

# **VIDYASAGAR UNIVERSITY**



**Post Graduate (M.Sc.)**

**Syllabus in**

**CLINICAL NUTRITION AND DIETETICS**

**(CND)**

**Under New Education Policy (NEP) 2020 Guidelines**

**(Effective from Academic Year 2025-2026)**

## **Preamble**

The M.Sc. in Clinical Nutrition is a specialized two-year postgraduate program introduced in 2012 at Vidyasagar University under the UGC Innovative Program. Designed with a strong clinical orientation, the program aims to cultivate advanced knowledge and skills in clinical nutrition to address the growing demand for qualified professionals in hospitals, healthcare institutions, and therapeutic nutrition services. In line with this academic vision, the department also launched a Ph.D. program in Clinical Nutrition to promote research-driven excellence in disease-specific nutritional science and evidence-based clinical practice.

Successfully running for over a decade, the program offers robust career prospects in clinical nutrition, therapeutic dietetics, hospital-based nutritional care, medical research, and nutrition consultancy.

Aligned with the National Education Policy (NEP) 2020, the upgraded syllabus offers a structured and progressive learning experience. The curriculum spans four semesters over two years, with 22 credits per semester, totalling 88 credits. Each semester is carefully crafted to strengthen both the core and advanced competencies in clinical nutrition, including medical nutrition therapy, metabolic disorders, critical care nutrition, nutritional biochemistry, and clinical assessment techniques.

The program is led by a team of experienced and qualified professionals. Students are trained in modern classrooms equipped with ICT tools and advanced laboratories featuring diagnostic and research-grade equipment. The curriculum emphasizes practical clinical exposure through partnerships with leading hospitals and healthcare institutions, offering students hands-on training and real-world insight into contemporary clinical nutrition practices.

## **Program Outcomes (POs)**

PO1: Demonstrate in-depth understanding of human nutrition, biochemistry, physiology, and dietetics principles relevant to health and disease management.

PO2: Apply evidence-based nutritional assessment, diagnosis, and intervention strategies in clinical and community settings.

PO3: Communicate effectively with patients, healthcare professionals, and the public through counselling, education, and dissemination of nutritional knowledge.

## **Programme Specific Outcomes (PSOs)**

PSO1: Understand the advanced pathophysiology of different diseases, nutrimerics, biomarkers related to the clinical nutrition.

PSO2: Understand the basics and clinical applications and dietary management of metabolic, lifestyle, respiratory disorders.

PSO3: Understand the microbiological aspect of food, food preservation, food laws, sanitation, hygiene in different hospital and community.

PSO4: Focus on advanced public health and nutritional health education and policies.

## Course Structure

Course Code	Course Title	Credit (L-T-P)	Maximum Marks		
			IA	End-Sem Exam	Total
<b>Semester - I</b>					
CNDC401X0	DSC1 (Major 14)- Advanced Physiology and Pathophysiology	4 (3-1-0)	10	40	50
CNDC402X1	DSC2 (Major 15)- Nutrimerics and Biomarkers	2 (0-2-0)	5	20	25
CNDC402X8	DSC 2P (Major 15) –Nutrimerics and Biomarkers	2 (0-0-2)	-	25	25
CNDC403X0	DSC3-Research Methodology and Ethics	4 (3-1-0)	10	40	50
CNDE404A1	DSE1 (MajorElect.3) – Biochemical and Molecular Techniques	2 (2-0-0)	5	20	25
CNDE404A8	DSE 1P (Major Elect. 3) – Biochemical and Molecular Techniques	2 (0-0-2)	-	25	25
CNDE404B1	DSE2– Computational Skill And Statistics For Nutritional Data Analysis	2(2-0-0)	5	20	25
CNDE404B8	DSE2P– Computational Skill And Statistics For Nutritional Data Analysis	2 (0-0-2)	-	25	25
CNDC405X1	DSC4 –Nutraceuticals and Application of Nanotechnology	2(2-0-0)	5	20	25
CNDC405X8	DSC4P –Nutraceuticals and Application of Nanotechnology	2 (0-0-2)	-	25	25
CNDO406VC	Indian Knowledge System (IKS)	2 (2-0-0)	5	20	25
CNDO407NC	Vidyasagar: Life and Philosophy	Compulsory non-credit course	-	-	25
Total		22			275
<b>Semester - II</b>					
CNDC451X0	DSC4(Major 16)-Clinical Nutrition Therapy I – Metabolic, Respiratory and Lifestyle Disorders and Dietary Management	4 (3-1-0)	10	40	50
CNDC452X0	DSE3(Major Elect.4) -Clinical Nutrition Therapy II – GI, Liver, Renal, Autoimmune Disorders	4 (3-1-0)	10	40	50
CNDE453X0	DSE4(MajorElect.5)-Nutridynamics and Nutriomics	4 (3-1-0)	10	40	50
CNDC454X0	DSE5(MajorElect.6) – Nutritional Counseling and Entrepreneurial Development	4 (3-1-0)	10	40	50

CNDC455X0	DSC4 /DSE - Dietary Management of Different Diseases	4 (0-0-4)	-	50	50
CNDO456VC	Field Visit / Community Survey For The Control and Prevention Of Different Nutrient Deficient Condition (Anthropometric, Clinical Symptoms Assessment) and Awareness Programme	2	-	25	25
Total		22			275
<b>Semester III</b>					
CNDO501X0	MOOCs	4 (3-1-0)	10	40	50
CNDC502X1	DSC 5- Sports Nutrition & Performance Nutri Medicine	2 (2-0-0)	5	20	25
CNDC502X8	DSC 5P- Sports Nutrition & Performance Nutri Medicine	2 (0-0-2)	-	25	25
CNDC503X1	DSC 6- Clinical Nutrition Therapy III- Geronto-nutrition, Onco-Nutrition, Neurological Nutrition	2 (2-0-0)	5	20	25
CNDC503X8	DSC 6- Clinical Nutrition Therapy III- Geronto-nutrition, Onco-Nutrition, Neurological Nutrition	2 (0-0-2)	-	25	25
CNDC504X0	DSC 7-Food Microbiology and Food Preservation	4 (3-1-0)	10	40	50
CNDE505A0	DSC 8- Food laws, Food Sanitation and Hygiene in Hospital and Community	4 (3-1-0)	10	40	50
CNDO506VC	Visit to healthy food manufacturing unit / visit food research center / visit coastal areas / high altitude for food safety and sanitation survey	2 (0-0-2)	-	25	25
Total		22			275
<b>Semester IV</b>					
CNDC551X1	DSC10-Clinical Nutrition Therapy IV-Critical Care Nutrition and Palliative care	2 (2-0-0)	5	20	25
CNDC551X8	DSC10P-Clinical Nutrition Therapy IV-Critical Care Nutrition and Palliative care	2 (0-0-2)	-	25	25
CNDC552X0	DSC 11- Public Health and Nutritional Health Education and Policies	4 (3-1-0)	10	40	50
CNDO553VC	Research project/Dissertation	8 (0-0-8)	-	100	100
CNDO554VC	Internship/Capstone project/ Applied Field or Industry project/Innovation and Incubation/Entrepreneurship/Start-up Proposal or Practice	4 (0-0-4)	-	50	50
CNDO555VC	Intellectual Property Right (IPR) Skill Enhanced Course Preparation of smart food and common therapeutic food	2 (0-0-2)	-	25	25
Total		22			275
Grand Total		88			1100
<b>Exit with Master's Degree (88 Credits) after Three-Year/Four-Year UG Degree</b>					

**Note for the credit and engagement hours for a course:**

- i) 4 credit for lecture/tutorial means 4 hrs. of engagement per week, and the total in a semester is 40 hrs. of engagement.
- ii) 5 credit for lecture/tutorial means 5 hrs. of engagement per week, and the total in a semester is 50 hrs. of engagement.
- iii) 2 credit for practical means 4 hrs. of engagement per week, and the total in a semester is 40 hrs. of engagement.
- iv) 4 credit for practical means 8 hrs. of engagement per week, and the total in a semester is 80 hrs. of engagement.
- v) 1 credit for seminars/projects/workshops means 2 hrs. of engagement per week, and the total in a semester is 20 hrs. of engagement; it will be multiplied according to more credit.
- vi) 1 credit for field visit/internship means 20 hrs. of engagement in a semester; it will be multiplied according to more credit.

## **SEMESTER – I**

### **CNDC401X0: DSC 1 (Major 14)- Advanced Physiology and Pathophysiology      Full marks: 50**

#### **Learning Objectives:**

LO1: Describe the structure, function, and integration of major organ systems, along with key cellular transport mechanisms (passive and active).

LO2: Explain the hormonal and neural regulation of gastrointestinal, cardiovascular, renal, and endocrine systems.

LO3: Analyze the pathophysiological basis of common gastrointestinal, hepatic, cardiovascular, renal, and endocrine disorders.

LO4: Evaluate the role of immune function, oxidative stress, and inflammation in the development and progression of chronic diseases.

#### **Course outcomes:**

CO1: Demonstrate an integrated understanding of body systems and cellular transport in maintaining physiological balance.

CO2: Interpret regulatory mechanisms and disease processes across major organ systems using current physiological and pathophysiological principles.

CO3: Critically assess the impact of immune responses, inflammation, and oxidative stress in non-communicable diseases such as diabetes, cardiovascular disease, and cancer.

## **Course Content:**

**Organization of Body Systems:** Overview of organs, systems and their functions. Integration and communication between and among systems.

**Cell Transport Mechanisms:** Passive transport including diffusion, osmosis, and facilitated diffusion. Active transport (primary and secondary). Endocytosis and exocytosis.

**Gastrointestinal & Hepatic System:** Overview of gastrointestinal system, gastrointestinal reflex.

Hormonal Regulation of the GI Tract: role of gastrin, secretin, cholecystokinin (CCK), motilin, and ghrelin.

Role of the enteric nervous system in gut regulation.

Pathophysiology of Common GI and Liver Disorders: Overview of gastroesophageal reflux disease (GERD), inflammatory bowel disease (IBD), irritable bowel syndrome (IBS), non-alcoholic fatty liver disease (NAFLD), and liver cirrhosis.

**Cardiovascular & Renal Systems:** Overview of blood Pressure Regulation: Functions of baroreceptors and chemoreceptors. Role of the renin-angiotensin-aldosterone system (RAAS). Roles of antidiuretic hormone (ADH) and -natriuretic peptides. Fluid and Electrolyte Balance

**Pathophysiology of Cardiovascular and Renal Disorders:** Clinical aspects of hypertension, atherosclerosis, chronic kidney disease (CKD), nephrotic syndrome, uraemia and renal dialysis.

**Endocrine & Metabolic Disorders** Hormonal Regulation of Metabolism: Roles of insulin, glucagon, thyroid hormones, cortisol, growth hormone, leptin, and adiponectin in metabolic control. Endocrinal Pathophysiology of metabolic syndrome, and thyroidal disorders (hypothyroidism and hyperthyroidism).

**Immunology, Inflammation & Oxidative Stress:** Brief concept of immunity, nutrient as immuno-booster, immuno-enhancer and immuno-suppressor. Oxidative Stress: and antioxidant defense systems and impact on cellular and molecular integrity. Inflammatory pathways including NF- $\kappa$ B and cytokines. The role of chronic inflammation in non-communicable diseases such as cardiovascular disease, diabetes, obesity, cancer, and neurodegenerative conditions.

## **Suggested readings:**

1. Textbook of Medical Physiology, Authors: Arthur C. Guyton and John E. Hall. Edition: 3rd South Asia Edition.
2. Review of Medical Physiology. Author: Kim E. Barrett (Ganong's). Edition: 26th Edition (Lange/McGraw Hill India).

### CO–PO–PSO Mapping (High/Medium/Low)

CO	PO1	PO2	PO3	POS1	POS2	POS3	POS4
CO1	H	M	M	H	M	L	L
CO2	H	M	H	H	M	M	M
CO3	H	L	M	H	H	H	L

### CNDC402X1: DSC 2T (Major 15) -Nutrimetrics and Biomarkers

Full marks: 25

#### Learning Objectives:

LO1: Understand the foundational concepts of nutrimetrics, including its domains, scope, and evolution from classical to modern digital approaches in anthropometric assessments.

LO2: Analyze and apply various anthropometric indices and methods, both traditional and advanced, to assess nutritional and body composition status.

LO3: Interpret key biochemical biomarkers relevant to macronutrient and micronutrient status, hydration, and enzyme activity for evaluating nutritional health.

#### Course outcomes:

CO1: Conduct and interpret traditional and digital anthropometric assessments.

CO2: Apply advanced tools (DEXA, BIA, AI) for body composition analysis.

CO3: Evaluate nutritional status using key biochemical biomarkers and integrate nutrimetrics with smart health technologies for personalized nutrition.

#### Course Content:

**Introduction to Nutrimetrics:** Concept, domains and scope of Nutrimetrics. Anthropometry in modern nutrition science. Evolution from classical methods to digital/smart assessment.

**Anthropometric Indices and Application:** Traditional measurements: Height, Weight, BMI, MUAC, Chest Circumference, Head circumference, waist–hip ratio, skinfold thickness, visceral fat index, conicity index, anthropo-genomic dashboard. Growth charts, Z-scores, percentile-based assessment.

Advanced methods: DEXA, BIA, 3D and digital body scanning, AI enabled anthropometric analytics  
Smart devices and digital health applications in anthropometry

**Biochemical Biomarkers of Nutritional Status:** Overview of nutritional biomarkers (direct vs

functional). Micronutrient biomarkers (iron, vitamin D, iodine, zinc, folate, B12). Macronutrient biomarkers (protein status, lipid profiles, carbohydrate metabolism major bio markers). Biomarkers of hydration and electrolyte balance. Enzyme characteristics, nomenclature, kinetics, control of enzyme activity.

### **CNDC402X8 DSC 2P (Major 15) - Nutrimerics and Biomarkers**

#### **Anthropometric Assessment**

1. Height, Weight, BMI, Arm Circumference, waist–hip ratio, skinfold thickness, BIA.
2. Growth charts, Z-scores, percentile-based assessment

#### **Biochemical Biomarkers Assessment**

1. Blood glucose, lipid profile, Plasma protein, Serum iron, Serum calcium assessment.

#### **Suggested readings:**

1. Textbook of Anthropometry. Author: Indu Khurana and Arushi Khurana. Edition: 1st Edition (CBS Publishers).
2. Nutritional Assessment. Author: Robert D. Lee and David C. Nieman. Edition: 7th Edition (McGraw Hill India).
3. Lehninger Principles of Biochemistry. Authors: David L. Nelson and Michael M. Cox. Edition: 8th Edition (Macmillan Learning / India Edition).

#### **CO–PO–PSO Mapping (High/Medium/Low)**

CO	PO1	PO2	PO3	POS1	POS2	POS3	POS4
CO1	M	H	M	M	H	L	L
CO2	M	H	H	L	H	M	M
CO3	H	H	M	M	M	H	L

### **CNDC403X0: DSC 3- Research Methodology and Ethics**

**Full marks: 50**

#### **Learning Objectives:**

- To introduce the fundamental concepts, characteristics, and types of research, and to distinguish between research methods and methodology.
- To develop the ability to identify and formulate research problems, review literature critically, and frame appropriate research questions and hypotheses.

- To equip students with knowledge of research design, data collection methods, sampling techniques, and proposal writing skills.
- To cultivate ethical awareness in research by emphasizing research integrity, academic honesty, and responsible conduct in data handling and publication.
- To familiarize students with research metrics, publication ethics, and modern tools for evaluating the quality and impact of research.

### **Course Outcomes (COs):**

**CO1:** Exhibit familiarity with the reading, assessing, and developing stages of the research process.

**CO2:** Determine, elucidate, contrast, and compile the essential components of a study proposal or report.

**CO3:** Describe and create a potential research proposal utilizing particular research designs.

**CO4:** Analyze the differences between the paradigms of qualitative and quantitative research.

**CO5:** Explain measurement tools and scales, sample techniques, and the proper applications for each.

**CO6:** Using appropriate examples, describe, evaluate, and use computational techniques and descriptive and inferential statistics.

### **Course Content:**

- 1. Data and Methods of Data Collection:** Survey, assessment, and analysis: data collection, primary and secondary sources of data, and collection of primary data through questionnaires and schedules. Collection of secondary data, processing, and analysis of data. Sample survey, simple random sampling, stratified random sampling, systematic sampling, cluster sampling, area sampling, and multistage sampling. The pilot survey, scaling techniques, validity & reliability.
- 2. Good Experimental, Observational, and Data Analysis, including Computer Applications:** Maintenance of laboratory records & e-Note books, Management of data and self-navigation of the research project and academic program progress (objectives and milestones as well as timeline compliance), Data integrity & archiving of observational data for retracing, Basic mathematical and statistical treatments of data for appropriate/rational interpretation, statistical analyses (descriptive and inferential statistics), common computational tools like a process flow diagram, chemical structure drawing, and writing SOP Data tabulation and figure presentation (graph, bar diagram, Venn diagram, heat maps, etc.) and data visualization—any suitable software-like Google Studio, etc.

3. **Writing & Communication of Research:** Scientific writing (including language proficiency), state-of-the-art scientific literature comprehension, Art and ethics of writing research reports/papers and writing of an abstract for the scientific community and general public.
4. **The Research Proposal:** The Introduction, Review of Literature, The Method Section, The Results Section, The Discussion Section, and The References as per standard formats.
5. **Research ethics:** Guidelines, plagiarism, fabrication, falsification, copyright, authorship, correspondence, citation, plagiarism checking tools.

**Suggested readings:**

1. Research Methodology: Methods and Techniques. Author: C.R. Kothari and Gaurav Garg. Edition: 4th Edition (New Age International Publishers)
2. Research Ethics. Author: Gary Comstock. Edition: 2nd Edition (Cambridge University Press)

**CO–PO–PSO Mapping (High/Medium/Low)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	H	H	M	M	H	L	H	M	M	L
CO2	H	H	H	M	H	L	H	H	M	L
CO3	H	H	H	M	H	M	H	H	M	L
CO4	H	H	H	M	H	M	H	H	M	L
CO5	M	M	M	M	M	L	M	M	M	M
CO6	M	M	L	L	L	L	M	M	M	L

**CNDE404A1: DSE 1T (Major Elect. 3) – Biochemical and Molecular Techniques**

**Full marks: 25**

**Learning Objectives:**

- Understand and evaluate the evolution and application of biochemical techniques in clinical nutrition and the biochemical markers associated with key nutritional disorders.
- Analyze and interpret nutrient-specific biochemical markers, including proteins, lipids, and carbohydrates, to assess nutritional status and metabolic health.
- Explain the role of redox biochemistry in nutrition, including oxidative stress and antioxidant interactions, and their relevance to disease states.
- Apply molecular techniques such as PCR and Western blotting to investigate nutrient–gene interactions and assess functional nutrient-related biomarkers.

## **Course Outcomes (COs):**

**CO1:** Critically assess biochemical indicators of malnutrition, obesity, metabolic syndrome, and diabetes using current clinical and laboratory tools.

**CO2:** Perform and interpret biochemical tests for key macro- and micronutrient markers relevant to nutritional assessment and disease management.

**CO3:** Demonstrate proficiency in analyzing oxidative stress biomarkers and understanding antioxidant nutrient dynamics in human health.

**CO4:** Utilize molecular biology techniques to explore nutrigenomic relationships, including gene expression and protein-level responses to dietary components.

## **Course Content:**

### **1. Conceptual Framework**

- Evolution of biochemical techniques in clinical nutrition.
- Biochemical signatures of malnutrition, metabolic syndrome, obesity, diabetes

### **2. Nutrient-Specific Biomarker Analysis**

- Proteins: Serum albumin, prealbumin, transferrin as nutritional indicators.
- Lipids: Lipoprotein fractions and their nutritional relevance.
- Carbohydrates: Glycemic indices, advanced glycation end-products (AGEs).

### **3. Redox Biochemistry in Nutrition**

- Oxidative stress biomarkers (MDA, GSH, SOD, catalase).
- Antioxidant nutrient interactions (vitamins C, E, selenium).

### **4. Micronutrient Biochemistry**

- Functional biomarkers for iron (ferritin, transferrin saturation), zinc (alkaline phosphatase), iodine (urinary iodine).
- Biochemical monitoring of vitamin D–calcium–parathyroid axis.

### **5. Molecular Techniques in Nutrigenomics**

- Introduction to Nutrigenomics: Role of nutrients in regulating gene expression, interaction between diet, genome, and health outcomes.
- PCR (Polymerase Chain Reaction): Principles, types (conventional PCR, RT-PCR, qPCR), and applications in assessing nutrient–gene interactions and transcriptional changes.

- Western Blotting: Principles and methodology for protein detection; application in studying nutrient-regulated protein expression and translational modifications.

**CNDE404A8: DSE 1P (Major Elect. 3) – Biochemical and Molecular Techniques Full marks 25**

- ELISA for Hormonal Assay: Insulin, Leptin, Ghrelin, Adiponectin, TSH.
- Polymerase Chain Reaction (PCR) For Gene Expression Analysis
- Western blot for protein expression analysis

**Suggested readings:**

1. Nanomedicine and Nutrigenomics: Pioneering the Future of Health. Editors: Yugal Kishore Mohanta, Hemen Sarma, and Mahesh Narayan. Edition: 1st Edition (2025/2026), Elsevier India
2. Nutritional Biochemistry. Author: Dr. Shalini Jiwan Chahande or V. Sampath. Publisher: AGPH Books / Shashwat Publication

**CO–PO–PSO Mapping (High/Medium/Low)**

CO	PO1	PO2	PO3	POS1	POS2	POS3	POS4
CO1	M	M	H	H	M	M	L
CO2	H	M	H	L	H	H	M
CO3	H	L	M	M	H	L	L
CO4	M	H	L	H	L	M	H

**CNDE404B1: DSE 2T – Computational Skill and Statistics for Nutritional data analysis**

**Full marks: 25**

**Learning Objectives:**

- To develop conceptual clarity on statistical measures including central tendency, variation, location, and dispersion; and learn how to classify, tabulate, and represent data effectively.
- To gain proficiency in using frequency distributions, histograms, probability distributions (binomial and normal), and interpret statistical tables.
- To apply parametric and non-parametric tests such as t-tests, chi-square tests, ANOVA, and regression to draw valid inferences from data.
- To effectively use MS Excel, SPSS, OriginLab, and other statistical software for data analysis, visualization (bar, pie, line diagrams), and application in food analysis.

**Course Outcomes (COs):**

**CO1:** Compute and interpret statistical measures such as mean, median, standard deviation, and effectively apply frequency distributions and graphical methods for data summarization.

**CO2:** Apply suitable parametric and non-parametric tests including t-tests, chi-square tests, and ANOVA; interpret p-values and identify Type I and Type II errors.

**CO3:** Perform and interpret correlation and regression analyses, develop prediction models, and apply ANOVA with post-hoc tests such as Tukey's and Dunnett's.

**CO4:** Utilize tools such as MS Excel, SPSS, and Origin Lab for statistical analysis, data visualization, and reporting, with applications in real-world scenarios like food analysis.

### **Course Content:**

1. Conceptual understanding of statistical measures, Classification and tabulation, Measurement of central tendency, Measurement of variation, statistics of location, statistics of dispersion.
2. Frequency distribution, Histogram, Frequency polygon, Binomial distribution, Normal distribution-use of probability table.
3. Parametric and non-parametric test, testing of hypothesis-Type I and Type II error, Chi-square test, Goodness of fit, Application of student 't' test for samples Difference in proportion for mean and difference in means.
4. Correlation, Coefficient of correction and rank correlation, Regression and prediction, model-I and II ANOVA and F test and critical F test, Tukey's test and Dunnet test
5. Experimental design, completely randomized design, Randomized block design, Latin square designs, Factorial design, Trend analysis.
6. Basic computer architecture, Software's use of MS word, MS-EXCEL-Bar diagram, Pie diagram and line diagram, MS power point.
7. Application of statistics, Application of SPSS, Origin lab, Software, Use of software for food analysis.

### **CNDE404B8: DSE 2P- Computational Skill and Statistics for Nutritional data analysis**

- Software's-use of MSword, MS-EXCEL-Bar diagram, Pie diagram and line diagram, MS power point.
- Application of statistics, Application of SPSS, Origin lab, Software, Use of software for food analysis.

### Suggested readings:

1. Biostatistics and Computer Applications. Author: Dr. Rajeev Goswami. Edition: Latest Edition

### CO–PO–PSO Mapping (High/Medium/Low)

CO	PO1	PO2	PO3	POS1	POS2	POS3	POS4
CO1	M	M	H	H	M	M	L
CO2	H	M	H	L	H	H	M
CO3	H	L	M	M	H	L	L
CO4	M	H	L	H	L	M	H

### CNDC405X1: DSC4T–Nutraceuticals and Application of Nanotechnology Full marks: 25

#### Learning Objectives:

- To define nutraceuticals and understand their chemistry, sources, metabolism, and bioavailability, including their physiological effects on chronic disease prevention.
- To study various bioactive plant compounds (polyphenols, phytoestrogens, phytosterols) and antinutritional factors (phytates, protease inhibitors, etc.) and their health implications.
- To examine the principles of genetically modified (GM) foods, food fortification, and the application of nanotechnology in enhancing nutraceutical delivery and effectiveness.
- To perform extraction, isolation, chromatographic separation, quantitative estimation of phytochemicals, and synthesis/characterization of nanoparticles using modern techniques.

#### Course Outcomes (COs):

**CO1:** Demonstrate a comprehensive understanding of nutraceuticals, their sources, metabolism, and roles in promoting health and reducing disease risk.

**CO2:** Analyze and differentiate various classes of bioactive and antinutritional compounds through both theoretical and practical approaches.

**CO3:** Evaluate the significance and methodology of GM foods, nanotechnology applications, and nano-fortified foods in enhancing nutritional value and food functionality.

**CO4:** Perform laboratory techniques including solvent extraction, TLC, column chromatography, antioxidant assays, and nanoparticle synthesis, and interpret analytical data for nutraceutical compounds.

#### Course Content:

1. **Nutraceuticals with Potential Health Benefit:** Definition, chemistry, sources, metabolism, and bioavailability.
2. **Physiological Effects and Disease Risk Reduction:** Role of nutraceuticals in promoting health and reducing chronic disease risks.
3. **Bioactive Plant Compounds:** Polyphenols (flavonoids, catechins, tannins), phytoestrogens, phytosterols, pigments (lycopene, curcumin).
4. **Antinutritional and Functional Compounds:** Phytates, protease inhibitors, amylase inhibitors, haemagglutinins, saponins.
5. **Genetically Modified (GM) Foods:** Concept, definition, available GM foods in India, techniques for GM food preparation, and food fortification.
6. **Nanotechnology in Nutraceuticals**
  - Nanoencapsulation for Enhanced Bioavailability: Improving solubility, stability, absorption, and targeted delivery of nutraceuticals.
  - Nanocarriers in Food Systems: Liposomes, nanoemulsions, solid lipid nanoparticles, polymeric nanoparticles.
  - Nano-fortified/ designer Foods: Nano fortification of food, improvement of nutritional quality and shelf life.
  - Safety and Regulatory Concerns: Toxicity, stability, and ethical considerations of nano-based nutraceuticals.

#### Suggested readings:

1. Nutraceuticals: A New Millennium Approach for Preventive Medicine. Editors: Dilipkumar Pal and Souvik Mukherjee. Edition: 1st Edition (Springer Nature / India Edition)

#### CNDC405X8: DSC4P-Nutraceuticals and Application of Nanotechnology

Full marks: 25

##### 1. Extraction & Isolation:

- Extraction of Phyto molecules using different solvents.
- Identification of bioactive compounds (polyphenols, flavonoids, alkaloids, saponins, etc.) from chromatographic data (demonstration).

##### 2. Separation techniques: TLC, column chromatography.

##### 3. Quantitative Estimation

- Total phenolic content (Folin-Ciocalteu method).
- Total flavonoid content (AlCl<sub>3</sub> method).
- Antioxidant activity assays: DPPH, ABTS, FRAP.

##### 4. Nanoparticle Synthesis & Formulation (demonstration):

- Preparation of polymeric nanoparticles (e.g., chitosan, PLGA).
- Green synthesis of metallic nanoparticles (AgNPs, AuNPs) using plant extracts.

- UV–Vis spectroscopy for nanoparticle confirmation.

CO–PO–PSO Mapping (High/Medium/Low)

CO	PO1	PO2	PO3	POS1	POS2	POS3	POS4
CO1	M	M	H	H	M	H	H
CO2	H	M	H	L	H	M	M
CO3	H	L	M	M	H	L	H
CO4	M	H	L	H	L	H	H

### CNDO406VC: Indian Knowledge System (IKS)

**Full marks: 25**

#### Learning Objectives:

LO1: To introduce students to the foundational concepts, principles, and philosophical underpinnings of the Indian Knowledge System (IKS) and its historical development.

LO2: To explore the contributions of IKS in various scientific domains, especially medicine.

LO3: To develop the ability to critically analyze and integrate traditional Indian knowledge with modern scientific approaches for interdisciplinary applications.

#### Course Outcomes (COs):

CO1: To understand and appreciate the rich Indian knowledge tradition.

CO2: To understand the contribution of Indians in various fields.

CO3: To increase subject awareness and self-esteem.

CO4: To develop a comprehensive understanding of how all knowledge is ultimately intertwined.

#### Course Content:

Introduction to IKS: What is knowledge System, Characteristic Features of Indian Knowledge System).

Importance of IKS: Macaulay's Education Policy and its impact, Need of revisiting Ancient Indian Traditions.

Scope of IKS: The Universality of IKS (from Micro to Macro), development form Earliest times to 18th Century CE.

Tradition of IKS: Ancient Indian Education System: Home, Gurukul, Pathashala, Universities and ancient educational centres.

Relevant sites in the vicinity of the Institute: Water Management System, Temple Management, etc.

Medicine (Ayurveda), Alchemy, Mathematics, Logic, Art of Governance (Arthashastra).

Aesthetics, Town Planning, Strategic Studies, Krishi Shastra, Vyakaran & Lexicography, Ancient Sports, Yoga and Wellbeing, Linguistics.

#### Suggested readings:

Concise history of science in India- D.M. Bose, S.N Sen, B.V. Subbarayappa.

Ramkrishna Mission- cultural heritage of India Vol.I, II & III.

Majumdar R. C & Pushalkar A.D- History & culture of the Indian people, Vol. I, II & III.  
 Positive sciences of the Ancient Hindus- Brajendranatha seal, Motilal Banrasidas, Delhi 1958.  
 History of Chemistry in Ancient India & Medieval India, P. Ray- Indian Chemicals Society, Calcutta 1956.

**CO–PO–PSO Mapping (High/Medium/Low)**

CO #	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	H	H	M	M	H	L	H	M	M	L
CO2	H	H	H	M	H	L	H	H	M	L
CO3	H	H	H	M	H	M	H	H	M	L
CO4	H	H	H	M	H	M	H	H	M	L

**Common code: Life & Philosophy of Vidyasagar**

**[Full Marks: 25]**

**Learning Objectives:**

- To introduce students to the life, education, and socio-cultural context of Ishwar Chandra Vidyasagar.
- To study Vidyasagar’s contributions to education, social reform, literature, and women’s empowerment.
- To analyze Vidyasagar’s philosophical principles of rationalism, humanitarianism, and social justice, and their relevance to contemporary society.

**Course Outcomes (COs):**

**CO1:** Understand the life, education, and historical context of Ishwar Chandra Vidyasagar.

**CO2:** Analyze Vidyasagar’s contributions to education, social reform, literature, and women’s empowerment.

**CO3:** Apply Vidyasagar’s philosophical principles of rationalism, humanitarianism, and social justice to contemporary societal and educational issues.

**Course Content**

**Early Life and Education:** Birth and Lineage, a Journey from Iswar Chandra Bondopadhaya to Iswar Chandra Vidyasagar

**Vidyasagar and Indian Education:** The then Indian education system, Vidyasagarian plan for reformation of Indian education- Vidyasagar as teacher, Vidyasagar as writer, planner and reformer of Indian education.

**Vidyasagar and Women Emancipation:** Introduction of widow remarriage, struggle to stop child marriage

**Philanthropist Vidyasagar:** Vidyasagar's philanthropy as narrated by others

**Vidyasagar: Traditions and modernity:** Tradition, Modernity, Vidyasagara as Traditional moderniser

**Relevance of Vidyasagarian thoughts and values:** Vidyasagar and the then Society of Bengal, Lesson for future generations

**Suggested reading:**

Online course. Available on the University website.

**CO–PO–PSO Mapping (High/Medium/Low)**

CO #	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	H	M	L	M	M	L	M	L	L	H
CO2	H	M	M	M	H	L	M	M	L	H
CO3	H	H	M	M	H	L	M	M	M	H

## Semester II

### **CNDC451X0: Clinical Nutrition Therapy I -Dietary Management of Metabolic and Lifestyle Disorders and Respiratory diseases**

**Full Marks: 50**

#### **Learning Objectives:**

LO1: Analyze the pathophysiology and etiology of metabolic, cardiovascular, and respiratory disorders to determine nutritional needs.

LO2: Design evidence-based medical nutrition therapy (MNT) plans, including calorie counting and meal structuring, for diverse clinical conditions.

LO3: Evaluate the efficacy of specialized dietary patterns (DASH, Keto, TRE) and food exchange systems in managing chronic lifestyle diseases.

#### **Course Outcomes (COs):**

CO1: Formulate personalized diet charts for patients with Diabetes (T1, T2, GDM), Obesity, and PCOS based on specific phenotypes and glycemic indices.

CO2: Plan therapeutic nutritional interventions for cardiovascular and respiratory diseases, adjusting for energy, protein, and texture requirements.

CO3: Apply clinical counseling strategies to manage disease-related complications like muscle wasting in COPD or hypertension in CVD.

#### **Course Content**

**1. Diabetes Mellitus:** Etiology of Diabetes Mellitus. Dietary management of various types of diabetes (juvenile, T2DM, gestational diabetes) and associated complication. Role of Food exchange list, glycemic index and glycemic load.

**2. Obesity:** Etiology and Complications. Calorie deficit planning and meal structuring.

**3. Cardiovascular diseases:** Etiology and Complications. Dietary management of Hyperlipidemia, Hypertension, Ischemic heart disease and Myocardial infarction.

**4. Polycystic Ovarian Syndrome:** Etiology, Phenotypes and Complications. Dietary management of PCOS based on the phenotypes.

**5. Role of different diet for metabolic diseases:** Mediterranean Diet, DASH diet, ketogenic Diet, Time-Restricted Eating (TRE).

**6. Respiratory diseases:** Etiology and complications of major respiratory diseases. Dietary management of Chronic Obstructive Pulmonary Disease (COPD), Bronchial Asthma, Pulmonary Tuberculosis and Acute Respiratory Distress Syndrome (ARDS). Energy and protein modification, meal planning and texture adjustment in respiratory disorders. Role of micronutrients, antioxidants and fluids in respiratory health and recovery. Nutritional strategies to manage breathlessness, muscle wasting and nutrition rehabilitation.

**Suggested reading:**

1. Dietetics. Author: B. Srilakshmi. Edition: 9th Edition (2024/2025), New Age International
2. Krause and Mahan's Food & the Nutrition Care Process. Author: Kelly Morrow (and formerly Janice L. Raymond & L. Kathleen Mahan). Edition: 16th Edition (2024), Elsevier India

**CO–PO–PSO Mapping (High/Medium/Low)**

CO	PO1	PO2	PO3	PSO1	PSO2	PSO3	PSO4
CO1	H	H	M	H	H	L	M
CO2	H	H	M	H	H	L	L
CO3	M	M	H	M	H	L	H

**CNDC452X0: Clinical Nutrition Therapy II – GI, Liver, Renal, Autoimmune Disorders**

**Full Marks: 50**

**Learning Objectives:**

LO1: Explain the pathophysiology of gastrointestinal, hepatobiliary, renal and autoimmune disorders to understand their impact on nutritional status.

LO2: Determine specific macro and micronutrient requirements, including fluid and electrolyte adjustments, for patients with progressive organ failure (e.g., Cirrhosis, CKD).

LO3: Formulate comprehensive medical nutrition therapy (MNT) plans for chronic inflammatory and autoimmune conditions to improve patient quality of life.

**Course Outcomes (COs):**

CO1: Design therapeutic diets for GI and liver disorders, specifically managing symptoms like dysphagia and complications like hepatic encephalopathy.

CO2: Compute precise renal diet prescriptions for various stages of kidney disease, including dialysis and kidney stones, focusing on the renal solute load.

CO3: Implement evidence-based nutritional protocols for autoimmune disorders such as Celiac disease and Rheumatoid arthritis to mitigate systemic inflammation.

## **Course Content**

### **1. Gastrointestinal Disorders**

Etiology, Pathophysiology and complications of all mentioned disorders or diseases below.

Dysphagia, odynophagia, aerophagia, regurgitation, bloating, belching. Barrett's oesophagus, Hiatus hernia, acid reflux, oesophagitis, gut dysbiosis.

Dietary management of gastric ulcer and gastro-oesophageal reflux disease (GERD) Nutritional intervention in acute and chronic pancreatitis

Dietary management of liver disorders and gallbladder disorder– NAFLD, hepatitis, cirrhosis of liver, hepatic encephalopathy, cholelithiasis

Nutrition management of intestinal disorders – malabsorption syndrome, inflammatory bowel disease (IBD): ulcerative colitis, Chron's Disease, and irritable bowel syndrome (IBS)

### **2. Renal Disorders**

Etiology, Pathophysiology and complications

Dietary management of renal stones, glomerulonephritis, nephrotic syndrome, nephritic syndrome, acute kidney failure under catabolic stress, Chronic kidney disease

BPH, Prostatitis, Cystitis

Protein, sodium, potassium, phosphorus and fluid modification

Nutrition during dialysis

### **3. Autoimmune Disorders**

Pathophysiology and dietary principles in autoimmune diseases

Nutrition management for - Rheumatoid arthritis, Psoriasis, Systemic lupus erythematosus, Celiac disease, urticaria due to autoimmunity.

## **Suggested reading:**

1. Clinical Nutrition Handbook. Editor: Anita Jatana. Edition: 1st Edition (Jaypee Brothers Medical Publishers)

2. Krause and Mahan's Food & the Nutrition Care Process. Author: Kelly Morrow (and formerly Janice L. Raymond & L. Kathleen Mahan). Edition: 16th Edition (2024), Elsevier India

### CO–PO–PSO Mapping (High/Medium/Low)

CO	PO1	PO2	PO3	PSO1	PSO2	PSO3	PSO4
CO1	H	H	M	H	H	L	L
CO2	H	H	M	H	H	L	L
CO3	M	H	H	H	H	L	M

### CNDE453X0: Nutridynamics and Nutriomics

Full Marks: 50

#### Learning Objectives:

LO1: Explain the molecular mechanisms by which genetic polymorphisms (SNPs) and nutrients interact to influence metabolic pathways and enzyme activity.

LO2: Evaluate the role of epigenetic modifications and early-life programming (DOHaD) in determining long-term disease risk and phenotype.

LO3: Appraise the integration of multi-omics platforms and AI-based models in developing precision medical nutrition therapy (PMNT) and personalized diet plans.

#### Course Outcomes (COs):

CO1: Interpret genomic profiling and biomarker data to recommend targeted micronutrient corrections for variants like Vitamin D receptor sensitivity or caffeine metabolism.

CO2: Utilize metabolotypes and Polygenic Risk Scores (PRS) to design risk-modification diets for chronic lifestyle disorders.

CO3: Apply metabolomics and gut microbiome modulation strategies to create evidence-based, personalized dietary interventions for individual patients.

#### Course Content

## 1. Nutrient-Gene Interaction

Concepts of Nutrigenetics. Genetic polymorphisms (e.g., SNPs, CNVs) influencing individual responses to nutrients with special focuses on gene variants affecting different Macronutrient and micronutrient metabolism.

Nutrients influencing gene expression, epigenetic modifications, and molecular signaling pathways.

Single Nucleotide Polymorphisms (SNPs) altering enzyme activity. Variants affecting on Vitamin D receptor sensitivity, Caffeine metabolism, Alcohol metabolism, Omega-3 fatty acid metabolism.

Concept of Metabotypes, Gene–nutrient interactions in lifestyle disorders.

## 2. Nutriomics

Application of Nutriomics in Diet Personalization and Risk Modification

Integration of Nutriomics with multi-omics platforms

Risk prediction tools: Polygenic Risk Scores (PRS), Biomarker-guided dietary modification, AI-based predictive nutrition models

Nutriomic Approaches in Preventive and Therapeutic Nutrition

Early-life epigenetic programming (Developmental Origins of Health and Disease – DOHaD concept), Gut microbiome modulation, Precision medical nutrition therapy (PMNT), Targeted micronutrient correction based on genomic profiling, Metabolomics-guided dietary interventions

### Suggested reading:

1. Principles of Nutrigenetics and Nutrigenomics: Fundamentals of Individualized Nutrition. Editors: Raffaele De Caterina, J. Alfredo Martinez, and Martin Kohlmeier. Edition: 1st Edition (Elsevier / Academic Press)

2. Nutriomics: Well-being through Nutrition. Editors: Devarajan Thangadurai, Saher Islam, Leo M.L. Nollet, and Juliana Adetunji. Edition: 1st Edition (2022/2023), CRC Press.

### CO–PO–PSO Mapping (High/Medium/Low)

CO	PO1	PO2	PO3	PSO1	PSO2	PSO4
CO1	H	H	M	H	H	M
CO2	H	M	L	H	H	H
CO3	H	H	M	H	H	H

**Learning Objectives:**

LO1: Apply advanced counseling frameworks like the Transtheoretical Model and Motivational Interviewing to facilitate long-term dietary behavior change in patients.

LO2: Evaluate the components of the startup ecosystem, including the roles of food parks, incubators, and accelerators, in launching a nutrition-based enterprise.

LO3: Develop a comprehensive project report and appraisal strategy for a micro or small-scale food startup, identifying current market trends

**Course Outcomes (COs):**

CO1: Conduct effective nutrition counseling sessions using the GALIDRAA approach and 5A's framework for both individuals and community groups.

CO2: Demonstrate entrepreneurial characteristics by identifying viable project opportunities and navigating the MSME regulatory landscape.

CO3: Design a business pitch or project report that aligns with the current startup ecosystem and food industry trends.

**Course Content**

**1. Nutritional Counselling**

Overview of nutrition education and counselling

Principles of counselling

Skills of Nutrition counsellor and keys to effective counselling

Major counselling techniques and framework - Transtheoretical Model, Motivational Interviewing (MI),

Cognitive Behavioral Therapy (CBT) and 5 A's framework

GALIDRAA Approach

Community based nutrition counselling

**2. Entrepreneurial Development**

Concept of Entrepreneur and Entrepreneurship

Entrepreneurial characteristics

Micro, Small and Medium Enterprises — An Overview

Project Identification, Project Report, Start-ups, Project Appraisal

Major trends in food startups

Start-up ecosystem

Food parks

Accelerators and incubators

**Suggested reading:**

1. Nutrition Counseling and Education Skill Development. Authors: Kathleen D. Bauer and Doreen Liou. Edition: 4th Edition (Cengage India Edition)

**CO–PO–PSO Mapping (High/Medium/Low)**

CO	PO1	PO2	PO3	PSO1	PSO2	PSO3	PSO4
CO1	M	H	H	Low	M	-	H
CO2	L	M	M	-	L	H	M
CO3	L	M	H	-	L	H	H

**CNDC455X0: Dietary Management of Different Diseases**

**Full Marks: 50**

**Learning Objectives:**

LO1: Develop precision in calculating nutrient requirements and designing therapeutic diet charts specifically tailored to patients with metabolic, respiratory, and renal complications.

LO2: Demonstrate the ability to interpret clinical biochemical markers and anthropometric data to monitor the effectiveness of dietary interventions.

**Course Outcomes (COs):**

CO1: Prepare and standardize therapeutic recipes (e.g., low protein/high calorie for renal, low GI for diabetes) based on modified exchange lists and texture requirements.

CO2: Conduct complete nutritional assessments and formulate comprehensive Medical Nutrition Therapy (MNT) plans for patients with multi-organ disorders (e.g., Hepato-renal or Cardio-respiratory conditions).

**Course Content**

1. Dietary Management of Metabolic and lifestyle diseases
2. Dietary Management of Respiratory diseases
3. Dietary Management of Gastrointestinal diseases
4. Dietary Management of renal diseases
5. Dietary Management of autoimmune diseases

**CO–PO–PSO Mapping (High/Medium/Low)**

CO	PO1	PO2	PO3	PSO1	PSO2	PSO3	PSO4
CO1	M	H	M	M	H	High	Low
CO2	H	H	H	H	H	Low	Medium

**CNDO456VC: Field Visit / Community survey****Full Marks: 25****Learning Objectives:**

LO1: Apply standardized anthropometric and clinical assessment techniques to identify specific nutrient deficiency conditions (e.g., PEM, Anemia, Vitamin A deficiency) within a community setting.

LO2: Design and execute evidence-based nutrition awareness programs tailored to the socio-economic and cultural context of the surveyed population.

**Course Outcomes (COs):**

CO1: Evaluate the nutritional status of a community by interpreting primary data collected through physical symptoms and body measurements.

CO2: Create effective health communication materials (posters, flipcharts, or street plays) that promote the prevention and control of local nutritional disorders.

**Course Content**

Field Visit or community Survey for the control and prevention of different nutrient deficient condition (Anthropometric, Clinical Symptoms Assessment) and Awareness Programme

**CO–PO–PSO Mapping (High/Medium/Low)**

CO	PO1	PO2	PO3	PSO1	PSO2	PSO3	PSO4
CO1	M	H	M	H	M	M	H
CO2	L	M	H	L	L	M	H

## Semester III

### **CNDO501X0: Massive Open Online Courses (MOOCs)**

**Full Marks: 50**

#### **Learning Objectives:**

LO1: To empower learners in managing their own learning schedule, flexibility and pace.

LO2: To increase access to high-quality education from renowned universities for anyone.

LO3: To foster the ability to synthesize complex information and conduct independent inquiries, often utilizing interactive community forums for collaboration.

#### **Course Content:**

Students will prefer relevant MOOCs for self-paced learning.

### **CNDC502X1: DSC 5-Sports Nutrition & Performance Nutri Medicine**

**Full Marks: 25**

#### **Learning Objectives:**

LO1: Analyze the biomechanical principles of force-velocity relationships and muscle-tendon mechanics to optimize athletic movement and efficiency.

LO2: Synthesize sport-specific fuelling architectures based on the metabolic demands of different energy systems.

LO3: Critique the efficacy of ergogenic aids and navigate the legal complexities of WADA/NADA compliance, including TUE protocols.

LO4: Develop precision-based dietary interventions for weight management and recovery, ensuring the prevention of Relative Energy Deficiency in Sport (REDs).

#### **Course Outcomes (COs):**

CO1: Design periodized nutrition plans for elite athletes (Power, Endurance, and Intermittent sports) by calculating carbohydrate kinetics and glycogen loading strategies.

CO2: Evaluate supplement safety and legality using IOC consensus statements to prevent accidental doping and manage Relative Energy Deficiency in Sport (REDs).

CO3: Apply kinesiological principles to assess joint loads and torque, advising on nutritional strategies for recovery and hypertrophic signaling.

CO4: Implement legal and evidence-based supplementation and weight-management strategies that prioritize long-term metabolic health and athletic integrity.

### **Course Content:**

#### **1. Kinetic Foundations & Biomechanics**

Applied Kinesiology: Analysis of muscle-tendon mechanics and joint load during athletic movement.

Biomechanics: Force-velocity relationships, torque, and movement efficiency in high-performance sports.

#### **2. Bioenergetics & Sport-Specific Fueling**

Energy Systems: Dynamics of the ATP-CP (Phosphagen) system, Anaerobic Glycolysis, and Oxidative Phosphorylation.

Performance Nutrition Architectures:

- Power/Sprint (e.g., Weightlifting, 100m): Strategies for phosphagen recovery and hypertrophic signaling.
- Endurance (e.g., Marathons, Triathlon): Fat-adaptation, glycogen loading, and intra-race carbohydrate kinetics.
- Mixed/Intermittent (e.g., Football, Basketball): Managing glycogen depletion in high-intensity interval sports.

#### **2. Ergogenic Aids**

Nutritional Ergogenics: Evidence-based analysis of Group A supplements (Caffeine, Creatine, Beta-alanine, Nitrates).

#### **3. Regulatory Frameworks & Sports Ethics**

Anti-Doping compliance with WADA & NADA

TUE (Therapeutic Use Exemptions): Legal protocols for medical necessity in competitive sports.

Global Standards: Analysis of IOC Consensus Statements on supplements and Relative Energy Deficiency in Sport (REDS).

### **Suggested reading:**

1. Sport Nutrition. Authors: Asker Jeukendrup and Michael Gleeson. Edition: 3rd or 4th Edition (Human Kinetics / India Edition)

**CNDC502X8: DSC 5-Sports Nutrition & Performance Nutri Medicine**

**Full Marks: 25**

**Course Content:**

- Menu planning and hydration strategies with nutrient periodization for various sports.
- Sport-specific nutrition including pre- and post-event diet planning.
- Diet planning for endurance athletes focusing on energy, fluids, and micronutrients.
- Weight management and performance nutrition for power and precision sports.

**CO–PO–PSO Mapping (High/Medium/Low)**

CO	PO1	PO2	PO3	PSO1	PSO2	PSO3	PSO4
CO1	H	H	M	H	H	L	M
CO2	M	H	H	M	M	-	H
CO3	H	M	L	H	H	-	L
CO4	M	H	H	M	H	L	H

**CNDC503X1: DSC 6- Clinical Nutrition Therapy III- Geronto-nutrition, Onco-Nutrition, And Neurological Nutrition**

**Full Marks: 25**

**Learning Objectives:**

LO1: Analyze the physiological and metabolic changes associated with aging, carcinogenesis, and neuro-degeneration to determine specific nutrient requirements.

LO2: Evaluate nutritional status in oncology and geriatric patients using specialized tools like PG-SGA and Subjective Global Assessment (SGA).

LO3: Design evidence-based therapeutic interventions, including texture-modified diets and ketogenic protocols, for neurological and pediatric disorders.

LO4: Synthesize medical nutrition therapy protocols to mitigate cancer cachexia, sarcopenia, and functional decline in chronic disease states.

**Course Outcomes (COs):**

CO1: Formulate personalized diet plans for geriatric and pediatric populations that address growth milestones, frailty, and metabolic syndrome.

CO2: Implement comprehensive MNT for cancer patients by managing cachexia and tumor metabolism during various stages of treatment and recovery.

CO3: Perform clinical assessments and develop feeding strategies (including dysphagia management) for patients with Parkinson's, Alzheimer's, and Multiple Sclerosis.

CO4: Apply disease-specific dietary management to improve immunity and quality of life in patients with chronic degenerative and malabsorptive conditions.

### **Course content:**

#### **1. Geronto and pediatric-Nutrition**

Geriatric complications and its effect on nutritional status

Energy, protein and micronutrient requirements

Nutrition intervention for osteoporosis, sarcopenia, frailty and functional decline

#### **2. Pediatric-Nutrition**

Impact of failure to thrive (FTT), obesity, and malabsorption on growth milestones and nutritional status. Age-specific RDA for energy, protein, and critical micronutrients (Iron, Calcium, Vitamin D, and Zinc) during growth phases.

Management of stunting, wasting, and pediatric metabolic syndrome.

#### **3. Onco-Nutrition**

The Biology of Cancer and Nutrition- carcinogenesis, cancer cachexia, tumour metabolism (Warburg Effect)

Nutrition Assessment through SGA (Subjective Global Assessment) and PG-SGA (Patient-Generated Subjective Global Assessment).

Medical Nutrition Therapy (MNT) during treatment and recovery

#### **4. Nutrition in Neurological conditions**

Fundamentals of Neuro-Metabolism

Dysphagia Management- Texture-modified diets and feeding strategies

Specialized Nutritional Interventions in – Parkinson's Disease, Alzheimer's & Dementia, Multiple Sclerosis, Refractory Epilepsy

### **Suggested reading:**

1. Krause and Mahan's Food & the Nutrition Care Process. Authors: Kelly Morrow and Janice L. Raymond. Edition: 16th Edition (2024), Elsevier India.

2. Nutrition and Dietetics. Author: Shubhangini A. Joshi. Edition: 5th Edition, Tata McGraw Hill India

**CNDC503X8: DSC 6-Clinical Nutrition Therapy III- Geronto-nutrition, Onco-Nutrition, Neurological Nutrition** **Full Marks: 25**

**Course content:**

- Clinical nutrition therapy focusing on geriatric, cancer, and neurological conditions.
- Disease-specific dietary management to improve recovery, immunity, and quality of life.
- Nutritional assessment and therapeutic interventions in chronic and degenerative disorders.

**CO–PO–PSO Mapping (High/Medium/Low)**

CO	PO1	PO2	PO3	PSO1	PSO2	PSO3	PSO4
CO1	H	H	M	H	H	L	M
CO2	H	H	M	H	H	—	L
CO3	H	H	H	H	H	—	L
CO4	M	H	H	M	H	L	H

**CNDC504X0: DSC 7 – Food Microbiology and Food Preservation**

**Full Marks: 50**

**Learning Objectives:**

LO1: Analyze microbial growth kinetics and the influence of environmental parameters to predict and control food spoilage.

LO2: Evaluate various physical, chemical, and biological preservation strategies, including the application of GRAS preservatives, to ensure food safety.

LO3: Appraise the etiology of food-borne illnesses and the mechanisms of microbial degradation across different food categories.

LO4: Develop an understanding of industrial bio-processing techniques, focusing on the production of functional metabolites, probiotics, and single-cell proteins.

**Course Outcomes (COs):**

CO1: Implement preservation protocols to mitigate contamination and extend the shelf life of dairy, flesh foods, and plant-based products.

CO2: Identify and troubleshoot primary sources of contamination in food process lines and environmental settings.

CO3: Design fermentation systems (Aerobic/Anaerobic, SSF) for the industrial production of organic acids, enzymes, and microbial biomass.

CO4: Formulate functional food products utilizing probiotics, prebiotics, and mushroom mycelia for enhanced nutritional value.

**Course content:**

**1. Microbial Growth & Physiology:**

Growth Kinetics and impact of intrinsic and extrinsic parameters.

Nutritional requirements for microbial growth.

**2. Control & Preservation Strategies:**

Contamination: Primary environmental and process-line sources.

Physical and Chemical/Biological methods, GRAS preservatives.

**3. Spoilage & Food Safety:**

Microbial degradation across food categories (Dairy, Flesh foods, Cereals, Fruits/Vegetables, and Canned goods).

Etiology of major food-borne illness.

**4. Applied Fermentation & Bio-processing**

Technology: Aerobic/Anaerobic, Submerged, and Solid-State Fermentation (SSF) systems.

Industrial Metabolites: Production of microbial enzymes, organic acids, amino acids, and vitamins.

Functional Nutrition: Probiotics and Prebiotics; cultivation of Single Cell Protein (SCP), Single Cell Lipids (SCL), and Mushroom mycelia.

**Suggested reading:**

1. Food Microbiology. Authors: William C. Frazier and Dennis C. Westhoff. Edition: 5th Edition (McGraw Hill India)

2. Principles of Fermentation Technology. Authors: P.F. Stanbury, A. Whitaker, and S.J. Hall. Edition: 3rd Edition (Elsevier / Aditya Books India)

**CO–PO–PSO Mapping (High/Medium/Low)**

CO	PO1	PO2	PO3	PSO1	PSO2	PSO3	PSO4
CO1	H	M	L	M	M	H	M
CO2	M	H	M	M	L	H	H
CO3	H	H	L	H	M	M	L
CO4	H	H	M	H	H	M	H

## **CNDE505A0: DSC 8 – Food laws, Food Sanitation and Hygiene in Hospital and Community**

**Full marks: 50**

### **Learning Objectives:**

LO1: Appraise the principles of HACCP and ISO 22000 to design and implement robust Food Safety Management Systems (FSMS) across the supply chain.

LO2: Evaluate the legal framework of the FSSAI Act (2006) and international standards like Codex Alimentarius to ensure regulatory compliance in food operations.

LO3: Analyze industrial sanitation protocols, including GMP, GHP, and sanitary facility design, to mitigate biological, chemical, and physical hazards.

LO4: Develop specialized safety protocols for clinical and community food services, focusing on enteral feed integrity and outbreak investigation.

### **Course Outcomes (COs):**

CO1: Identify Critical Control Points (CCPs) in a food production line and conduct comprehensive Risk Assessments to ensure patient and consumer safety.

CO2: Navigate FSSAI licensing and enforcement protocols for micro and small-scale food enterprises (MSMEs) or hospital dietary departments.

CO3: Implement sterile nutrition protocols and allergen management strategies specifically tailored for therapeutic hospital diets.

CO4: Design a sanitation and hygiene prerequisite program (PRP) that incorporates personnel health screening and waste management standards.

### **Course content:**

#### **1. Food Safety Management Systems (FSMS)**

HACCP Principles: Critical Control Points; identifying hazards.

ISO 22000 & FSSC: International standards for food safety across the supply chain.

Risk Analysis: Components of Risk Assessment, Risk Management, and Risk Communication.

#### **2. Sanitation, Hygiene & Operational Prerequisite Programs (PRPs)**

Industrial Sanitation: Good Manufacturing Practices (GMP) and Good Hygienic Practices (GHP).

Personnel Hygiene: Health screening, protective clothing, and behavioural protocols for food handlers.

Facility Design: Sanitary design of equipment, waste disposal systems, and pest control management.

#### **3. Sector-Specific Safety & Quality Control**

Clinical & Hospital Food Service: Patient Safety: Protocols for sterile nutrition, enteral feed integrity, and allergen management in therapeutic diets.

Community & Public Health: Epidemiology: Investigating foodborne outbreaks in mass catering and street food sectors.

#### 4. National and international food laws and standards

National Framework (FSSAI): Food Safety and Standards Act (2006); latest amendments, licensing, and enforcement protocols in India; AGMARK, ISI.

International organizations and standards: Codex Alimentarius, WTO, ISO, FAO.

#### Suggested reading:

**1. Food Safety and Standards in India. Author:** Dr. J.S. Pai and others (Published via the Protein Foods and Nutrition Development Association of India - PFNDAI).

#### CO–PO–PSO Mapping (High/Medium/Low)

CO	PO1	PO2	PO3	PSO1	PSO2	PSO3	PSO4
CO1	M	H	M	M	M	H	M
CO2	L	M	M	—	L	H	H
CO3	H	H	M	H	H	H	M
CO4	L	M	M	L	L	H	M

**CNDO506VC: Visit to healthy food manufacturing unit / visit food research center / visit coastal areas / high altitude for food safety and sanitation survey**

**Full marks: 25**

#### Learning Objective:

To evaluate the implementation of Good Manufacturing Practices (GMP) and Hazard Analysis Critical Control Point (HACCP) systems across varying environmental conditions and processing scales.

#### Course Outcomes (CO):

Analyze site-specific food safety risks and design comprehensive sanitation SOPs (Standard Operating Procedures) that comply with international regulatory standards.

#### Course content:

Visit to healthy food manufacturing unit / visit food research center / visit coastal areas / high altitude for food safety and sanitation survey.

## Semester IV

### **CNDC551X1: DSC 10- Clinical Nutrition Therapy IV- Critical Care Nutrition and Palliative care**

**Full marks: 25**

#### **Learning Objectives:**

LO1: Calculate metabolic requirements and design EN/PN protocols for patients in catabolic stress or organ failure.

LO2: Evaluate ethical frameworks and symptom-led nutrition strategies for end-of-life and palliative care.

#### **Course Outcomes (CO):**

CO1: Implement targeted nutrition support (Enteral/Parenteral) while monitoring for complications like refeeding syndrome.

CO2: Counsel families on ethical feeding decisions and manage nutrition-related symptoms (e.g., dysphagia, anorexia) in terminal illness.

#### **Course content:**

##### **Critical Care Nutrition**

Nutrition screening and assessment in critically ill patients

Determination of energy, protein and fluid requirements

Enteral and parenteral nutrition: indications and monitoring

Nutrition intervention during catabolic stress and organ dysfunction

Monitoring outcomes and complications of nutrition support

##### **Palliative Care Nutrition**

Principles and goals of nutrition in palliative care

Symptom-focused nutrition intervention

Ethical considerations in feeding and nutrition support

Nutrition counseling for patients and caregivers

#### **Suggested reading:**

1. Textbook of Critical Care Nutrition. Editor: Endorsed by ISPEN (Indian Society for Parenteral and Enteral Nutrition). Edition: 1st Edition (2024/2025), Jaypee Brothers Medical Publishers

## **CNDC551X8: DSC 10P- Clinical Nutrition Therapy IV- Critical Care Nutrition and Palliative care**

**Full marks: 25**

### **Course content:**

Diet planning and nutrition support strategies for critically ill patients including enteral and parenteral feeding.  
Assessment of energy, protein, and fluid requirements with monitoring of outcomes and complications.  
Menu planning and symptom-based nutrition care in palliative conditions.  
Nutrition counseling and ethical considerations for patients and caregivers in supportive care.

### **CO–PO–PSO Mapping (High/Medium/Low)**

CO	PO1	PO2	PO3	PSO1	PSO2	PSO3	PSO4
CO1	H	H	M	H	H	M	L
CO2	M	M	H	M	L	L	M

## **CNDC552X0: DSC 11- Public Health and Nutritional Health Education and Policies Full marks: 50**

### **Learning Objectives:**

LO1: Analyze the determinants of community health and the structural delivery of healthcare systems in India.  
LO2: Design nutrition education and communication strategies to combat undernutrition, "hidden hunger," and food insecurity at the population level.

### **Course Outcomes (CO):**

CO1: Evaluate vital statistics and health indicators to identify public health priorities and undernutrition trends.  
CO2: Formulate nutrition education interventions using appropriate tools and communication aids for diverse community groups.  
CO3: Appraise national nutrition policies and food security initiatives to align clinical practice with governmental health goals.

### **Course content:**

#### **Concepts and scope of public health nutrition**

Health – Definition, dimensions, determinants and indicators

Vital statistics

National Health Care Delivery System - Health care of the community, Health care systems

Public Health Aspects of Undernutrition - Public health implications and preventive strategies for:  
PEM/CED and “Hidden hunger”

#### **Nutrition education in public health**

Nutrition education strategies

Nutrition communication

Tools and aids in Nutrition education

**Programmes and policies**

National nutrition programs and policies

Food and nutrition security initiatives

**Suggested reading:**

1. Public Health Nutrition. Author: Dr. B. Srilakshmi. Edition: 1st or 2nd Edition (New Age International)
2. Nutrition Science. Author: B. Srilakshmi. Edition: 8th Edition

**CO–PO–PSO Mapping (High/Medium/Low)**

CO	PO1	PO2	PO3	PSO1	PSO2	PSO3	PSO4
CO1	H	H	L	H	M	L	H
CO2	M	M	H	L	L	M	H
CO3	H	M	M	L	M	M	H

**CNDO553VC: Research project/ Dissertation****Full marks: 100****Learning Objectives:**

LO1: To develop advanced skills in literature review, hypothesis formulation, and experimental design in clinical nutrition.

LO2: To perform systematic data collection, statistical analysis (nutrimetrics), and academic reporting.

**Course Outcomes (CO):**

CO1: Execute an independent research study using appropriate biomarkers and clinical research methodology.

CO2: Synthesize research findings into a scientific dissertation and communicate results through viva-voce or publication.

**Course content:** Identification of research problem, literature review, hypothesis testing, data collection, statistical analysis, and thesis compilation.

**CO–PO–PSO Mapping (High/Medium/Low)**

CO	PO1	PO2	PO3	PSO1	PSO2	PSO3	PSO4
CO1	H	H	L	H	H	M	M
CO2	M	M	H	H	M	L	H

**CNDO554VC: Internship/Capstone project/ Applied Field or Industry project/ Innovation and Incubation/Entrepreneurship/Start-up Proposal or Practice****Full marks: 50****Learning Objectives:**

LO1: To gain hands-on professional experience in hospital, industry or startup environments.

LO2: To foster entrepreneurial thinking in the development of nutritional products or services.

**Course Outcomes (CO):**

CO1: Apply clinical nutrition principles and dietary management in a real-world hospital or industry setting.

CO2: Develop a business proposal or project report demonstrating innovation, ethics and professional communication.

**Course content:** Clinical case management, industrial process observation, market survey for food products and development of a startup business model.

**CO–PO–PSO Mapping (High/Medium/Low)**

CO	PO1	PO2	PO3	PSO1	PSO2	PSO3	PSO4
CO1	M	H	M	M	H	H	M
CO2	L	M	H	L	L	M	H

**CNDO555VC: Intellectual Property Right (IPR) Skill Enhanced Course  
Preparation of smart food and common therapeutic food** **Full marks: 25**

**Learning Objectives:**

LO1: To understand the fundamentals of patents, copyrights, and GI tags related to food innovations.

LO2: To develop skills in formulating "smart foods" (functional foods) and therapeutic diets with commercial potential.

**Course Outcomes (CO):**

CO1: Identify IPR requirements for protecting novel food formulations and therapeutic products.

CO2: Design smart food prototypes (e.g., low-GI or protein-enriched) that comply with food laws and hygiene standards.

**Course content:** Basics of patents and trademarks, formulation of functional "smart" foods and processing techniques for specialized therapeutic diets.

**CO–PO–PSO Mapping (High/Medium/Low)**

CO	PO1	PO2	PO3	PSO1	PSO2	PSO3	PSO4
CO1	L	L	M	L	L	M	H
CO2	H	M	M	H	M	H	M

