomy and Physiology. 12thed.

1.3 Major (Core)

Course Title	**Medical Nutrition Therapy - I**
Course Credits	**4**
Course Outcomes	After going through the course, learners will be able to
	1. Explain the promotive and therapeutic role of diet and nutritional care With reference to weight management, fevers& infections and diseases of the gastrointestinal tract and hepatobiliary system.
	2. Discuss the etiology, physiologic and metabolic anomalies of acute and chronic diseases and patient needs.
	3. Describe the effect of the various diseases on nutritional status and nutritional and dietary requirements.
	4. Recommend and provide appropriate nutritional care based on pathophysiology, prevention/ and treatment of the various diet-related disorders/ diseases.
	5. Apply different nutritional support systems to nourish the Patient.
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Describe the Nutrition Care Process
	2. Apply the nutritional assessment techniques.
Content Outline	• Nutritional (and dietary) Care Process a) in health - Depending on the state of growth & development ofthe individual - at various activity levels and socioeconomicstatus. b) in disease - Nutritional screening/ assessment and identification of nutritional problem - Nutritional Intervention and Diet Modification based on interpretation of - Patient data- clinical, biochemical and other relevant data - Nutrition Education and Counseling -Evaluation of Nutritionalcare • Delivery of Nutritional Support – Meeting nutritionalneeds a) Enteral tube feeding Different Enteral feeding accessroutes PracticalAspects b) Parenteralnutrition
Module 2 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Explain the causes of Obesity
	2. Differentiate between the effect of imbalance in weight on health

Content Outline	● Nutrition for weight management: Disorders of energy balance a) Obesity Components of body weight Adipose tissue- structure, regional distribution and storage Regulation of body weight Types of obesity Assessment of obesity Health risks Causes of obesity: neural, hormonal, and psychological Management of obesity - Dietary Modification : past and present approach - Psychology of weight reduction : psychotherapy and behaviour modification Physical activity and exercise - Pharmacological treatment - Surgical treatment (Bariatric surgery) effect on satiety and other factors - Maintenance of Reduced weight b) Underweight/Excessive Leanness/ Undernutrition - Pathophysiology, Causes and assessment including fever and infectious diseases (Tuberculosis, AIDS) - Health risks and effect on nutritional status - Dietary Management - Psychotherapy C) Eating disorders: Anorexia Nervosa and Bulimia Nervosa.
Module 3 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to -
	1. Discuss the nutrition care process in GIdisorders 2. Analyze the role of nutrients and therapeutic dietary modifications
Content Outline	● Medical Nutrition therapy for Upper Gastrointestinaltract Diseases/Disorders a) Diagnostic Tests for the G.I.diseases b) Pathophysiology and Nutritional care and diet therapy in i) Diseases of oesophagus; oesophagitis, Hiatus hernia ii) Disorders of stomach: Indigestion, Gastritis, Gastric and duodenal ulcers Management: associated with H. pylori infection, NSAIDS Dietary management: traditional approach and liberalapproach c) Gastric Surgery: Nutritional care, dumpingsyndrome ● Medical Nutrition therapy for Lower gastrointestinaltract Diseases/Disorders a) Common Symptoms of Intestinal dysfunction - Flatulence, constipation, haemorhoids, diarrhoea, steatorrhoea,typhoid Diseases of the large intestine: - Diverticular disease,Irritable

	bowel syndrome, inflammatory bowel disease c) Malabsorption Syndrome/Diseases of Small intestine - Celiac (Gluten –induced) sprue, tropical sprue, intestinal brush border enzyme deficiencies, Lactose intolerance, proteinlosingenteropathy d) Principles of dietary Care: Fibre, residue Modified fibrediets e) Intestinal surgery: Short bowel syndrome, Ileostomy,Colostomy, Rectalsurgery.
Module 4 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to - 1. Plan the MNT in hepato biliary disorders
Content Outline	● Medical Nutrition therapy for Diseases of the Hepato - Biliary Tract a. Nutritional care in liver disease in context with results of specific liver function tests - Dietary care and management in viral hepatitis(different types) , cirrhosis of liver, hepaticencephalopathy, Wilson's disease b. Dietary care and management in diseases of the gall bladderand pancreas i.e. billary dyskinesia, cholelithiasis, cholecystitis, cholecystectomy, pancreatitis, ZollingerEllisonsyndrome
Assignments/Activities towards Comprehensive Continuous Evaluation (CCE) : • Carry out Nutrition screening to identify individuals at risk of malnutrition. • Survey the nutritional supplements recommended in GI and hepato-biliary cases.	

Bibliography:

- Duggan C, Walker, W.A. and Watkins, J.B. (2016): Nutrition in Pediatrics, Boston, Little, Brown &Co.
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- Fauci, S.A. et al (1998): Harrison's Principles of Internal Medicine, 14th Edition, McGraw Hill.
- Guyton, A.C. and Hall, J.E. (2006): Textbook of Medical Physiology, 9th Edition, W.B. Saunders Co.
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- Mahan, L.K. and Escott-Stump, S. (2012): Krause's Food Nutrition and Diet Therapy, 10th Edition, W.B. Saunders Ltd.
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- Srilaksjmi B. (2014). Dietetics. New Age Publishers, New

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- Srilakshmi B. (2021). Nutrition Science, New Age Publishers, New Delhi
- Williams, S.R. (2016): Nutrition and Diet Therapy, 7th Edition, Times Mirror/Mosby CollegePublishing
- World Cancer Research Fund (1997). Food, Nutrition and the Prevention of Cancer- A Global perspective, Washington E.D. WCRF.

Indicative List of Journals and Other Reference Series

1. Nutrition UpdateSeries
2. World Review of Nutrition andDietetics
3. Journal of the American DieteticAssociation
4. American Journal of ClinicalNutrition
5. European Journal of ClinicalNutrition
6. NutritionReviews

1.4 Major (Core)

Course Title	**Medical Nutrition Therapy - I (Pr.)**
Course Credits	**2**
Course Outcomes	After going through the course, learners will be able to:
	1.Carry out the Nutritional assessment for the patient
	2.Read the reports and interpret the same
	3.Decide the method of Nutritional support and mode of delivery
	4.Assess the nutritional requirements and plan diets
	5.Educate the patient on the therapeutic modifications
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	Conduct the Nutritional assessment
	Apply the exchange list effectively as a tool of meal planning
	Plan diets for patients suffering from energy imbalance and eating disorders
Content Outline	● Nutritional (and dietary) Care Process a) inhealth. b) in disease - Nutritional screening/ assessment and identification of nutritional problem–

	Delivery of Nutritional Support – Meeting nutritional needs a) Enteral tube feeding Different Enteral feeding accessroutes PracticalAspects b) Parenteralnutrition ● Exchange lists as a tool in planningdiets. ● Case studies of weight management: Disorders ofenergy balance a) Obesity Types of obesity Assessment of obesity Health risks Causes of obesity: neural, hormonal, and psychological Management of obesity - Dietary Modification Psychology of weight reduction : psychotherapy andbehaviour modification Physical activity andexercise b) Underweight/Excessive Leanness/ Undernutrition - Health risks and effect on nutritionalstatus Dietary Management - Psychotherapy C) Eating disorders: Anorexia Nervosa and Bulimia Nervosa.
Module 2 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to -
	Plan diets for various disorders of the Gastro intestinal tract
Content Outline	● Case studies of Upper Gastrointestinal tractDiseases /Disorders a) Diagnostic Tests for the G.I.diseases b) Pathophysiology and Nutritional care and diet therapy in i) Diseases of oesophagus; oesophagitis, Hiatus hernia ii) Disorders of stomach: Indigestion, Gastritis, Gastric and duodenal ulcers Management: associated with H. pylori infection, NSAIDS Dietary management: traditional approach and liberalapproach c) Gastric Surgery: Nutritional care, dumpingsyndrome ● Case studies of Lower gastrointestinaltract Diseases/Disorders a) Common Symptoms of Intestinal dysfunction - Flatulence, constipation, haemorhoids, diarrhoea, steatorrhoea,typhoid b) Diseases of the large intestine: - Diverticular disease,Irritable bowel syndrome, inflammatory boweldisease

	Malabsorption Syndrome/Diseases of Small intestine -Celiac
	(Gluten –induced) sprue, tropical sprue, intestinal brush border enzyme deficiencies, Lactose intolerance, proteinlosingenteropathy d) Principles of dietary Care: Fibre, residue Modified fibrediets ● Case studies of the Hepato - Biliary Tractdiseases a. Nutritional care in liver disease in context with results of specific liver function tests - Dietary care and management in viral hepatitis(different types) , cirrhosis of liver, hepaticencephalopathy, Wilson's disease b. Dietary care and management in diseases of the gall bladderand pancreas i.e. billary dyskinesia, cholelithiasis, cholecystitis, cholecystectomy, pancreatitis, ZollingerEllisonsyndrome.
Assignments/Activities towards Comprehensive Continuous Evaluation (CCE) : • Use nutritional assessment tools like – SGA, MUST, NRS, etc • Survey of the meal replacers recommended in the management of obesity	

Bibliography:

- Clinical Dietetics Manual (2018), Indian Dietetics Association,Banglore.
- Escott-Stump, S. (2008): Nutrition and Diagnosis Related Care, Sixth Edition, Williams and Wilkins,US.

1.5 Major (Elective)

Course Title	**Advanced Nutrition I (Macronutrients & Water)**
Course Credits	**4**
Course Outcomes	After going through the course, learners will be able to -
	Acquire the knowledge of the physiological and metabolic role of macronutrients and their importance in human nutrition.
	Discuss the basis of human nutritional requirements and recommendations through the life cycle and translate the knowledge into practical guidelines for dietary needs.
	Familiarize with the recent advances in nutrition and apply this knowledge in planning for public health programmes.
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to -
	1. Define RDA, EAR, etc,
	2. Discuss the components of energy expenditure.
Content Outline	• Human Nutritional Requirements – Development andRecent

	Concepts a. Methods of determining human nutrientneeds b. Description of basic terms and concepts in relation to human nutritionalrequirements. c. Guidelines and Recommendations - Development of International and National Nutritional Requirements - Translation of nutritional requirements intoDietary ● BodyComposition a. Significance of body composition and changes through the lifecycle b. Methods for assessing body composition (both classical and recent) and their applications. ● Nutrition in Special Conditions: Space Travel, HighAltitudes, Low Temperature,Submarines. ● Energy a.Components of energy requirements: BMR, RMR, thermic effect of feeding, physical activity. Factors affecting energy requirements, methods of measuring energy expenditure. b.Estimating energy requirements of individuals and groups. c.Regulation of energy metabolism and body weight: Control of food intake – role of leptin and other hormones.
Module 2 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to -
	Define Glycemic index, glycemic load and differentiate between the types of dietary fiber and their mechanism of action.
	Relate carbohydrates with gene expression.
Content Outline	● Carbohydrates a.Review of nutritional significance of carbohydrates and changing trends in dietary intake of different types of carbohydrates and their implications b.Dietaryfibre: Types, sources, role and mechanism of action c.Resistant starch, fructo-oligosaccharides, other oligosaccharides: Chemical composition and physiological significance d.Glycemic Index and glycemic load e.Carbohydrates and gene expression
Module 3 (Credit 1)	

Learning Outcomes	After learning the module, learners will be able to -
	Understand the role of protein & its metabolism.
Content Outline	● Proteins a.Overview of role of muscle, liver and G.I. tract in protein metabolism b.Amino acid and peptide transporters c.Therapeutic applications of specific amino acids d.Peptides of physiological significance e.Proteins, amino acids and gene expression.
Module 4 (credit 1)	
Learning Outcomes	After learning the module, learners will be able to -
	Explain the role and metabolism of lipids.
CourseContent	● Lipids a.Nutritional significance of fatty acids – SFA, MUFA, PUFA: functions and deficiency b.Role of n-3 and n-6 fatty acids c.Prostaglandins d.Trans Fatty Acids e.Conjugated linoleic acid f.Nutritional Requirements and dietary guidelines (International & National) for visible and invisible fats in diets. g.Lipids and gene expression.
Assignments/Activities towards Comprehensive Continuous Evaluation (CCE): ● Make a list of foods categorizing in low , moderate and high GI foods. ● Market survey of omega 3 fatty acid supplements.	

Bibliography:

- Bodwell, C.E. and Erdman, J.W. (1988) Nutrient Interactions. Marcel DekkerInc. NewYork
- Gropper, Sarin S.; Smith Jack L.; Carr, Timothy (2021) Advanced Nutrition and Human Metabolism . Wadsworth Publishing co.Inc
- Shils, M.E.; Olson, J.; Shike, M. and Roos, C. (2006): Modern Nutrition in Health and Disease. Williams and Williams. A Beverly Co.London.
- World Reviews of Nutrition andDietetics

1.6 Minor Stream

Course Title	**Research Methodology (Th)**
Course Credits	4
Course Outcomes	After learning the module, learners will be able to -
	1. Develop a scientific approach and know the processes of research
	2. Develop the competence for selecting methods and tools appropriate for research topics
	3. Discuss the concepts of statistical measures of central tendency, dispersion, variability and probability
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to -
	1. Explain process of research and its relationship to knowledge andscience. 2. Identify research process based on actual researchesconducted. 3. Recognize process of research problemformulation.
Content Outline	**The Research Process** a. Scientific approach to enquiry in comparison to native, common senseapproach b. Knowledge, theory andresearch c. Role, need and scope of research in the discipline of Home Science **Assignment** : *Differentiate between investigative reporting and research report (with examples to be brought by students asexercise)* **Steps in Research Process and Elements of Research** a. Identifying interest areas and prioritizing Selection of topic and considerations inselection b. Review of related literature andresearch c.Variables- types of variables including discrete and continuous variables Conceptual definitions and operational definitions d. Concepts, hypotheses andtheories e Hypothesis- meaning, attributes of a sound hypothesis, Stating the hypothesis and types of hypothesis Hypothesis testing**-** null hypothesis, sample distribution, level of significance, critical regions, Type I and Type II errors f. Research Design Research questions, objectives and assumptions **Ethics in Research**
Module 2 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to -
	1. Apply different types of researchprocedures. 2. Design research studies by knowing methods ofresearch.

Content Outline	**Types of Research** a. Basic and Applied research, Qualitative and Quantitativeresearch (brief review ofdifferences) b. Historicalresearch c. Descriptive research methods – survey, case study, correlational study, content analysis, causal-comparativeresearch d. Analytic studies- pre-experimental, experimental research,quasi experimentalresearch e. Qualitative research,Ethnography Evaluative research- general characteristics, use of qualitative methods in enquiry Scope and importance in Home Science.
Module 3 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to -
	1. Explain different techniques ofsampling. 2. Apply sampling procedures for specific researchproblems.
Content Outline	**Sampling** a. Rationale, characteristics- meaning, concept of population and sample, andutility b. Types of sampling and generalizability ofresults c. Probability sampling - simple random sample, systematicrandom sample, stratified random sampling etc - random and non-random samples, random numbers anduse d.. Non-probability sampling - purposive samples, incidental samples, quota samples, snowball samples e.. General consideration in determination of sample size
Module 4 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to -
	1. Differentiate the tools of datacollection. 2. Design different tools of datacollection.
	Tools for Data Collection a.Primary and secondary methods of data collection b.Different types of questionnaires, rating scales, check lists, schedules, attitude scales, inventories, standardized tests, interviews, observation Development of tools, estimation of reliability and validity oftools Procedure for preparation of the tool, administration of tools for datacollection Procedure for datacollection Planning for data analysis-coding ofresponses

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

- Recognize different Types of variables.
- Hypothesis formations and research questions from Research readings –students identify hypothesis/research questions – Discussion
- Construction of tools for data collection a) types of questions b) Questionnaire c) interview schedule d) observation d) scales

- Differentiate between (a) basic and applied research (Exercise to be based on actual research papers published in accredited journals) (b) qualitative and quantitative research
- Based on Journal contents undertake a critical appraisal of studies/research papers and discuss types of Research with examples.
- For given topic students to frame and discuss the different possibilities of methods and tools.

Bibliography:

- Bhaskaran, V. (2008). Research methods for social work. NewDelhi
- McBurney, D.H. (2001): Research Methodology, Thomson-Wadsworth,Australia
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END OF SEMESTER- I

Syllabus Contents

Semester – II

2.1 Major (Core)

Course Title	**Advanced Nutrition II (Micronutrients)**
Course Credits	4
Course Outcomes	After going through the course, learners will be able to
	1. Recognize the physiological and metabolic role of vitamins and minerals in human nutrition.
	2. Evaluate the pharmacological actions of various vitamins & minerals along with their implications.
Module 1(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Acknowledge the metabolism of fat soluble vitamins.
	2. Explore the pharmacological & therapeutic role of fat soluble vitamins.
Content Outline	For each of the vitamins, the following will be discussed: • Historical background • Structure and chemistry • Food sources • Metabolism (digestion, absorption, transport, storage and elimination), Bioavailability and factors affecting bioavailability. • Biochemical and physiological functions • Assessment of status • Interaction with other nutrients, regulation of gene expression (wherever applicable) • Pharmacological and therapeutic effects • Requirements, methods for estimating requirements and recommended daily allowance. • Deficiency, overload and toxicity. **Fat Soluble Vitamins** Vitamin A and Beta Carotene Vitamin D

	Vitamin E Vitamin K
Module 2(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1.Acknowledge the metabolism of Water soluble vitamins.
	2.Explore the pharmacological & therapeutic role of water soluble vitamins.
	For each of the vitamins, the following will be discussed: • Historical background • Structure and chemistry • Food sources • Metabolism (digestion, absorption, transport, storage and elimination), Bioavailability and factors affecting bioavailability. • Biochemical and physiological functions • Assessment of status • Interaction with other nutrients, regulation of gene expression (wherever applicable) • Pharmacological and therapeutic effects • Requirements, methods for estimating requirements and recommended daily allowance. • Deficiency, overload and toxicity. **Water Soluble Vitamins** a. Ascorbic acid b. Thiamin c. Riboflavin d. Niacin e. Pyridoxine f. Folic acid g. Vitamin B_{12} h. Biotin i. Pantothenic acid
Module 3(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Acknowledge the metabolism of macro-minerals
	2. Explore the pharmacological & therapeutic role of macro-minerals

Content Outline	For each of the minerals the following will be discussed: • Historical background • Structure and chemistry • Food sources • Metabolism (digestion, absorption, transport, storage and elimination), Bioavailability and factors affecting bioavailability. • Biochemical and physiological functions • Assessment of status • Interaction with other nutrients, regulation of gene expression (wherever applicable) • Pharmacological and therapeutic effects • Requirements, methods for estimating requirements and recommended daily allowance. • Deficiency, overload and toxicity. **Macrominerals** a. Calcium and Phosphorus b. Magnesium c. Sodium, Potassium, Chloride
Module 4 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Acknowledge the metabolism of micro-minerals.
	2. Explore the pharmacological & therapeutic role micro-minerals..
	For each of the minerals, the following will be discussed: • Historical background • Structure and chemistry • Food sources • Metabolism (digestion, absorption, transport, storage and elimination), Bioavailability and factors affecting bioavailability. • Biochemical and physiological functions • Assessment of status • Interaction with other nutrients, regulation of gene expression (wherever applicable) • Pharmacological and therapeutic effects • Requirements, methods for estimating requirements and recommended daily allowance. • Deficiency, overload and toxicity. **Microminerals**

	a. Iron b. Copper c. Manganese d. Iodine e. Fluoride f: Zinc g. Selenium h. Cobalt i. Chromium j. Molybdenum
Assignments/Activities towards Comprehensive Continuous Evaluation (CCE) • Market survey on micronutrient fortification of food • Importance of micro nutrient supplement • Antioxidant property of micronutrient • How to minimize loses of micro nutrient while cooking	

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Journals:

- Nutrition Reviews
- Journal of Nutrition
- American Journal of Clinical Nutrition
- British Journal of Nutrition
- European Journal of Clinical Nutrition
- International Journal of Vitamin and Nutrition Research
- International Journal of Food Science and Nutrition
- Nutrition Research
- Annals of Nutrition & Metabolism

2.2 Major (Core)

Course Title	**Nutritional Assessment**
Course Credits	**4**
Course Outcomes	After going through the course, learners will be able to
	1. Analyze and various methods for assessment of nutritional status, body composition analysis.
	2. Interpret tests used for lipid profile and glycemic control.
	3. Carry out and interpret the assessment of dietary/nutrient intakes.
	4. Conduct assessment of physical activity and energy expenditure.
Module 1(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Evaluate the different body composition analysis techniques for nutritional assessment
	2. Apply the correct methods for anthropometric measurements.
Content Outline	• Assessment of Nutritional Status a) Reliability b) Validity c) Accuracy d) Precision • Measurement of weight and height a) Assessment of nutritional status for adults, young and older children b) Calculation of BMI c)Interpretation Use of WHO reference standards Wasting, stunting, underweight, severe and moderate malnutrition d) Calculation of z-scores and use of software

	Circumference Measurements – chest, head, mid arm. Waist, hip and ratios wherever applicable to children and adults ● Body Composition a) Use of skinfold b) Bioelectric impedance c) Dual X-ray Absorptiometry (DEXA) d) Calculation of body fat
Module 2(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Compare the various dietary intake assessment techniques and techniques to assess energy expenditure.
	2. Utilize the techniques for evaluation of nutrient intake and energy expenditure.
Content Outline	● Dietary intake assessment a) Food frequency questionnaire b) A 24 hour diet recall and record - Weighment method ● Assessment of energy expenditure a) Indirect calorimetry - use of ergometer, treadmill, heart rate monitoring b) Recording physical activities c) Factorial estimation of energy expenditure: MET, PAL Study of food labels- calculation of DV
Module 3(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Summarize the use of dietary protein evaluation and serum protein estimation techniques.
	2. Explore the techniques for assessment of protein status.

Content Outline	• Dietary Protein Evaluation and Assessment of Protein Status a) Assessment of protein quality - Chemical Score, PDCAAS, In vitro protein digestibility b) Estimation of serum albumin, globulin and albumin: globulin ratio
Module 4(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Describe the interpretation of blood glucose levels, lipid profiles and other biomarkers.
	2. Select the appropriate biomarkers in assessing the nutritional status.
Content Outline	• Biomarkers of Metabolism - Methods and interpretation of following markers: a) Fasting and Postprandial Blood Glucose estimation, OGTT, Glycosylated Hemoglobin b) Glycemic index and glycemic load, Insulin index c) Serum lipid levels
Assignments/Activities towards Comprehensive Continuous Evaluation (CCE) • Assessment and interpretation of anthropometric measurements. • List of foods according to glycemic index and glycemic load.	

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2.3 Major (Core)

Course Title	**Medical Nutrition Therapy - II (Theory)**
Course Credits	**4**
Course Outcomes	After going through the course, learners will be able to
	1. Evaluate the promotive and therapeutic role of diet and nutritional care with reference to Endocrine disorders, renal disorders, cardiovascular system, and musculoskeletal system.
	2. State the etiology, physiologic and metabolic anomalies of acute and chronic diseases and patient needs.
	3. Describe the effect of the various diseases on nutritional status and nutritional and dietary requirements.
	4. Plan, recommend and provide appropriate nutritional care based on pathophysiology, prevention/ and treatment of the various diet-related disorders/ diseases.
Module 1(Credit 1)	
Learning Outcomes *(Specific related to the module.. e.g. Define, Differentiate, Carry out, Design, etc. …)*	After learning the module, learners will be able to
	1. Illustrate the etiology as well as the physiological and metabolic alterations in metabolic disorders.
	2. Apply the principles of dietary management to specific conditions.
Content Outline	• Nutrition for Endocrine Disorders Nutrition for Diabetes Mellitus and hypoglycemia a) Aetiology, classification, pathophysiology symptoms and diagnosis b) Management of DM: i) Home blood glucose monitoring ii) Glycosylated hemoglobin iii) Urine testing c) Blood sugar lowering agents: i) Oral hypoglycemic agents ii) Insulin d) Exercise e) Nutritional management: Diet planning for Type1, Type2 ii) For Special conditions a) Pregnancy b) Elderly c) Surgery d) Illness e) Physical activities f) Acute complications – pathophysiology,

	diagnosis, types, treatment i) Hypoglycemia ii) Ketoacidosis iii) Somogyi effect iv) Dawn phenomenon g) Long term complication - pathophysiology, diagnosis, types, and treatment i). Macrovascular ii). Microvascular ● Nutrition in Diseases of Other Endocrine organs a) Functions of the adrenal cortex, thyroid and parathyroid gland, their insufficiencies, clinical symptoms and metabolic implications. b) Dietary treatment as supportive to other form of therapy - Hyper and Hyperthyroidism, goiter, Hypocalcaemia.
Module 2(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Explore the various risk factors for cardiovascular diseases.
	2. Discuss the dietary management in relation to the physiologic and metabolic alterations of the diseases.
Content Outline	● Nutrition in Cardiovascular Diseases a) Review of Normal circulatory system (in brief) b) Blood pressure,i) Regulation, Short-term (sympathetic nervous system) and long-term (kidneys), ii) Hypertension – classification (secondary and essential) iii) Risk Factors for hypertension iv) Dietary management-DASH approach v) Use of various drugs (In brief). ● Hyperlipidemia and Hyperlipoproteinemia a) Classifications b) Dietary management c) Drug management – (in brief) ● Atherosclerosis - Etiology and understanding the pathogenesis a) Coronary Heart Disease - Angina Pectoris and Myocardial Infarction - Clinical manifestation and importance of cardiac enzymes to aid in the detection of CHD - Dietary management b). Congestive Heart Failure - Pathogenesis - Pathogenesis of sodium and water retention Risk factors Clinical manifestation Cardiac Cachexia Treatment - Nutritional Care c) Cerebrovascular

	Disease and Peripheral Vascular Disease - In brief etiology and dietary care d) Rheumatic and Congenital Heart Disease - Clinical manifestation, pathogenesis and nutritional care.
Module 3(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Describe the interrelationship between the renal diseases and nutritional status.
	2. Apply the medical nutrition therapy in the management of renal diseases.
Content Outline	• Nutrition in Renal Diseases Physiology and function of normal kidney A brief review - Classification of kidney diseases a) Glomerular Nephritis Etiology, characteristics Objectives, Principles of dietary treatment and management b) Nephrotic Syndrome Etiology, Objectives, Principles of dietary treatment and management c) Uremic Renal Failure i) History, General importance of protein nutrition in renal failure and uremia ii) Causes and Dietary management in Acute Renal Disease iii) Causes and Dietary management in Chronic Renal Disease iv) Dietary modification in chronic renal disease with complications v) Sodium and Potassium Exchange list d) Types of dialysis and their nutritional care –Haemodialysis, CAPD, Continuous Ambulatory peritoneal dialysis) e) Renal Transplant and its nutritional care f) Nephrolithiasis- etiology, types of stones and nutritional care (acid & alkaline ash diet)
Module 4(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1.Describe the pathophysiology of various pulmonary diseases and musculoskeletal disorders

	2.Apply the principles of dietary management to specific conditions
Content Outline	• Nutritional Management in Pulmonary Disease Review of respiratory system and breathing mechanism. a) Effects of Malnutrition on Respiration b) Chronic Obstructive Pulmonary Disease c) Pneumonia d) Broncho Pulmonary Displasia e) Cystic Fibrosis • MNT for Rheumatic disorders (of the musculoskeletal system) Pathophysiology of inflammation in - a) Rheumatic Diseases b) Osteoarthritis c) Rheumatoid Arthritis, Gout Pharmacologic therapy and Nutritional Care
Assignments/Activities towards Comprehensive Continuous Evaluation (CCE) • Presentations on recent research papers and evidence-based guidelines for management. • Identification of videos on normal cardiovascular and pulmonary functions. • Identification of visual presentation on atherosclerosis and cardiac disease.	

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Journals and Other Reference Series

- Nutrition Update Series
- World Review of Nutrition and Dietetics
- Journal of the American Dietetic Association
- American Journal of Clinical Nutrition
- European Journal of Clinical Nutrition
- Nutrition Review

2.4 Major (Core)

Course Title	**Medical Nutrition Therapy - II (Pr.)**
Course Credits	**2**
Course Outcomes	After going through the course, learners will be able to
	1. Carry out the nutritional assessment for the patient.
	2. Assess the nutrient requirements as per the specific medical condition
	3. Plan the medical nutrition therapy.
Module 1(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Plan the diets for diabetes mellitus and cardiovascular diseases.
	2. Plan the nutrition prescription for various endocrine disorders.
Content Outline	• Case studies for Diabetes a) Diet planning for Type1, Type2 diabetes mellitus b) Diet planning for Special conditions - Pregnancy, Elderly, Surgery, Illness, Physical activities c) Acute complications – nutritional care i) Hypoglycemia ii) Somogyi effect iii) Dawn phenomenon d) Long term complication – prevention and nutritional care i). Macrovascular ii). Microvascular • Case studies for diseases of other Endocrine organs a) Dietary treatment as supportive to other form of therapy in diseases of the adrenal cortex, thyroid and parathyroid gland b) Diet planning for Hyper and Hyperthyroidism, goiter, Hypocalcaemia • Case studies for Cardiovascular Diseases a) Diet planning of Hypertension-DASH b) Developing low sodium recipes c) Dietary management of Hyperlipidemia and Hyperlipoproteinemia Dietary management i) Coronary Heart

	Disease ii). Congestive Heart Failure iii) Cerebrovascular Disease and Peripheral Vascular Disease
Module 2(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Plan the diets for renal diseases.
	2. Plan nutrition prescription for pulmonary conditions and rheumatic disorders.
Content Outline	● Case studies for pulmonary Diseases a) Diet planning for asthma, COPD b) Nutrition care for bronchopulmonarydisplasia and cystic fibrosis ● Case studies for Renal Diseases a) Sodium and Potassium Exchange list b)Diet planning for GlomeruloNephritis, Nephrotic Syndrome, Acute Renal Disease, Chronic Renal Disease c) Dietary modification in chronic renal disease with complications d) Types of dialysis and their nutritional care – Haemodialysis, Continuous Ambulatory peritoneal dialysis e) Renal Transplant and its nutritional care f) Nephrolithiases- nutritional care (acid & alkaline ash diet) ● Nutrition care for Rheumatic disorders of the musculoskeletal system a) Osteoarthritis b) Rheumatoid arthritis c) Gout
Assignments/Activities towards Comprehensive Continuous Evaluation (CCE) ● Market survey of commercial nutritional supplements and nutritional support substrates. ● Commonly used tests for diagnosis of various diseases- system-wise. ● Interpretation of patient data and diagnostic tests of drawing up of patient diet prescription, using a case study approach.	

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Journals and Other Reference Series

- Nutrition Update Series
- World Review of Nutrition and Dietetics
- Journal of the American Dietetic Association
- American Journal of Clinical Nutrition
- European Journal of Clinical Nutrition
- Nutrition Review

2.5.1 Major (Elective)

Course Title	**Hospital, Personnel and Food Service Management**
Course Credits	**4**
Course Outcomes	After going through the course, learners will be able to
	1. Relate with the medical food services and hospitals organizations.
	2. Outline the management processes in terms of planning, organizing, leading, evaluating and controlling.
	3. Associate with legislation relating to food service and labour laws.
Module 1(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. State the organizational structure and principles of management in food service sector.
	2.Identify the roles and responsibilities in health care
Content Outline	● Introduction to medical food service a) Goals and objectives. b) Organization – Definitions, types of organization and food service Systems – an overview c) Organization chart, Preparation of chart – activity analysis, decision analysis, relation analysis ● Management principles a) Planning b) Organizing c) Directing d)Controlling e) Management ● Roles and Responsibilities of health care team and dietitians a) Tools of Management

	b) Professional ethics ● Computer Applications in Food Service
Module 2(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Discuss the decision making and problem solving process.
	2. Apply food related laws and labour laws in health care.
Content Outline	● Recruitment, selection, training of personnel employees, supervision, performance appraisal, motivation and rewards incentives for effective performance, placement and promotion ● Decision-making – Types and approaches to decision making, problem solving tools. ● Time Management ● Labour laws, policies and food related laws, welfare schemes for employees in India.
Module 3(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Describe the food service systems in health care.
	2. Apply the nutrition knowledge at various stages of food service systems.
Content Outline	● Review of types of catering and food service systems. ● Menu planning a) Menu considerations b) Meal pattern and menu format c) Steps in menu planning d) Modified diet Menu planning e) Cyclic Menus ● Food production and service equipment in Hospitals a) Space allocation

	b) Equipment selection. c) Safety, care and use of equipments. d) Energy management related to equipment planning. ● Purchasing and Storeroom management a) Purchasing systems b) Specifications, food requisition and inventory systems c) Quality assurance d) Evaluation laws relating to food purchasing
Module 4(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Explain the financial management and budget system.
	2. Reason the hygiene and sanitation at food service system.
Content Outline	● Financial Management a) Cost-Identifying Elements of cost b) Food cost control – cost analysis of dishes c) Portions and menus d) Labour cost control e) Energy cost control ● Budget systems and accounting a) Budget preparation b) Relationship of costs, profits and sales in commercial and non-commercial establishments. ● Sanitation and Hygiene in food storage, preparation and service

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

- Carry out a survey of the cyclic menu planned at hospitals.
- Observation of preparation of special diets (enteral feeds) for hospitalized patients.
- Kitchen layout of a hospital food service system.

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2.5.2 Major (Elective)

Course Title	**Food Safety**
Course Credits	**4**
Course Outcomes	After going through the course, learners will be able to
	1. Recognize safe receiving, storing and handling of raw material and final product.
	2. Identify the critical control points.
	3. Report food contamination and its prevention.
	4. Describe personal hygiene and sanitation.
Module 1(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Enclist the basics of food safety through food regulations and legislations.
	2. Identify the concerns in food sanitation and safety.
Content Outline	• Introduction to food safety History of food regulations in India. Legislations- Prevention of Food Adulteration act 1954, Food product order (1955), Solvent Extracted Oil, De-oiled Meal and Edible Flour (Control) Order, 1967, Meat Food Products Order (1973),Edible Oils Packaging, 1998, Edible Oils Packaging, 1998, Vegetable Oil Products Order, 1998, Milk & Milk Product Amendment Regulations – 2009. • Food Sanitation and safety: Factors contributing to physical, chemical and biological contamination in food chain, prevention and control of food borne hazards, definition and regulation of food sanitation, sources of contamination, personal hygiene-food handlers, cleaning compounds, sanitation methods, waste disposal strategy (solid and liquid waste) and pest control • Major food safety concerns – a) Food adulteration b) Pesticide residues c) Toxic metals d) Misuse of food additives

	e) Food toxicity – Aflatoxins, Lathyrism ● Food contamination and spoilage a) Microbial contamination of foods – Types of microbial contamination, factors responsible for microbial contamination, sources for microbial contamination b) Plant sanitation – Sanitary requirements for equipment, cleaning agents, pest control.
Module 2(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Summarize the standard operational procedures in food processing.
	2. Apply the knowledge of occupational health, safety and personal hygiene.
Content Outline	● Standard Operating Procedures Preparing scope, quality policy and quality objectives of food processing company, Defining Standard operating procedure – purpose- Format - developing and implementing, effective writing. SOP for purchasing raw materials, receiving raw materials, storage, cleaning, holding, cooling, freezing, thawing, reheating, personal hygiene, facility and equipments. Systems in laboratory accreditation ● Pre-requisite Program Good Manufacturing Practices - Personal hygiene – occupational health and safety specification, Food Plant Sanitation Management - Plant facilities construction and maintenance - exterior of the building- interior of the building- equipments. Storage, transportation, traceability, recalling procedures, training.
Module 3(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Identify the hazard analysis in food processing.
	2. Organize various audit control points in hazard analysis.

<table>
<tr><td>Content Outline</td><td>● HACCP
Conduct a hazard analysis, CCP identification, establish critical limits for each CCP, establish CCP monitoring procedures, establish corrective actions procedures, and establish procedures for HACCP verification and validation, documenting the HACCP Program.

HACCP for jam, biscuit, bread, dairy, meat, fish and egg industries.

● Audit Check List
Preparation of HACCP based SOP checklist - personal hygiene, food preparation, hot holding, cold holding, refrigerator, freezer and milk cooler, food storage and dry storage, cleaning and sanitizing, utensils and equipments, large equipments, garbage storage and disposal and pest control.</td></tr>
<tr><td colspan="2">Module 4(Credit 1)</td></tr>
<tr><td>Learning Outcomes</td><td>After learning the module, learners will be able to</td></tr>
<tr><td></td><td>1. Discuss the food safety practices.</td></tr>
<tr><td></td><td>2. Apply food safety practices in food processing.</td></tr>
<tr><td>Content Outline</td><td>● Other Food Safety Practices
Good Agriculture Practices, Good Animal Husbandry Practices and Good Manufacturing Practices Good Retail Practices, Good Transport Practices and Nutrition Labelling, Traceability Studies</td></tr>
<tr><td colspan="2">Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

• Conduct a survey of street food vendors to observe food safety.
• Undertaking street vendor awareness programme.
• Assessing food safety standards practiced by street vendors through field observation.</td></tr>
</table>

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2.5.3 Major (Elective)

Course Title	**Nutrition for Exercise and Fitness**
Course Credits	**4**
Course Outcomes	After going through the course, learners will be able to
	1. Analyze the special nutritional requirements for physical activities related to sports and exercise.
	2. Carry out different techniques to improve the performance of sportspersons.
	3. Acquire the knowledge about nutritional requirements of different sports.
Module 1(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Evaluate the energy needs of various sports.
	2. Discuss the role and effective use of sports drinks.
Content Outline	• Nutritional considerations for sports / exercising person as compare to normal active person. • Energy substrate for activities of different intensity and duration, aerobic and anaerobic activities. • Fluid balance in sports and exercise, importance, symptoms and prevention of dehydration, Sports drink.
Module 2(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Analyze the carbohydrates requirements in difference sports.
	2. Consider and apply carbohydrate loading in different stages of sports.
Content Outline	• Carbohydrates a) Carbohydrate as an energy source for sport and exercise. b) Carbohydrate stores c) Fuel for aerobic and anaerobic metabolism d) Glycogen re-synthesis e) Carbohydrates Loading

	f) Carbohydrate composition for pre exercise, during and recovery period.
Module 3(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Analyze the requirement of fats in various sports and exercises.
	2. Evaluate the use of the different amino acids (protein) for sports and exercises.
Content Outline	• Role of Fat as an energy source for sports and exercise. a) Fat stores, regulation of fat metabolism b) Factors affecting fat oxidation (intensity, duration, training status, CHO feeding) c) Effect of fasting and fat ingestion • Protein and amino acid requirements a) Factors affecting Protein turnover b) Protein requirement and metabolism during endurance exercise, resistance exercise and recovery process. c) Protein supplement.
Module 4(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Identify the role of micronutrients in sports and exercise.
	2.Relate to the various issues of sports personnel – eating disorders, female athletic triad, sports anemia etc.
Content Outline	• Important micronutrients for exercise a) B complex vitamin and specific minerals. b) Exercise induced oxidative stress and role of antioxidants chronic dieting and eating disorder. c) Female athletic triad, sports anemia d) Dietary supplements and ergogenic aids (nutritional, pharmacological and physiological).

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

- Market survey of supplements for various sports and exercises.
- Trends in sports drinks for athletes.

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2.6 OJT

Course Title	**Internship**
Course Credits	**4**
Course Outcomes	After going through the course, learners will be able to
	1. Achieve practical experience of nutritional assessment, education & counseling
	2. Acquire professional skills in various departments / specializations in the hospital set up.
	3. Outline the scope, functions, and job responsibilities in various department of organization.
Learning Outcomes	After learning the module, learners will be able to
	1. Undertake patient management in hospital set up.
	2. Design diet plans and counseling for behavior changes for patients.
Content Outline	• Every candidate shall undergo professional training for 30 days in a multispecialty hospital with minimum capacity of 150 beds. • Internal and external evaluation will be carried out to assess the progress of the work during Internship. • At the end of the internship the student will submit the internship report. During the internship student is expected to complete the following:
Assignments/Activities towards Comprehensive Continuous Evaluation (CCE) : • Case study presentations. • Orientation to clinical nutrition / dietetics department in the hospital. • Observation and documentation of various activities - nutritional assessment, interventions, counseling and follow-ups. • Internship report along with detailed case studies. • Presentation of case studies.	