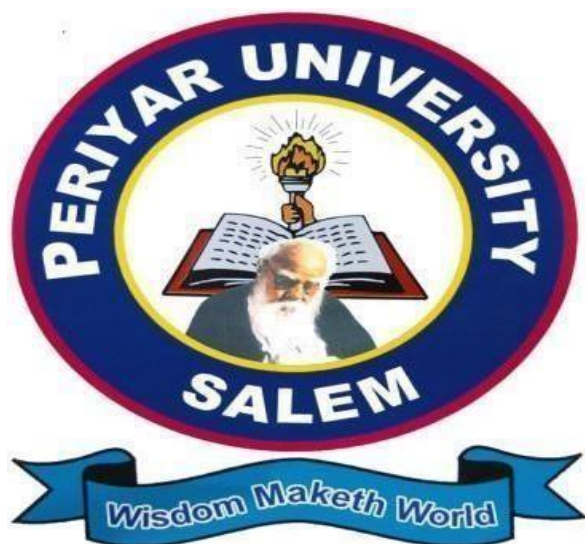


PERIYAR UNIVERSITY
SALEM-636011.



DEGREE OF MASTER OF SCIENCE

CHOICE BASED CREDIT SYSTEM

Syllabus for
M.Sc. NUTRITION AND DIETETICS
(SEMESTER PATTERN)

(For Candidates admitted in the Colleges affiliated to Periyar
University from 2026-2027 onwards)

REGULATIONS

1. Preamble:

The **Master of Science (M.Sc.) in Nutrition and Dietetics** is a postgraduate programme designed in accordance with the **Learning Outcomes-based Curriculum Framework (LOCF)** to prepare graduates with advanced knowledge, practical competencies, research aptitude, and professional skills in the fields of nutrition, dietetics, food science, and public health. The programme integrates fundamental and applied aspects of nutritional sciences with evidence-based practice to address contemporary nutritional and health challenges at the individual, community, and clinical levels.

The curriculum emphasizes interdisciplinary learning through advanced courses in nutritional biochemistry, clinical nutrition, therapeutic dietetics, public health nutrition, food safety, nutritional assessment, research methodology, biostatistics, and laboratory techniques. It provides hands-on training in biochemical analysis, dietary assessment, anthropometric measurements, clinical diagnostics, and nutritional counselling, enabling students to translate scientific knowledge into effective nutrition care and health promotion.

Aligned with the principles of the LOCF, the programme focuses on clearly defined learning outcomes that promote critical thinking, analytical reasoning, problem-solving, ethical practice, communication, leadership, and lifelong learning. Students are encouraged to undertake research projects, seminars, internships, and community-based interventions that strengthen their ability to generate evidence, evaluate nutritional problems, and develop sustainable solutions for improving health and nutritional well-being.

Graduates of the programme will be equipped to pursue careers as **clinical dietitians, nutrition consultants, public health nutritionists, research scientists, food and nutrition educators, quality assurance professionals, wellness consultants, and academic faculty** in hospitals, healthcare institutions, research organizations, universities, government agencies, food industries, and non-governmental organizations. The programme also provides a strong academic foundation for doctoral studies and advanced research in nutrition and allied health sciences.

Through a balanced combination of theoretical knowledge, practical laboratory training, clinical exposure, research experience, and professional ethics, the M.Sc. Nutrition and Dietetics programme aims to develop competent,

innovative, and socially responsible nutrition professionals capable of contributing to national and global health, food security, and sustainable development.

Programme Objectives (POB)

The programme aims to:

1. **Provide advanced knowledge** in nutrition, dietetics, clinical nutrition, nutritional biochemistry, and public health nutrition.
2. **Develop practical, clinical, and laboratory skills** for nutritional assessment, biochemical analysis, therapeutic diet planning, and patient care.
3. **Enhance research and analytical abilities** through research methodology, biostatistics, and evidence-based practice to solve nutrition-related problems.
4. **Prepare competent and ethical professionals** with leadership, communication, and lifelong learning skills for careers in healthcare, academia, research, public health, and the food industry.

Highlights of the Revamped Curriculum

1. **LOCF-Based Curriculum** with clearly defined learning outcomes, competency-based education, and continuous assessment.
2. **Advanced Clinical and Laboratory Training** in nutritional assessment, clinical biochemistry, therapeutic dietetics, and diagnostic techniques.
3. **Research and Evidence-Based Learning** through research methodology, biostatistics, dissertation work, seminars, and scientific writing.
4. **Interdisciplinary and Industry-Oriented Approach** integrating nutrition, food science, public health, clinical practice, and food service management.
5. **Skill Development and Employability** through hands-on practicals, clinical postings, internships, case studies, and nutrition counselling.
6. **Innovation, Entrepreneurship, and Digital Learning** with emphasis on food product development, nutrition entrepreneurship, ICT-enabled learning, and professional ethics.

2. Eligibility for Admission

An under graduate degree in Food and Nutrition/ Nutrition and Dietetics/ Food science and Nutrition/ Clinical nutrition and Dietetics/ Nutrition, Food service management and Dietetics/ Home Science.(Kindly refer to the updated university eligibility criteria)

3. Duration of the program

Two academic years consisting of 4semesters

4. Examinations

There shall be four examinations by adhering semester pattern - two in the first year, and two in the second year. Candidates failing in any subject / subjects

will be permitted to appear for such failed courses at subsequent examinations. The Syllabus has been divided into four semesters. Examinations for I and III semesters will be held in November/ December and for II and IV semesters will be held in April / May.

Requirement to appear for the examination: A candidate shall be permitted to appear for the university examinations for any semester (practical/theory) if he / she secure not less than 75% of attendance in the number of working days during the semester.

5. Passing Minimum

A candidate shall be declared to have passed the examination in a **theory or practical** course if he/she secures **not less than 50% marks in the University (External) Examination and not less than 50% marks in the Internal Assessment (Continuous Internal Assessment)** for that course.

6. Classification of Successful Candidates

Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in First Class. All other successful candidate shall be declared to have passed in the Second Class. Candidates who obtain 75% of the marks in the aggregate shall be deemed to have passed the examination in the First Class with Distinction provided they pass all the examinations prescribed for the course at the first appearance. Candidates who pass all the examinations prescribed for the course in the first instance and within a period of two academic years from the year of admission to the course only are eligible for University Ranking.

7. Maximum Duration for the Completion of the Programme

The maximum duration for completion of the PG Programme shall not exceed Four Years from the year of admission.

8. Commencement of this Regulation

These regulations shall take effect from the academic year 2026-27, i.e. for students who are to be admitted to the first year of the course during the academic year 2026-27 and thereafter.

9. Pattern of Question Paper (Theory)

The following is the model question paper pattern for M.Sc. Nutrition and Dietetics

Time: 3 Hours

Maximum: 75 Marks

Part A: 15 x 1 = 15 (Multiple Choice) (Three questions from each unit)

Part B: 2 x 5 = 10 (Any Two questions) (One question from each unit)

Part C: 5 x 10 = 50 (One question from each unit with internal choice)

10. Evaluation Pattern for Internal Assessment

A. THEORY PAPERS

External Assessment (EA)		Internal Assessment (IA)	
75 Marks		25 Marks	
Component	Time	Total Marks	IA marks
Test I	2 hours	50	10
Test II	2 hours	50	10
Assignment(2)/Seminar/Problem based Activity		10	05
		Total	25

PASS PERCENTAGE

Passing minimum (Internal Assessment) 50%	12 marks
Passing minimum (External Assessment) 50%	38 marks
Total	50 marks

B. PRACTICALS

External Assessment (EA)		Internal Assessment (IA)	
60 Marks		40 Marks	
Component	Time	Total Marks	IA marks
Practical Test I	3 hours	50	15
Practical Test II	3 hours	50	15
Record / Filled in Manual			05
Attendance / Performance Evaluation of the Experiments during the Conduct of the Course			05
Total			40

PASS PERCENTAGE

Passing minimum (Internal Assessment) 50%	20 marks
Passing minimum (External Assessment) 40%	30 marks
Total	50 marks

PROJECT EVALUATION

External Assessment (EA)	Internal Assessment (IA)
75 Marks	25 Marks

Programme Outcomes

Upon successful completion of the M.Sc. Nutrition and Dietetics programme, graduates will be able to:

PO1: Advanced Knowledge in Nutrition and Dietetics

Demonstrate comprehensive and advanced knowledge of human nutrition, nutritional biochemistry, clinical nutrition, public health nutrition, food science,

functional foods, nutraceuticals, and emerging areas of nutrition science for professional practice and research.

PO2: Critical Thinking and Problem Solving

Analyze, evaluate, and solve complex nutrition and health-related problems using scientific principles, evidence-based approaches, and interdisciplinary knowledge to improve nutritional well-being at individual and community levels.

PO3: Professional Competency in Nutritional Assessment and Diet Planning

Apply advanced nutritional assessment techniques, dietary evaluation methods, counseling strategies, and therapeutic diet planning skills to promote health, prevent diseases, and manage clinical conditions.

PO4: Research and Innovation

Design, conduct, interpret, and communicate research using appropriate research methodologies, biostatistical tools, and scientific approaches to generate innovative solutions in nutrition, food science, and public health.

PO5: Leadership and Management Skills

Demonstrate leadership, managerial, organizational, and decision-making skills in clinical nutrition services, food service institutions, public health programmes, community interventions, and multidisciplinary healthcare settings.

PO6: Communication and Professional Ethics

Communicate effectively with individuals, communities, healthcare professionals, policymakers, and stakeholders while adhering to professional ethics, legal standards, and social responsibilities in nutrition and dietetics practice.

PO7: Sustainability and Community Engagement

Promote sustainable food systems, nutrition-sensitive interventions, food security, environmental responsibility, and community participation for improving public health and nutritional outcomes.

PO8: Entrepreneurship and Lifelong Learning

Develop entrepreneurial competencies, innovation skills, and a commitment to lifelong learning for establishing nutrition-related enterprises, adopting emerging technologies, and advancing professional growth in nutrition and dietetics.

Programme Specific Outcomes

Upon successful completion of the programme, graduates will be able to:

PSO1: Clinical and Community Nutrition Practice

Assess nutritional status, formulate therapeutic diets, provide nutrition counseling, and implement evidence-based nutrition interventions for disease prevention, treatment, and health promotion in clinical and community settings.

PSO2: Food Science, Functional Foods and Research Applications

Apply advanced knowledge of food science, food processing, nutraceuticals, functional foods, nutritional biochemistry, and research methodologies for product development, quality evaluation, and scientific investigation.

PSO3: Nutrition Entrepreneurship and Professional Development

Develop and manage nutrition consultancy services, food and nutraceutical enterprises, wellness programmes, and innovative nutrition-based startups while demonstrating professional competence and leadership.

- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level
- Remember and Understand – Low Level

K-Level Descriptors (Bloom's Revised Taxonomy) for M.Sc. Nutrition and Dietetics .

K-Level	Cognitive Level	Description
K1	Remember	Recall, identify, define, and list fundamental concepts, principles, terminology, nutrients, laboratory methods, and clinical guidelines in nutrition and dietetics.
K2	Understand	Explain, describe, classify, interpret, and summarize concepts related to nutritional biochemistry, clinical nutrition, public health nutrition, food science, and therapeutic dietetics.
K3	Apply	Apply nutritional knowledge, laboratory techniques, dietary assessment methods, therapeutic diet planning, and clinical skills to solve practical nutrition and health problems.
K4	Analyze	Analyze nutritional status, biochemical data, dietary patterns, clinical cases, research findings, and laboratory reports to identify nutrition-related problems and formulate evidence-based conclusions.
K5	Evaluate	Critically evaluate scientific literature, nutritional interventions, research outcomes, clinical practices, and public health nutrition programmes to make informed professional decisions.
K6	Create	Design and develop research projects, nutrition care plans, innovative food products, public health interventions, educational programmes, and evidence-based strategies to improve nutritional health.

M.Sc. Nutrition and Dietetics

The following **teaching–learning methods** are recommended under the **Learning Outcomes-based Curriculum Framework (LOCF)**:

1. **Interactive Lectures** – Concept-based teaching using ICT-enabled classrooms and multimedia presentations.
2. **Laboratory Practicals** – Hands-on training in nutritional biochemistry, food analysis, and clinical laboratory techniques.
3. **Clinical Postings and Hospital Training** – Exposure to patient assessment, therapeutic diet planning, and nutrition care processes.
4. **Case-Based Learning** – Analysis and discussion of clinical and community nutrition case studies.
5. **Seminars and Student Presentations** – Development of scientific communication, critical thinking, and presentation skills.
6. **Journal Club and Literature Review** – Critical appraisal of recent research articles and evidence-based nutrition practices.
7. **Problem-Based Learning (PBL)** – Solving real-life nutrition, dietetics, and public health problems through analytical approaches.
8. **Research Projects and Dissertation** – Training in research methodology, data analysis, scientific writing, and ethical research practices.
9. **Field Visits and Community-Based Learning** – Visits to hospitals, food industries, research laboratories, community nutrition programmes, and public health organizations.
10. **Workshops, Guest Lectures, and Expert Talks** – Interaction with professionals from academia, healthcare, research, and the food industry.
11. **Group Discussions and Collaborative Learning** – Team-based activities to enhance communication, leadership, and decision-making skills.

These teaching methods help students acquire knowledge, develop practical skills, strengthen research ability, improve critical thinking, and promote lifelong learning.

CREDIT DISTRIBUTION FOR PG PROGRAMME											
Sem I	C	H	Sem II	C	H	Sem III	C	H	Sem IV	C	H
Core Theory-1	4	4	Core Theory-4	5	6	Core Theory-7	5	5	Core Theory-10	5	6
Core Theory- 2	4	5	Core Theory- 5	5	6	Core Theory- 8	5	6	Core Project	5	14
Core Theory-3	5	5	Core Theory-6	5	5	Core Theory-9	5	5	Elective Theory –1	3	6
Core Practical-1	3	5	Core Practical-3	4	5	Core Practical-4	3	5	SEC II	2	4
Core Practical-2	3	5	Elective Theory –2	3	4	Core Practical-5	3	5	E A	1	-
Elective Theory –1	3	4	HR	2	2	Elective Theory –1	3	4			
SEC-1	2	2	NMEC	2	2	Internship	2	-			
	24	30		26	30		26	30		16	30

M.Sc., NUTRITION & DIETETICS

SEMESTER – I

Course status	Course Title	Credits	Hours
Core Theory-1	Advanced Human Nutrition	4	4
Core Theory- 2	Nutritional Bio Chemistry	4	5
Core Theory-3	Advanced Food Science	5	5
Core Practical-1	Food Analysis Practical	3	5
Core Practical-2	Nutritional Biochemical Techniques Practical	3	5
Elective Theory –1	A. Maternal and Child Nutrition Or B. Principles of Food Service Management	3	4
SEC-1	Communication and Counseling Skills for Nutrition	2	2
	Total	24	30

SEMESTER – II

Course status	Course Title	Credits	Hours
Core Theory-4	Clinical Nutrition and Diet Therapy – I	5	6
Core Theory- 5	Research Methodology and Biostatistics	5	6
Core Theory-6	Food Product Development and Innovation	5	5
Core Practical-3	Food Product Development and Sensory Evaluation Practical	4	5
Elective Theory –2	A. Food Safety and Quality Assurance Or B. Quantity Food Production Management	3	4
HR	Human Rights	2	2
NMEC	Fundamentals of Nutrition and Healthy Living (offered to other departments)	2	2
		26	30

SEMESTER – III

Course status	Course Title	Credits	Hours
Core Theory-7	Clinical Nutrition and Diet Therapy II	5	5
Core Theory- 8	Nutraceuticals and Functional Foods	5	6
Core Theory-9	Public Health Nutrition	5	5
Core Practical-4	Clinical Nutrition and Diet Therapy Practical	3	5
Core Practical-5	Food Quality Control Practical	3	5
Elective Theory –3	A.Sports Nutrition Or B. Institutional Food Service Management	3	4
Internship	Internship Training Report (Summer vacation at the end of II semester activity)	2	-
		26	30

SEMESTER – IV

Course status	Course Title	Credits	Hours
Core Theory-10	Advanced Food Processing Technologies	5	6
Core Project	Project and Viva Voce	5	14
Elective Theory –4	A. Geriatric Nutrition and Care Or B. Digital Food Service and E-Commerce Management	3	6
SEC II	Start-up Development in Nutrition and Dietetics	2	4
E A	Extension Activity	1	-
		16	30

Course of Study and Scheme of Examination													
S.N o.	S E M	Paper Code	Cours e Group	Paper Type	Subject Title	C	H W	E H	I M	E M	Total Marks	Pag e No	
1	I		Core	Theory	Advanced Human Nutrition	4	4	3	25	75	100	13	
2	I		Core	Theory	Nutritional Bio Chemistry	4	5	3	25	75	100	16	
3	I		Core	Theory	Advanced Food Science	5	5	3	25	75	100	19	
4	I		Core	Practical	Food Analysis Practical	3	5	3	40	60	100	22	
5	I		Core	Practical	Nutritional Biochemical Techniques Practical	3	5	3	40	60	100	24	
6	I		Elective	Theory	A. Maternal and Child Nutrition Or B. Principles of Food Service Management	3	4	3	25	75	100	26 29	
7	I				SEC	Theory	Communication and Counseling Skills for Nutrition	2	2	3	25	75	100
8	II		Core	Theory	Clinical Nutrition and Diet Therapy – I	5	6	3	25	75	100	35	
9	II		Core	Theory	Research Methodology and Biostatistics	5	6	3	25	75	100	38	
10	II		Core	Theory	Food Product Development and Innovation	5	5	3	25	75	100	41	
11	II		Core	Practical	Food Product Development and Sensory Evaluation Practical	4	5	3	40	60	100	44	
12	II		Elective	Theory	A. Food Safety and Quality Assurance Or B. Quantity Food Production Management	3	4	3	25	75	100	47 50	
13	II				HR	Theory	Human Rights	2	2	3	25	75	100
14	II		NMEC	Theory	Fundamentals of Nutrition and Healthy Living (offered to other departments)	2	2	3	25	75	100	53	
15	III		Core	Theory	Clinical Nutrition and Diet Therapy II	5	5	3	25	75	100	54	
16	III		Core	Theory	Nutraceuticals and Functional Foods	5	6	3	25	75	100	57	
17	III		Core	Theory	Public Health Nutrition	5	5	3	25	75	100	60	

18	III		Core	Practical	Clinical Nutrition and Diet Therapy Practical	3	5	3	40	60	100	63
19	III		Core	Practical	Food Quality Control Practical	3	5	3	40	60	100	65
20	III		Elective	Theory	A.Sports Nutrition Or B. Institutional Food Service Management	3	4	3	25	75	100	67 70
21	III		Internship	Training Report	Summer vacation at the end of II semester activity	2	-	Commended/Highly Commended				73
22	IV		Core	Theory	Advanced Food Processing Technologies	5	6	3	25	75	100	74
23	IV		Core	Theory	Project and Viva Voce	5	14	3	25	75	100	77
24	IV		Elective	Theory	A. Geriatric Nutrition and Care Or B. Digital Food Service and E-Commerce Management	3	6	3	25	75	100	78 81
25	IV		SEC	Theory	Start-up Development in Nutrition and Dietetics	2	4	3	25	75	100	84
26	IV		-	-	Extension Activity	1	-	-	-	-	-	
C-Credits HW -Hours per Week EH -Exam Hours IM –Internal Marks EM -External Marks												

Syllabus

Semester I	Core Theory -Advanced Human Nutrition
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Course Objectives :

- Acquire advanced knowledge of nutrient metabolism, physiological functions, and nutritional requirements throughout the life cycle.
- Analyze the biochemical, molecular, and physiological roles of macro- and micronutrients in health and disease.
- Apply evidence-based nutritional concepts in clinical practice, research, and public health nutrition.

UNIT I: Advanced Concepts of Energy Metabolism and Carbohydrates

Principles of human nutrition and nutrient functions. Energy balance, energy expenditure, and energy homeostasis. Components of energy expenditure: Basal Metabolic Rate (BMR), Resting Metabolic Rate (RMR), Thermic Effect of Food (TEF), and Physical Activity Level (PAL). Measurement of energy expenditure: Direct and indirect calorimetry.

Carbohydrates: Classification, digestion, absorption, transport, and metabolism. Glycolysis, glycogenesis, glycogenolysis, gluconeogenesis, and pentose phosphate pathway (overview). Glycemic Index (GI), Glycemic Load (GL), resistant starch, dietary fibre, and prebiotics. Carbohydrates in metabolic disorders and chronic diseases.

UNIT II: Advanced Protein Nutrition

Structure, classification, and biological functions of proteins. Digestion, absorption, transport, and metabolism of proteins. Amino acid metabolism: Transamination, deamination, decarboxylation, and urea cycle. Essential, non-essential, conditionally essential, and functional amino acids. Protein quality assessment: BV, NPU, PER, PDCAAS, and DIAAS. Nitrogen balance and protein turnover. Protein requirements during growth, pregnancy, lactation, ageing, sports, and disease conditions. Protein-energy malnutrition and metabolic adaptations.

UNIT III: Advanced Lipid Nutrition

Classification, chemistry, and physiological functions of lipids. Digestion, absorption, transport, and metabolism of lipids. Lipoprotein metabolism and reverse cholesterol transport. Essential fatty acids and metabolism of Omega-3 and Omega-6 fatty acids.

Medium-chain triglycerides (MCTs) and structured lipids. Bioactive lipids and eicosanoids. Trans fatty acids and their health implications. Lipids in cardiovascular diseases, obesity, diabetes, and inflammation.

UNIT IV: Advanced Vitamin Nutrition

Classification, chemistry, absorption, transport, storage, metabolism, and bioavailability of vitamins. Fat-soluble vitamins (A, D, E, and K):

Metabolism and physiological functions. Molecular mechanisms of action.

Vitamin D endocrinology and calcium homeostasis. Vitamin E as an antioxidant.

Vitamin K in coagulation and bone metabolism. Water-soluble vitamins:

B-complex vitamins as coenzymes in energy metabolism. Vitamin C in collagen synthesis, antioxidant defense, and immunity. Vitamin deficiencies, toxicities, nutrient interactions, and recent advances in vitamin research.

UNIT V: Advanced Mineral Nutrition

Major Minerals

Classification, absorption, transport, bioavailability, homeostatic regulation, and physiological functions.

Calcium: Bone metabolism, osteoporosis, hormonal regulation.

Phosphorus: Metabolism and physiological significance.

Magnesium: Enzyme activation and metabolic functions.

Trace Minerals

Iron: Absorption, transport, storage, hepcidin regulation, iron deficiency, and iron overload.

Zinc: Metabolism, immunity, growth, antioxidant functions, and zinc-dependent enzymes.

Copper: Metabolism, physiological functions, deficiency, and toxicity.

Selenium: Glutathione peroxidase activity and antioxidant defense.

Manganese: Enzyme activation and metabolism.

Chromium: Insulin action and glucose metabolism.

Molybdenum: Cofactor functions and metabolism.

Cobalt: Role in Vitamin B₁₂ metabolism and hematopoiesis.

Text Books

1. **Gropper, S.S. & Smith, J.L.** (2021). *Advanced Nutrition and Human Metabolism* (8th Edition). Cengage Learning.
2. **Mahan, L.K. & Raymond, J.L.** (2024). *Krause's Food & the Nutrition Care Process* (16th Edition). Elsevier.
3. **Gibney, M.J., Lanham-New, S.A., Cassidy, A. & Vorster, H.H.** (2020). *Introduction to Human Nutrition* (3rd Edition). Wiley-Blackwell.
4. **Satyanarayana, U. & Chakrapani, U.** (2023). *Biochemistry*. Elsevier.

Reference Books

1. **Shils, M.E., Shike, M., Ross, A.C., Caballero, B. & Cousins, R.J.** *Modern Nutrition in Health and Disease*. Lippincott Williams & Wilkins.
2. **Whitney, E. & Rolfes, S.R.** *Understanding Nutrition*. Cengage Learning.
3. **Wardlaw, G.M., Smith, A.M. & Collene, A.L.** *Contemporary Nutrition*. McGraw-Hill Education.
4. **Gibson, R.S.** *Principles of Nutritional Assessment*. Oxford University Press.

E-Learning Resources

1. [SWAYAM](#) – Online postgraduate courses in nutrition and health sciences.
2. [NPTEL](#) – Video lectures on nutrition, biochemistry, and food science.
3. [e-PG Pathshala](#) – UGC postgraduate e-content in Food Science and Nutrition.
4. [National Digital Library of India \(NDLI\)](#) – Digital repository of books, journals, and learning resources.

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the digestion, absorption, metabolism, physiological functions, and nutritional significance of macro- and micronutrients in human health.	K2
CO2	Apply the principles of nutrient metabolism and dietary recommendations to assess nutritional requirements across different physiological conditions.	K3
CO3	Analyze the biochemical and physiological roles of nutrients in maintaining health and preventing nutrition-related disorders.	K4
CO4	Evaluate current evidence on vitamin and mineral nutrition, nutrient interactions, and their role in disease prevention and management.	K5
CO5	Formulate evidence-based nutritional strategies for promoting health and managing nutritional problems using advanced concepts of human nutrition.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	2	2	2	–	–	2	1–	–	3	2	2
CO2	3	3	2	1	–	–	–	–	3	2	–
CO3	3	3	3	2	1	–	–	2	3	3	1
CO4	3	3	3	3	2	1	2	–	3	3	2
CO5	3	3	3	3	3	2	1	1	3	3	3

Semester I	Core Theory -Nutritional Biochemistry
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Course Objectives

- To understand the biochemical composition, structure, and functions of biomolecules in human nutrition.
- To explain metabolic pathways and their regulation in normal and altered physiological conditions.
- To apply biochemical principles in understanding nutritional disorders and therapeutic nutrition.

UNIT I: Cell Biology and Biomolecules

Cell structure and functions.

Biomolecules: carbohydrates, proteins, lipids, nucleic acids.

Biological membranes and membrane transport.

Water and electrolyte balance. Acid-base balance and pH regulation.

UNIT II: Carbohydrate Biochemistry

Structure and classification of carbohydrates. Digestion and absorption of carbohydrates. Glycolysis, TCA cycle, Glycogenesis and Glycogenolysis. Gluconeogenesis and Pentose Phosphate Pathway. Hormonal regulation of carbohydrate metabolism. Biochemical basis of diabetes mellitus.

UNIT III: Protein and Amino Acid Biochemistry

Structure and classification of proteins. Digestion, absorption, and metabolism of proteins. Amino acid metabolism. Transamination, deamination, and decarboxylation. Urea cycle. Inborn errors of amino acid metabolism.

UNIT IV: Lipid Biochemistry

Structure and classification of lipids. Digestion, absorption, and transport of lipids. Fatty acid oxidation and synthesis. Ketogenesis and ketolysis. Cholesterol synthesis and metabolism. Lipoproteins and dyslipidemia.

UNIT V: Vitamins, Minerals and Clinical Biochemistry

Biochemical functions of vitamins. Coenzyme functions of B-complex vitamins.

Mineral metabolism and biochemical significance. Antioxidants and oxidative stress. Biochemical markers in nutritional assessment. Clinical biochemistry of nutritional disorders.

Text Books

1. **Rodwell, V.W., Bender, D.A., Botham, K.M., Kennelly, P.J. & Weil, P.A.**Harper's Illustrated Biochemistry (32nd Edition).**Publisher:** McGraw-Hill Education.
2. **Satyanarayana, U. & Chakrapani, U.**Biochemistry (6th Edition).**Publisher:** Elsevier India Pvt. Ltd.
3. **Nelson, D.L. & Cox, M.M.**Lehninger Principles of Biochemistry (8th Edition).**Publisher:** W.H. Freeman and Company.
4. **Vasudevan, D.M., Sreekumari, S. & Vaidyanathan, K.**Textbook of Biochemistry for Medical Students (10th Edition).**Publisher:** Jaypee Brothers Medical Publishers.

Reference Books

1. **Devlin, T.M.**Textbook of Biochemistry with Clinical Correlations (8th Edition).
Publisher: Wiley-Blackwell.
2. **Lieberman, M. & Marks, A.D.**Marks' Basic Medical Biochemistry: A Clinical Approach (6th Edition).**Publisher:** Wolters Kluwer.
3. **Ferrier, D.R.**Lippincott Illustrated Reviews: Biochemistry (8th Edition).
Publisher: Wolters Kluwer.
4. **Shils, M.E., Shike, M., Ross, A.C., Caballero, B. & Cousins, R.J.**Modern Nutrition in Health and Disease (12th Edition).**Publisher:** Lippincott Williams & Wilkins.
5. **Marshall, W.J., Lapsley, M., Day, A.P. & Ayling, R.M.**Clinical Biochemistry: Metabolic and Clinical Aspects (4th Edition).**Publisher:** Elsevier.

E-Learning Resources

1. [NPTEL \(National Programme on Technology Enhanced Learning\)](#)
Online courses on Biochemistry, Human Physiology, Food Science, and Nutrition.
2. [SWAYAM \(Study Webs of Active Learning for Young Aspiring Minds\)](#)
Government of India online learning platform offering postgraduate courses in Life Sciences, Nutrition, and Biochemistry.
3. [National Digital Library of India \(NDLI\)](#)
Digital repository providing access to textbooks, research papers, theses, journals, and educational resources.
4. [PubMed](#)
National Library of Medicine database for biomedical and nutrition research articles.
5. [The Nutrition Society](#)
Educational resources, scientific publications, webinars, conferences, and professional development in nutrition science.
6. [FAO E-Learning Academy](#)
Free online courses on food security, nutrition, sustainable food systems, public health nutrition, and agriculture.

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the structure and functions of biomolecules and their role in human nutrition.	K2
CO2	Analyze carbohydrate metabolic pathways and their regulation in health and disease.	K4
CO3	Evaluate protein and amino acid metabolism and their significance in nutritional disorders.	K5
CO4	Assess lipid metabolism and its implications in chronic diseases.	K5
CO5	Apply biochemical principles to interpret nutritional assessment and clinical nutrition problems.	K3

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	2	2	-
CO2	3	3	3	2	-	-	-	-	2	3	1
CO3	3	3	3	2	-	-	-	-	2	3	1
CO4	3	3	3	2	-	-	-	-	2	3	1
CO5	3	3	3	3	1	1	1	2	3	3	2

Semester I	Core Theory -Advanced Food Science
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Course Objectives

- To provide advanced knowledge of food composition, food chemistry, and physicochemical properties of foods.
- To understand the functional characteristics and interactions of food constituents in complex food systems.
- To evaluate the scientific basis of food quality, functionality, and innovative food applications.

UNIT I: Food Structure, Composition and Physicochemical Properties

Advanced concepts and scope of food science. Food structure and food matrix. Physicochemical properties of foods. Water activity, moisture sorption isotherms, and food stability. Colloidal systems: emulsions, foams, sols, gels, and dispersions. Rheological properties and texture of foods. Functional properties of carbohydrates, proteins, and lipids.

UNIT II: Food Chemistry and Ingredient Interactions)

Chemistry of carbohydrates during food preparation. Protein chemistry: denaturation, coagulation, gelation, and Maillard reaction. Lipid chemistry: oxidation, hydrolysis, rancidity, and antioxidants. Pigments and colour changes in foods. Flavour chemistry and aroma compounds. Enzymatic and non-enzymatic browning. Ingredient interactions affecting food quality and stability.

UNIT III: Functional Properties of Food Constituents

Functional characteristics of cereal proteins and starches. Functional properties of milk and dairy proteins. Functional properties of egg proteins. Functional properties of meat proteins. Fruits and vegetables as functional ingredients. Dietary fibre and resistant starch. Hydrocolloids, gums, stabilizers, and food emulsifiers.

UNIT IV: Food Analysis and Instrumental Techniques

Principles of food analysis. Proximate composition analysis. Instrumental methods for food quality evaluation. Spectroscopic techniques in food analysis. Chromatographic techniques (HPLC, GC) in food analysis. Thermal analysis of foods. Texture profile analysis and colour measurement.

UNIT V: Emerging Concepts in Food Science

Foodomics and food metabolomics. Precision nutrition and personalized foods. Bioavailability and bioaccessibility of nutrients. Functional food

ingredients and novel food matrices. Sustainable food systems and future foods. Artificial intelligence and digital technologies in food science. Recent advances and future perspectives in food science.

Text Books

1. **Damodaran, S., Parkin, K.L. & Fennema, O.R.** *Fennema's Food Chemistry* (5th Edition). **CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.**
2. **Belitz, H.D., Grosch, W. & Schieberle, P.** *Food Chemistry* (4th Revised Edition). **Springer-Verlag, Berlin Heidelberg, Germany.**
3. **Vaclavik, V.A. & Christian, E.W.** *Essentials of Food Science* (5th Edition). **Springer Science+Business Media, New York, USA.**
4. **Srilakshmi, B.** *Food Science* (7th Edition). **New Age International (P) Limited Publishers, New Delhi, India.**

Reference Books

1. **deMan, J.M., Finley, J.W., Hurst, W.J. & Lee, C.Y.** *Principles of Food Chemistry* (4th Edition). **Springer Science+Business Media, New York, USA.**
2. **Coulter, T.P.** *Food: The Chemistry of Its Components* (7th Edition). **Royal Society of Chemistry (RSC Publishing), Cambridge, UK.**
3. **Sun, D.-W.** *Modern Techniques for Food Authentication* (2nd Edition). **Academic Press, Elsevier, London, UK.**
4. **Ramaswamy, H.S. & Marcotte, M.** *Food Processing: Principles and Applications*. **CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.**
5. **Potter, N.N. & Hotchkiss, J.H.** *Food Science* (5th Edition). **Springer Science+Business Media, New York, USA.**

E-Learning Resources

1. **NPTEL – National Programme on Technology Enhanced Learning**
Website: <https://nptel.ac.in>
2. **SWAYAM – Study Webs of Active Learning for Young Aspiring Minds**
Website: <https://swayam.gov.in>
3. **e-PG Pathshala (UGC–INFLIBNET)**
Website: <https://epgp.inflibnet.ac.in>
4. **National Digital Library of India (NDLI)**
Website: <https://ndl.iitkgp.ac.in>
5. **Food and Agriculture Organization (FAO) E-Learning Academy**
Website: <https://elearning.fao.org>
6. **PubMed – National Library of Medicine, USA**
Website: <https://pubmed.ncbi.nlm.nih.gov>
7. **National Center for Biotechnology Information (NCBI)**
Website: <https://www.ncbi.nlm.nih.gov>
8. **Institute of Food Technologists (IFT)**
Website: <https://www.ift.org>

9. **International Union of Food Science and Technology (IUFoST)**

Website: <https://iufost.org>

10. **Food Safety and Standards Authority of India (FSSAI)**

Website: <https://www.fssai.gov.in>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the physicochemical properties, structure, and functional characteristics of food constituents.	K2
CO2	Apply the principles of food chemistry to interpret changes occurring during food preparation, processing, and storage.	K3
CO3	Analyze the interactions among food constituents and evaluate their influence on food quality, texture, stability, and functionality.	K4
CO4	Evaluate modern analytical techniques and emerging concepts for assessing food quality and functionality.	K5
CO5	Develop innovative approaches for improving food quality, functionality, and sustainable food systems using advanced food science principles.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	–	1	–	–	–	3	2	–
CO2	3	3	2	1	2	–	–	–	3	2	1
CO3	3	3	3	2	2	1	–	–	3	3	2
CO4	3	3	3	3	2	2	1	–	3	3	2
CO5	3	3	3	3	3	2	2	1	3	3	3

Course Objectives

- To develop practical skills in the qualitative and quantitative analysis of food constituents using standard laboratory techniques.
- To enable students to evaluate the nutritional composition, physicochemical properties, and quality of food samples.
- To familiarize students with modern analytical instruments and laboratory procedures used in food analysis.

Practical Exercises

1. Determination of Moisture Content.
2. Determination of Total Ash Content.
3. Estimation of Crude Fibre.
4. Estimation of Reducing Sugars.
5. Estimation of Total Sugars.
6. Estimation of Starch.
7. Estimation of Protein by Kjeldahl Method.
8. Estimation of Fat by Soxhlet Extraction Method.
9. Determination of Peroxide Value of Fats and Oils.
10. Determination of Iodine Value of Fats and Oils.
11. Determination of Saponification Value of Fats and Oils.
12. Determination of Acid Value of Fats and Oils.
13. Estimation of Vitamin C by Titrimetric Method.
14. Estimation of β -Carotene by Spectrophotometric Method.
15. Estimation of Calcium in Food Samples.
16. Estimation of Phosphorus in Food Samples.
17. Estimation of Iron in Food Samples.
18. Determination of pH and Titratable Acidity.
19. Spectrophotometric Analysis of Food Constituents (Demonstration).
20. Chromatographic Analysis of Food Components (Paper Chromatography/TLC/HPLC Demonstration).
21. Bomb Calorimeter – Determination of Energy Value of Foods (Demonstration).

Text Books

1. **S. Ranganna. *Handbook of Analysis and Quality Control for Fruit and Vegetable Products*.** Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. **S. Sadashivam and A. Manickam. *Biochemical Methods*** (3rd Edition). New Age International (P) Limited Publishers, New Delhi.

Reference Books

1. **AOAC International. *Official Methods of Analysis of AOAC International*** (21st Edition). AOAC International, Gaithersburg, Maryland, USA.

2. **S. Suzanne Nielsen.** *Introduction to Food Analysis*. Springer Nature, New York, USA.
3. **D.B. Min and S.S. Nielsen.** *Food Analysis Laboratory Manual* (3rd Edition). Springer Science+Business Media, New York, USA.
4. **Y.H. Hui (Ed.).** *Handbook of Food Science, Technology and Engineering*. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.

E-Learning Resources

1. **NPTEL – National Programme on Technology Enhanced Learning**
<https://nptel.ac.in>
2. **SWAYAM – Study Webs of Active Learning for Young Aspiring Minds**
<https://swayam.gov.in>
3. **e-PG Pathshala (UGC–INFLIBNET)**
<https://epgp.inflibnet.ac.in>
4. **National Digital Library of India (NDLI)**
<https://ndl.iitkgp.ac.in>
5. **AOAC International**
<https://www.aoac.org>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the principles and analytical methods used for the determination of food constituents and quality parameters.	K2
CO2	Perform standard laboratory techniques for the estimation of nutrients and physicochemical properties of foods.	K3
CO3	Analyze food samples and interpret analytical results for quality evaluation and nutritional assessment.	K4
CO4	Evaluate food quality using chemical and instrumental methods and interpret the analytical findings.	K5
CO5	Develop laboratory reports and recommend appropriate analytical procedures for food quality assessment.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	–	–	–	–	–	3	2	–
CO2	3	3	3	2	–	1	–	–	3	3	1
CO3	3	3	3	3	1	2	–	–	3	3	2
CO4	3	3	3	3	2	2	1	–	3	3	2
CO5	3	3	3	3	3	3	2	1	3	3	3

Semester I	Core Practical- Nutritional Biochemical Techniques Practical
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Course Objectives

1. To develop practical skills in biochemical analysis of blood, serum, urine, and food samples using standard laboratory techniques.
2. To understand the biochemical basis of metabolism through qualitative and quantitative analytical methods.
3. To interpret biochemical findings for nutritional assessment, clinical diagnosis, and research applications.

Practical Exercises

1. Estimation of Blood Glucose.
2. Estimation of Blood Haemoglobin.
3. Estimation of Serum Total Protein.
4. Estimation of Serum Albumin.
5. Estimation of Serum Total Cholesterol.
6. Estimation of Serum Iron.
7. Estimation of Serum Calcium.
8. Estimation of Serum Phosphorus.
9. Estimation of Urinary Creatinine.
10. Estimation of Urinary Urea.
11. Estimation of Urinary Total Nitrogen.
12. Estimation of Urinary Calcium.
13. Estimation of Urinary Phosphorus.
14. Qualitative Analysis of Urinary Glucose.
15. Qualitative Analysis of Urinary Protein.
16. Identification of Monosaccharides (Glucose, Fructose, Galactose, Mannose, and Ribose).
17. Identification of Disaccharides (Maltose, Lactose, and Sucrose).
18. Identification of Polysaccharides (Starch, Dextrin, and Glycogen).
19. Identification of an Unknown Carbohydrate Sample.
20. Identification of Individual Amino Acids (Tyrosine, Tryptophan, Arginine, Histidine, Cystine, and Methionine).
21. Identification of an Unknown Amino Acid Sample.
22. Spectrophotometric Estimation of Biomolecules (Demonstration).
23. Thin Layer Chromatography (TLC) of Biomolecules (Demonstration).
24. Electrophoresis of Serum Proteins (Demonstration).
25. Demonstration of ELISA Technique for Biochemical Analysis.

Text Books

1. Satyanarayana, U. & Chakrapani, U. *Biochemistry* (6th Edition). Elsevier India Pvt. Ltd., New Delhi.
2. Vasudevan, D.M., Sreekumari, S. & Vaidyanathan, K. *Textbook of Biochemistry for Medical Students* (10th Edition). Jaypee Brothers Medical Publishers (P) Ltd., New Delhi.

Reference Books

1. Sadasivam, S. & Manickam, A. *Biochemical Methods* (3rd Edition). New Age International (P) Ltd., New Delhi.
2. Tietz, N.W. *Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics* (8th Edition). Elsevier, St. Louis, USA.

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3. e-PG Pathshala (UGC-INFLIBNET Centre)
<https://epgp.inflibnet.ac.in>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the principles of biochemical analysis and laboratory techniques used in nutritional biochemistry.	K2
CO2	Perform qualitative and quantitative biochemical analyses of blood, serum, urine, carbohydrates, proteins, and amino acids.	K3
CO3	Analyze biochemical data for nutritional assessment and clinical interpretation.	K4
CO4	Evaluate laboratory findings using standard biochemical methods and quality control procedures.	K5
CO5	Develop laboratory reports and interpret biochemical investigations for clinical nutrition and research applications.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	—	—	—	—	—	3	2	—
CO2	3	3	3	2	—	1	—	—	3	3	1
CO3	3	3	3	3	1	2	—	—	3	3	2
CO4	3	3	3	3	2	2	1	—	3	3	2
CO5	3	3	3	3	3	3	2	1	3	3	3

Semester I	Elective Theory- A. Maternal and Child Nutrition
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Course Objectives

- To provide advanced knowledge of nutritional requirements during pregnancy, lactation, infancy, childhood, and adolescence.
- To develop competencies in nutritional assessment, dietary planning, and management of nutritional problems among mothers and children.
- To apply evidence-based nutritional interventions and national health programmes for improving maternal and child health.

UNIT I: Maternal Nutrition and Reproductive Health

Scope and significance of maternal nutrition. Nutrition during preconception and reproductive health. Nutrition and fertility. Physiological and metabolic adaptations during pregnancy. Maternal nutritional requirements during pregnancy. Recommended gestational weight gain. Dietary guidelines for pregnant women. Nutrition-sensitive interventions for improving pregnancy outcomes.

UNIT II: Nutrition During Pregnancy and Lactation

Maternal adaptation to lactation. Nutritional requirements during lactation. Breast milk composition and factors affecting lactation. Breastfeeding practices and counselling. WHO recommendations for breastfeeding. Nutritional management of: Anaemia, Gestational Diabetes Mellitus (GDM), Pregnancy-Induced Hypertension (PIH), Hyperemesis gravidarum. Maternal nutrition and fetal programming.

UNIT III: Infant and Young Child Nutrition

Growth and development during infancy. Nutritional requirements of infants. Exclusive breastfeeding. Complementary feeding. Infant and Young Child Feeding (IYCF) guidelines. Baby-Friendly Hospital Initiative (BFHI). Feeding of low birth weight and preterm infants. Nutrition during toddlerhood.

UNIT IV: Nutrition During Childhood

Growth and development of preschool and school-age children. Nutritional requirements. Meal planning and dietary guidelines. School feeding programmes. Nutritional assessment of children. Prevention and management of: Protein Energy Malnutrition (PEM), Vitamin A Deficiency, Iron Deficiency Anaemia, Iodine Deficiency Disorders. Nutrition education for children and caregivers.

UNIT V: Adolescent Nutrition and National Nutrition Programmes

Growth and physiological changes during adolescence. Nutritional requirements of adolescents. Nutrition for adolescent girls. Eating disorders and body image issues. Lifestyle-related nutritional challenges among adolescents.

National nutrition programmes: Integrated Child Development Services (ICDS), POSHAN Abhiyaan ,PM POSHAN, Scheme Anaemia Mukh Bharat .

Recent advances in maternal and child nutrition.

Text Books

1. **Judith E. Brown.** *Nutrition Through the Life Cycle* (7th Edition). **Cengage Learning, Boston, USA.**
2. **Mahtab S. Bamji, N. Prahlad Rao & Vinodini Reddy.** *Textbook of Human Nutrition* (4th Edition). **Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.**
3. **B. Srilakshmi.** *Nutrition Science* (7th Edition). **New Age International (P) Ltd., New Delhi.**
4. **M.S. Swaminathan.** *Essentials of Food and Nutrition, Volume I & II* (3rd Edition). **Ganesh & Company, Chennai.**

Reference Books

1. **Kathleen L. Mahan & Janice L. Raymond.** *Krause's Food & the Nutrition Care Process* (16th Edition). **Elsevier, St. Louis, USA.**
2. **Eleanor N. Whitney & Sharon R. Rolfes.** *Understanding Nutrition* (16th Edition). **Cengage Learning, Boston, USA.**
3. **Gordon M. Wardlaw & Anne M. Smith.** *Contemporary Nutrition* (11th Edition). **McGraw-Hill Education, New York, USA.**
4. **Michael J. Gibney, Barrie M. Margetts, John M. Kearney & Lenore Arab.** *Public Health Nutrition.* **Wiley-Blackwell, Oxford, UK.**
5. **World Health Organization (WHO).** *Guideline: Maternal, Infant and Young Child Nutrition.* **World Health Organization, Geneva, Switzerland.**

E-Learning Resources

1. **SWAYAM – Study Webs of Active Learning for Young Aspiring Minds**
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3. **e-PG Pathshala (UGC–INFLIBNET Centre)**
<https://epgp.inflibnet.ac.in>
4. **National Digital Library of India (NDLI)**
<https://ndl.iitkgp.ac.in>
5. **ICMR – National Institute of Nutrition (NIN)**
<https://www.nin.res.in>
6. **World Health Organization (WHO) Learning and Nutrition Resources**
<https://www.who.int>

7. **UNICEF – Nutrition and Learning Resources**
<https://www.unicef.org/nutrition>
8. **Food and Agriculture Organization (FAO) E-Learning Academy**
<https://elearning.fao.org>
9. **PubMed – National Library of Medicine**
 I wish you every success with the implementation of your **M.Sc. Nutrition and Dietetics** programme and your Board of Studies presentation. If you need assistance with the remaining courses, practical

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the nutritional requirements and physiological changes during pregnancy, lactation, infancy, childhood, and adolescence.	K2
CO2	Analyze nutritional problems and health challenges affecting mothers, infants, children, and adolescents.	K4
CO3	Apply evidence-based dietary guidelines and nutrition interventions for maternal and child health.	K3
CO4	Evaluate national nutrition programmes and public health strategies for improving maternal and child nutrition.	K5
CO5	Design nutrition care plans and community-based interventions to promote maternal and child health.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	–	–	–	–	–	3	2	–
CO2	3	3	3	2	–	–	–	–	3	3	1
CO3	3	3	2	2	1	1	–	–	3	3	2
CO4	3	3	3	3	2	1	1	–	3	3	2
CO5	3	3	3	3	3	2	2	1	3	3	3

Semester I	Elective Theory-Principles of Food Service Management
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Course Objectives

- To provide advanced knowledge of food service systems, management principles, and organizational functions in institutional and commercial food service operations.
- To develop managerial competencies in menu planning, procurement, production, quality assurance, financial management, and human resource management.
- To enable students to apply modern food service management strategies for efficient, safe, sustainable, and customer-oriented food service operations.

UNIT I: Foundations of Food Service Management

Evolution, scope, and significance of food service management.
 Classification of food service establishments. Food service systems:
 Conventional ,Commissary,Ready-prepared ,Assembly-serve .Organization and functions of food service departments. Planning and layout of food service establishments.
 Workflow and work simplification. Role and responsibilities of the food service manager.

UNIT II: Menu Planning, Purchasing and Inventory Management

Principles of menu planning. Factors affecting menu planning.
 Types of menus. Standardization of recipes and portion control.
 Food purchasing procedures and specifications. Vendor selection and supplier evaluation.
 Receiving, storage, and inventory control. Cost-effective purchasing practices.

UNIT III: Food Production and Quality Management

Quantity food production principles. Production planning and scheduling.
 Food production methods. Food quality management.
 Sensory quality evaluation. Standard operating procedures (SOPs).
 Quality assurance in food production. Waste reduction and resource optimization.

UNIT IV: Human Resource and Financial Management

Human resource planning. Recruitment, selection, and training.
 Staff scheduling and supervision. Leadership and motivation.

Communication and teamwork. Budget preparation. Food cost control.
Labour cost analysis. Financial record maintenance. Productivity assessment.

UNIT V: Contemporary Trends in Food Service Management

Customer relationship management. Food service marketing strategies.
Sustainable food service practices. Green food service operations.
Digital technologies in food service. Automation and artificial intelligence in food service. Food delivery platforms and cloud kitchens. Future trends and innovations in food service management.

Text Books

1. **Payne-Palacio, J. & Theis, M.** *Foodservice Management: Principles and Practices* (14th Edition). **Pearson Education, New York, USA.**
2. **Kotschevar, L.H. & Withrow, D.** *Management by Menu* (6th Edition). **John Wiley & Sons, Hoboken, New Jersey, USA.**
3. **West, B.B., Wood, L. & Harger, V.F.** *Food Service in Institutions* (8th Edition). **John Wiley & Sons, New York, USA.**
4. **Sethi, M. & Malhan, S.** *Catering Management: An Integrated Approach*. **New Age International (P) Ltd., New Delhi, India.**

Reference Books

1. **Gregoire, M.B.** *Foodservice Organizations: A Managerial and Systems Approach* (9th Edition). **Pearson Education, New York, USA.**
2. **Ninemeier, J.D.** *Management of Food and Beverage Operations*. **American Hotel & Lodging Educational Institute, Orlando, Florida, USA.**
3. **Lendal H. Kotschevar & Margaret E. Terrell.** *Foodservice Planning: Layout, Design and Equipment*. **John Wiley & Sons, Hoboken, New Jersey, USA.**
4. **National Restaurant Association.** *ServSafe Coursebook* (Latest Edition). **National Restaurant Association Educational Foundation, Chicago, Illinois, USA.**
5. **Cousins, J., Foscett, D. & Pennington, A.** *Food and Beverage Management*. **Goodfellow Publishers Ltd., Oxford, UK.**

E-Learning Resources

1. **NPTEL – National Programme on Technology Enhanced Learning**
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3. **e-PG Pathshala (UGC–INFLIBNET Centre)**
<https://epgp.inflibnet.ac.in>
4. **National Digital Library of India (NDLI)**
<https://ndl.iitkgp.ac.in>

5. **Food Safety and Standards Authority of India (FSSAI)**
<https://www.fssai.gov.in>
6. **Food and Agriculture Organization (FAO) E-Learning Academy**
<https://elearning.fao.org>
7. **Institute of Hospitality (UK)**
<https://www.instituteofhospitality.org>
8. **National Restaurant Association (USA)**
<https://restaurant.org>
9. **Academy of Nutrition and Dietetics**
<https://www.eatright.org>
10. **World Health Organization (WHO) – Food Safety**
<https://www.who.int/health-topics/food-safety>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the principles, systems, and organizational structure of food service management.	K2
CO2	Apply managerial principles in menu planning, purchasing, food production, and inventory management.	K3
CO3	Analyze food service operations, quality management, and financial performance for effective decision-making.	K4
CO4	Evaluate human resource practices, quality assurance systems, and customer-oriented food service strategies.	K5
CO5	Design efficient, sustainable, and technology-enabled food service management systems for institutional and commercial organizations.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	–	–	–	–	–	3	2	–
CO2	3	3	2	2	1	–	–	–	3	3	2
CO3	3	3	3	3	2	1	–	–	3	3	2
CO4	3	3	3	3	3	2	1	–	3	3	3
CO5	3	3	3	3	3	3	2	2	3	3	3

Semester I	SEC Theory- Communication and Counseling Skills for Nutrition
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Course Objectives

- To develop effective communication and interpersonal skills required for professional nutrition practice.
- To understand counseling principles, behavior change theories, and client-centered counseling techniques.
- To enhance competencies in nutrition education, health communication, and professional counseling across diverse population groups.

UNIT I: Fundamentals of Communication

Concepts, principles, process, and importance of communication. Types of communication: verbal, non-verbal, written, visual, and digital communication. Communication models and barriers to effective communication. Interpersonal and therapeutic communication. Active listening, empathy, feedback, and assertive communication. Professional communication in nutrition and healthcare settings.

UNIT II: Nutrition Education and Health Communication

Principles and objectives of nutrition education. Health communication strategies. Information, Education and Communication (IEC) and Behaviour Change Communication (BCC). Development of nutrition education materials. Audio-visual aids and digital communication tools. Communication strategies in community nutrition and public health programmes.

UNIT III: Nutrition Counseling Principles and Techniques

Concepts, scope, and objectives of nutrition counseling. Counseling process and stages. Characteristics and competencies of an effective nutrition counselor. Counseling techniques: Rapport building, Active listening, Questioning skills, Reflective responses, Goal setting. Ethics, confidentiality, and professional conduct in counseling.

UNIT IV: Behavior Change Communication in Nutrition

Concepts of health behavior and behavior modification. Health Belief Model (HBM). Tran theoretical Model (Stages of Change). Social Cognitive Theory. Motivational Interviewing (MI). Counseling strategies for dietary behavior modification and lifestyle management.

UNIT V: Professional Practice in Nutrition Counseling

Nutrition counseling for obesity and weight management.
Counseling for diabetes, hypertension, and cardiovascular diseases.
Maternal, child, and adolescent nutrition counseling. Geriatric nutrition counseling. Tele-counseling, digital health communication, and social media in nutrition education. Professional ethics, leadership, and communication competencies for nutrition professionals.

Text Books

1. **Holli, B.B. & Beto, J.A.** *Nutrition Counseling and Education Skills for Dietetics Professionals* (6th Edition). **Lippincott Williams & Wilkins, Philadelphia, USA.**
2. **Bauer, K.D. & Liou, D.** *Nutrition Counseling and Education Skill Development* (4th Edition). **Cengage Learning, Boston, USA.**
3. **Rodriguez, N.R.** *Nutrition and Diet Therapy* (11th Edition). **Pearson Education, New York, USA.**
4. **Park, K.** *Park's Textbook of Preventive and Social Medicine* (27th Edition). **Banarsidas Bhanot Publishers, Jabalpur, India.**

Reference Books

1. **Glanz, K., Rimer, B.K. & Viswanath, K.** *Health Behavior: Theory, Research and Practice* (5th Edition). **Jossey-Bass, John Wiley & Sons, San Francisco, USA.**
2. **Mullen, M.C. & Gans, K.M.** *Counseling Strategies for Nutrition and Health.* **Springer Publishing Company, New York, USA.**
3. **Srilakshmi, B.** *Dietetics* (8th Edition). **New Age International (P) Ltd., New Delhi, India.**
4. **Roth, S.L.** *Nutrition and Diet Therapy* (12th Edition). **Cengage Learning, Boston, USA.**
5. **O'Donnell, M.P.** *Health Promotion in the Workplace* (5th Edition). **Delmar Cengage Learning, Clifton Park, New York, USA.**

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5. **World Health Organization (WHO)**
<https://www.who.int>
6. **UNICEF Learning and Nutrition Resources**
<https://www.unicef.org>

7. **Food and Agriculture Organization (FAO) E-Learning Academy**
<https://elearning.fao.org>
8. **PubMed – National Library of Medicine**
<https://pubmed.ncbi.nlm.nih.gov>
9. **Academy of Nutrition and Dietetics – Professional Education Resources**
<https://www.eatrightpro.org>
10. **Indian Council of Medical Research – National Institute of Nutrition (ICMR–NIN)**
<https://www.nin.res.in>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the principles, methods, and importance of communication and counseling in nutrition practice.	K2
CO2	Apply effective communication strategies and counseling techniques for nutrition education and client care.	K3
CO3	Analyze communication barriers, counseling situations, and behavior change strategies in diverse populations.	K4
CO4	Evaluate behavior change models and counseling approaches for promoting healthy dietary practices.	K5
CO5	Design client-centered nutrition education and counseling programmes using evidence-based communication strategies.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	2	2	2	–	–	–	3	1	2	2	–
CO2	3	3	2	1	–	1	3	1	3	3	1
CO3	3	3	3	2	–	1	3	1	3	3	2
CO4	3	3	3	3	1	2	3	2	3	3	2
CO5	3	3	3	3	2	2	3	2	3	3	3

Semester II	Core Theory- Clinical Nutrition and Diet Therapy-1
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Course Objectives

- To provide advanced knowledge of the principles and practice of clinical nutrition and Medical Nutrition Therapy.
- To develop competencies in nutritional assessment, therapeutic diet planning, and evidence-based nutritional management of diseases.
- To apply the Nutrition Care Process in planning and evaluating individualized nutrition interventions for patients with acute and chronic diseases.

UNIT I: Principles of Clinical Nutrition and Nutrition Care Process

Scope and significance of Clinical Nutrition. Principles and objectives of Medical Nutrition Therapy (MNT). Nutrition Care Process (NCP) and standardized nutrition care terminology. Nutritional assessment in clinical practice.

Therapeutic modifications of normal diets: Regular diet, Soft diet, Liquid diet, Therapeutic diets. Hospital diets and menu planning. Nutrient–drug and food–drug interactions.

UNIT II: Medical Nutrition Therapy for Gastrointestinal Disorders

Etiology, clinical manifestations, diagnosis, and nutritional implications of: Gastro esophageal Reflux Disease (GERD) ,Gastritis, Peptic Ulcer Disease, Constipation
Diarrhea ,Irritable Bowel Syndrome (IBS),Inflammatory Bowel Disease (Crohn's Disease and Ulcerative Colitis) .Nutritional assessment. Medical Nutrition Therapy. Dietary modifications and menu planning.

UNIT III: Medical Nutrition Therapy for Hepatic, Gallbladder and Pancreatic Disorders

Etiology, clinical features, and nutritional management of: Hepatitis, Cirrhosis of Liver, Non-Alcoholic Fatty Liver Disease (NAFLD), Cholelithiasis and Cholecystitis
Acute and Chronic Pancreatitis.Nutritional assessment. Therapeutic dietary modifications. Role of functional foods and nutritional supplements in liver and pancreatic disorders.

UNIT IV: Medical Nutrition Therapy for Cardiovascular Disorders (12 Hours)

Etiology and nutritional management of: Atherosclerosis,Coronary Artery Disease,

Hypertension, Congestive Heart Failure, Dyslipidaemia , DASH Diet and Mediterranean Diet. Dietary fat modification. Sodium and fluid management. Lifestyle modification and cardiovascular risk reduction.

UNIT V: Medical Nutrition Therapy for Diabetes Mellitus and Obesity)

Classification and pathophysiology of Diabetes Mellitus. Glycaemic Index (GI) and Glycaemic Load (GL). Carbohydrate counting and exchange lists. Medical Nutrition Therapy for Type 1 and Type 2 Diabetes Mellitus. Etiology, assessment, and classification of obesity. Energy balance and body composition. Evidence-based dietary approaches for obesity management. Lifestyle modification and weight management strategies.

Text Books

1. **Mahan, L.K. & Raymond, J.L.** *Krause's Food & the Nutrition Care Process* (16th Edition). Elsevier, St. Louis, USA.
2. **Escott-Stump, S.** *Nutrition and Diagnosis-Related Care* (8th Edition). Lippincott Williams & Wilkins, Philadelphia, USA.
3. **Roth, S.L.** *Nutrition and Diet Therapy* (12th Edition). Cengage Learning, Boston, USA.
4. **Srilakshmi, B.** *Dietetics* (9th Edition). New Age International (P) Ltd., New Delhi, India.

Reference Books

1. **Williams, P.** *Williams' Essentials of Nutrition and Diet Therapy* (12th Edition). Elsevier, St. Louis, USA.
2. **Wardlaw, G.M. & Smith, A.M.** *Contemporary Nutrition* (11th Edition). McGraw-Hill Education, New York, USA.
3. **Shils, M.E., Shike, M., Ross, A.C., Caballero, B. & Cousins, R.J.** *Modern Nutrition in Health and Disease* (11th Edition). Lippincott Williams & Wilkins, Philadelphia, USA.
4. **Garrow, J.S., James, W.P.T. & Ralph, A.** *Human Nutrition and Dietetics* (11th Edition). Churchill Livingstone, Elsevier, London, UK.
5. **Brown, J.E.** *Nutrition Through the Life Cycle* (7th Edition). Cengage Learning, Boston, USA.

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<https://epgp.inflibnet.ac.in>
4. **National Digital Library of India (NDLI)**
<https://ndl.iitkgp.ac.in>

5. **ICMR – National Institute of Nutrition (NIN)**
<https://www.nin.res.in>
6. **World Health Organization (WHO) – Nutrition and Non-Communicable Diseases**
<https://www.who.int>
7. **Food and Agriculture Organization (FAO) E-Learning Academy**
<https://elearning.fao.org>
8. **PubMed – National Library of Medicine**
<https://pubmed.ncbi.nlm.nih.gov>
9. **Academy of Nutrition and Dietetics – Evidence Analysis Library and Professional Resources**
<https://www.eatrightpro.org>
10. **European Society for Clinical Nutrition and Metabolism (ESPEN)** <https://www.espen.org>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the principles of clinical nutrition, therapeutic diets, and the Nutrition Care Process in patient management.	K2
CO2	Apply nutritional assessment methods and Medical Nutrition Therapy for gastrointestinal, hepatic, pancreatic, and cardiovascular disorders.	K3
CO3	Analyze the nutritional problems associated with metabolic and chronic diseases using evidence-based approaches.	K4
CO4	Evaluate therapeutic dietary interventions for diabetes mellitus, obesity, and cardiovascular diseases.	K5
CO5	Design comprehensive nutrition care plans and therapeutic diets for patients with acute and chronic diseases.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	–	–	–	–	–	3	2	–
CO2	3	3	3	2	1	–	–	–	3	3	2
CO3	3	3	3	3	2	1	–	–	3	3	2
CO4	3	3	3	3	2	2	1	–	3	3	2
CO5	3	3	3	3	3	2	2	1	3	3	3

Semester II	Core Theory-Research Methodology and Biostatistics
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Course Objectives

- To provide comprehensive knowledge of research methodology, scientific inquiry, and ethical principles in nutrition and health research.
- To develop competencies in research design, data collection, statistical analysis, data interpretation, and scientific report writing.
- To enable students to critically appraise scientific literature, interpret research evidence, and conduct independent research in nutrition and dietetics.

UNIT I: Introduction to Research Methodology

Meaning, objectives, scope, and significance of research. Types of research: Basic research, Applied research, Experimental research, Descriptive research, Analytical research, Qualitative and quantitative research. Research process and scientific method.

Identification and formulation of research problems. Review of literature: sources, methods, and importance. Formulation of research objectives, hypotheses, and research questions.

UNIT II: Research Design and Sampling Techniques

Research design: meaning, purpose, and classification. Experimental and non-experimental research designs. Cross-sectional, longitudinal, cohort, and case-control studies. Survey research and observational studies. Variables in research: Independent variables, Dependent variables, Confounding variables. Sampling methods: Probability sampling, Simple random sampling, Stratified sampling, Systematic sampling,

Cluster sampling. Non-probability sampling: Purposive sampling, Convenience sampling,

Snowball sampling. Sample size determination.

UNIT III: Data Collection and Research Ethics

Sources of data: Primary data, Secondary data. Methods of data collection: Observation, Interview, Questionnaire, Schedule, Focus group discussion.

Development and validation of research instruments. Reliability and validity.

Ethical principles in research. Informed consent. Institutional Ethics Committee (IEC).

Plagiarism and research misconduct. Research proposal writing.

UNIT IV: Biostatistics and Data Analysis

Introduction to Biostatistics and its applications in nutrition research.

Classification and presentation of data. Tabulation and graphical presentation.

Measures of central tendency: Mean, Median, Mode.

Measures of dispersion: Range, Quartile deviation, Standard deviation, Variance.

Probability and normal distribution. Correlation and regression analysis.

Statistical software applications (SPSS, R, MS Excel).

UNIT V: Statistical Tests and Scientific Writing

Hypothesis testing. Parametric and non-parametric tests. Student's t-test.

Chi-square test. Analysis of Variance (ANOVA). Interpretation of p-value and confidence interval. Report writing and thesis preparation. Referencing styles (APA, Vancouver).

Preparation of research papers and scientific publications. Presentation of research findings. Research communication and publication ethics.

Text Books

1. **Kothari, C.R. & Garg, G.** *Research Methodology: Methods and Techniques* (4th Edition). **New Age International (P) Ltd., New Delhi, India.**
2. **Mahajan, B.K.** *Methods in Biostatistics for Medical Students and Research Workers* (9th Edition). **Jaypee Brothers Medical Publishers (P) Ltd., New Delhi, India.**
3. **Gurumani, N.** *Research Methodology for Biological Sciences.* **MJP Publishers, Chennai, India.**
4. **Daniel, W.W. & Cross, C.L.** *Biostatistics: A Foundation for Analysis in the Health Sciences* (11th Edition). **John Wiley & Sons, Hoboken, New Jersey, USA.**

Reference Books

1. **Daniel, W.W.** *Biostatistics: Basic Concepts and Methodology for the Health Sciences* (10th Edition). **John Wiley & Sons, Hoboken, New Jersey, USA.**
2. **Sahu, S.K.** *Research Methodology and Statistical Techniques.* **New Age International (P) Ltd., New Delhi, India.**
3. **Kumar, Ranjit.** *Research Methodology: A Step-by-Step Guide for Beginners* (5th Edition). **SAGE Publications India Pvt. Ltd., New Delhi, India.**
4. **Rosner, Bernard.** *Fundamentals of Biostatistics* (9th Edition). **Cengage Learning, Boston, USA.**
5. **Gupta, S.P.** *Statistical Methods* (46th Revised Edition). **Sultan Chand & Sons, New Delhi, India.**

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2. **NPTEL – National Programme on Technology Enhanced Learning**
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3. **e-PG Pathshala (UGC–INFLIBNET Centre)**
<https://epgp.inflibnet.ac.in>

4. **National Digital Library of India (NDLI)**
<https://ndl.iitkgp.ac.in>
5. **INFLIBNET Centre – Information and Library Network**
<https://www.inflibnet.ac.in>
6. **PubMed – National Library of Medicine**
<https://pubmed.ncbi.nlm.nih.gov>
7. **World Health Organization (WHO) Learning and Training**
<https://www.who.int>
8. **Indian Council of Medical Research (ICMR) – National Institute of Nutrition (NIN)**
<https://www.nin.res.in>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the principles, methods, and ethical considerations involved in scientific research.	K2
CO2	Analyze research problems and select appropriate research designs and sampling techniques.	K4
CO3	Apply suitable methods for data collection, validation, and management in nutrition research.	K3
CO4	Evaluate research data using appropriate biostatistical techniques and statistical software.	K5
CO5	Design research proposals and prepare scientific reports, dissertations, and publications.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	1	2	2	3
CO2	3	3	3	2	1	-	-	-	2	3	3
CO3	3	3	2	2	2	-	-	-	2	3	3
CO4	3	3	3	3	2	-	-	1	2	3	3
CO5	3	3	3	3	2	2	1	2	2	3	3

Course Objectives

- To provide advanced knowledge of food product development, innovation processes, and emerging trends in functional and health-oriented food products.
- To develop competencies in formulation, processing, quality evaluation, packaging, and commercialization of novel food products.
- To enable students to design innovative, consumer-oriented, sustainable, and nutritionally enriched food products using scientific and technological approaches.

UNIT I: Principles of Food Product Development

Concept, scope, and significance of food product development, stages of product development, product development process and innovation cycle, market research and consumer needs assessment, factors influencing food product development, product life cycle, multidisciplinary approach in product development, product feasibility analysis and product launch strategies.

UNIT II: Product Formulation and Processing Technologies

Principles of food formulation, selection of raw materials and ingredients, functional ingredients and food additives, ingredient interactions, formulation optimization, recipe standardization, pilot-scale production, novel food processing technologies, process optimization, scale-up production, commercialization of food products.

UNIT III: Quality Evaluation and Packaging of Food Products

Quality attributes of food products, sensory evaluation methods, instrumental quality evaluation, physicochemical analysis, microbiological quality assessment, shelf-life studies, food packaging materials, active packaging, intelligent packaging, sustainable packaging systems, food labeling, nutrition labeling, food safety standards and quality assurance systems.

UNIT IV: Functional Foods and Innovative Food Product Development (12 Hours)

Development of functional foods, fortified foods, enriched foods, probiotic foods, prebiotic foods, synbiotic products, nutraceuticals, plant-based foods, alternative protein products, gluten-free foods, allergen-free products, personalized nutrition products, sustainable food innovations using indigenous food resources.

UNIT V: Entrepreneurship and Commercialization of Food Products

Food product commercialization, product costing and pricing, food regulations and statutory approvals, intellectual property rights, patents and trademarks, food product branding, marketing strategies, consumer acceptance studies, business plan preparation, food startups, entrepreneurship development, recent trends and innovations in food product development.

Text Books

1. **Earle, M.D. & Earle, R.L.** *Creating New Foods: The Product Developer's Guide* (2nd Edition). **Woodhead Publishing Ltd., Cambridge, UK.**
2. **Fuller, G.W.** *New Food Product Development: From Concept to Marketplace* (3rd Edition). **CRC Press, Taylor & Francis Group, Boca Raton, USA.**
3. **Moskowitz, H.R., Beckley, J.H. & Resurreccion, A.V.A.** *Sensory and Consumer Research in Food Product Design and Development* (2nd Edition). **Wiley-Blackwell, Ames, USA.**
4. **Manay, N.S. & Shadaksharaswamy, M.** *Foods: Facts and Principles* (3rd Edition). **New Age International (P) Ltd., New Delhi, India.**

Reference Books

1. **Potter, N.N. & Hotchkiss, J.H.** *Food Science* (5th Edition). **Springer Science & Business Media, New York, USA.**
2. **Vaclavik, V.A. & Christian, E.W.** *Essentials of Food Science* (5th Edition). **Springer, New York, USA.**
3. **Wildman, R.E.C. & Bruno, R.S.** *Handbook of Nutraceuticals and Functional Foods* (3rd Edition). **CRC Press, Taylor & Francis Group, Boca Raton, USA.**
4. **Gibson, G.R. & Williams, C.M.** *Functional Foods: Concept to Product* (2nd Edition). **Woodhead Publishing Ltd., Cambridge, UK.**
5. **Robertson, G.L.** *Food Packaging: Principles and Practice* (4th Edition). **CRC Press, Taylor & Francis Group, Boca Raton, USA.**

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<https://epgp.inflibnet.ac.in>
4. **National Digital Library of India (NDLI)**
<https://ndl.iitkgp.ac.in>
5. **Food Safety and Standards Authority of India (FSSAI)**
<https://www.fssai.gov.in>
6. **Indian Council of Agricultural Research (ICAR)**
<https://icar.org.in>

7. **Food and Agriculture Organization (FAO) E-Learning Academy**
<https://elearning.fao.org>
8. **Institute of Food Technologists (IFT)**
<https://www.ift.org>
9. **Institute of Food Science and Technology (IFST)**
<https://www.ifst.org>
10. **PubMed – National Library of Medicine**
<https://pubmed.ncbi.nlm.nih.gov>
11. **Academy of Nutrition and Dietetics – Evidence-Based Practice Resources**
<https://www.eatrightpro.org>
12. **World Health Organization (WHO) – Food Safety and Nutrition**
<https://www.who.int>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the physicochemical properties, structure, and functional characteristics of food constituents.	K2
CO2	Apply the principles of food chemistry to interpret changes occurring during food preparation, processing, and storage.	K3
CO3	Analyze the interactions among food constituents and evaluate their influence on food quality, texture, stability, and functionality.	K4
CO4	Evaluate modern analytical techniques and emerging concepts for assessing food quality and functionality.	K5
CO5	Develop innovative approaches for improving food quality, functionality, and sustainable food systems using advanced food science principles.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	–	–	–	–	–	3	2	–
CO2	3	3	2	2	1	–	–	–	3	3	2
CO3	3	3	3	3	2	1	–	–	3	3	2
CO4	3	3	3	3	3	2	1	–	3	3	3
CO5	3	3	3	3	3	3	1	–	3	3	3

Semester II	Core Practical-Food Product Development and Sensory Evaluation Practical
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Course Objectives

- To develop practical skills in the formulation, preparation, standardization, and evaluation of innovative food products.
- To provide hands-on training in sensory evaluation, quality assessment, packaging, and shelf-life studies of food products.
- To enable students to design nutritionally enhanced, consumer-acceptable, and commercially viable food products using indigenous and functional ingredients.

Practical Exercises

1. Standardization of recipes using the principles of food product development.
2. Development of cereal-based value-added food products.
3. Development of millet-based functional food products.
4. Development of pulse and legume-based convenience foods.
5. Development of fruit-based value-added products.
6. Development of vegetable-based value-added products.
7. Preparation of fortified food products using locally available ingredients.
8. Development of protein-enriched food products.
9. Development of fibre-rich functional food products.
10. Development of probiotic food products.
11. Development of prebiotic food formulations.
12. Development of gluten-free food products.
13. Development of low glycaemic index food products for diabetes management.
14. Development of low-fat and low-sodium food products.
15. Development of nutraceutical snack products.
16. Development of complementary foods for infants and young children.
17. Product standardization and recipe optimization.
18. Sensory evaluation using the Nine-Point Hedonic Rating Scale.
19. Sensory evaluation using Composite Scoring Test.
20. Sensory evaluation using Difference Tests (Triangle Test, Duo-Trio Test and Paired Comparison Test).
21. Consumer acceptability evaluation and product ranking.
22. Packaging of developed food products using suitable packaging materials

23. Food label preparation in accordance with FSSAI regulations
24. Shelf-life study of developed food products under different storage conditions.
25. Cost analysis and pricing of developed food products
26. Preparation of a business proposal for commercialization of a developed food product

Text Books

1. **Earle, M.D. & Earle, R.L.** *Creating New Foods: The Product Developer's Guide* (2nd Edition). **Woodhead Publishing Ltd., Cambridge, UK.**
2. **Fuller, G.W.** *New Food Product Development: From Concept to Marketplace* (3rd Edition). **CRC Press, Taylor & Francis Group, Boca Raton, USA.**
3. **Moskowitz, H.R., Beckley, J.H. & Resurreccion, A.V.A.** *Sensory and Consumer Research in Food Product Design and Development* (2nd Edition). **Wiley-Blackwell, Ames, USA.**
4. **Stone, H., Bleibaum, R.N. & Thomas, H.A.** *Sensory Evaluation Practices* (5th Edition). **Academic Press, Elsevier, USA.**

Reference Books

1. **Lawless, H.T. & Heymann, H.** *Sensory Evaluation of Food: Principles and Practices* (3rd Edition). **Springer Nature, New York, USA.**
2. **Manay, N.S. & Shadaksharaswamy, M.** *Foods: Facts and Principles* (3rd Edition). **New Age International (P) Ltd., New Delhi, India.**
3. **Potter, N.N. & Hotchkiss, J.H.** *Food Science* (5th Edition). **Springer Science & Business Media, New York, USA.**
4. **Robertson, G.L.** *Food Packaging: Principles and Practice* (4th Edition). **CRC Press, Taylor & Francis Group, Boca Raton, USA.**
5. **Wildman, R.E.C. & Bruno, R.S.** *Handbook of Nutraceuticals and Functional Foods* (3rd Edition). **CRC Press, Taylor & Francis Group, Boca Raton, USA.**

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5. **Food Safety and Standards Authority of India (FSSAI)**
<https://www.fssai.gov.in>
6. **Institute of Food Technologists (IFT)**
<https://www.ift.org>
7. **Institute of Food Science and Technology (IFST)**
<https://www.ifst.org>

8. **Food and Agriculture Organization (FAO) E-Learning Academy**
<https://elearning.fao.org>
9. **PubMed – National Library of Medicine**
<https://pubmed.ncbi.nlm.nih.gov>
10. **Academy of Nutrition and Dietetics – Evidence-Based Practice Resources**
<https://www.eatrightpro.org>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Demonstrate skills in developing and standardizing innovative and value-added food products.	K3
CO2	Apply appropriate sensory evaluation techniques to assess product quality and consumer acceptability.	K3
CO3	Analyze the nutritional quality, packaging, labeling, and shelf-life of developed food products.	K4
CO4	Evaluate functional food formulations and optimize products based on quality and sensory characteristics.	K5
CO5	Design nutritionally enriched, commercially feasible, and consumer-oriented food products for different population groups.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	1	–	–	–	–	3	2	2
CO2	3	3	2	2	1	–	–	–	3	3	2
CO3	3	3	3	3	2	1	–	–	3	3	2
CO4	3	3	3	3	3	2	1	–	3	3	3
CO5	3	3	3	3	3	3	2	2	3	3	3

Semester II	Elective Theory-A. Food Safety and Quality Assurance
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Course Objectives

- To provide comprehensive knowledge of food safety principles, food quality management systems, and national and international food regulations.
- To develop competencies in food quality evaluation, food safety monitoring, hazard analysis, and quality assurance practices across the food supply chain.
- To enable students to apply food safety standards, quality management systems, and regulatory requirements in food processing and food service industries.

UNIT I: Fundamentals of Food Safety and Quality

Concept, scope, and importance of food safety and quality assurance, principles of food quality management, food quality attributes, factors affecting food quality, food hazards including biological, chemical, physical, and allergenic hazards, food contamination and food spoilage, foodborne diseases and outbreaks, personal hygiene, sanitation, and Good Hygienic Practices (GHP).

UNIT II: Food Safety Management Systems

Good Manufacturing Practices (GMP), Good Laboratory Practices (GLP), Good Agricultural Practices (GAP), Sanitation Standard Operating Procedures (SSOP), Hazard Analysis and Critical Control Point (HACCP), prerequisite programmes, food safety management systems, ISO 22000 Food Safety Management System, quality assurance and quality control in food industries.

UNIT III: Food Standards, Laws and Regulations

Food Safety and Standards Act, 2006, Food Safety and Standards Authority of India (FSSAI), Codex Alimentarius Commission, Bureau of Indian Standards (BIS), AGMARK standards, international food safety regulations, food inspection and certification systems, food labeling regulations, nutrition labeling, health claims, food traceability, and food recall systems.

UNIT IV: Food Quality Evaluation and Food Safety Monitoring

Quality evaluation of raw materials and processed foods, physical, chemical, microbiological, and sensory quality assessment, sampling techniques, quality control procedures, shelf-life evaluation, food packaging and storage, environmental monitoring, food safety auditing, documentation, record maintenance, and laboratory quality assurance.

UNIT V: Emerging Trends in Food Safety and Quality Assurance

Risk analysis and risk assessment in food safety, food fraud and food defense, food authenticity and traceability, rapid methods for food safety testing, biosensors and molecular techniques, nanotechnology in food safety, digital food safety management systems, sustainability in food quality management, current issues and recent advances in food safety and quality assurance.

Text Books

1. **Srilakshmi, B.** *Food Science (7th Edition)*. New Age International (P) Ltd., New Delhi, India.
2. **Marriott, N.G., Schilling, M.W. & Gravani, R.B.** *Principles of Food Sanitation* (6th Edition). Springer Nature, New York, USA.
3. **Fellows, P.J.** *Food Processing Technology: Principles and Practice* (5th Edition). Woodhead Publishing, Elsevier, Cambridge, UK.
4. **Motarjemi, Y. & Lelieveld, H.** *Food Safety Management: A Practical Guide for the Food Industry* (1st Edition). Academic Press, Elsevier, London, UK.

Reference Books

1. **Jay, J.M., Loessner, M.J. & Golden, D.A.** *Modern Food Microbiology* (8th Edition). Springer Science + Business Media, New York, USA.
2. **Adams, M.R. & Moss, M.O.** *Food Microbiology* (4th Edition). Royal Society of Chemistry, Cambridge, UK.
3. **Mortimore, S. & Wallace, C.** *HACCP: A Practical Approach* (3rd Edition). Springer Nature, New York, USA.
4. **Early, R.** *Guide to Quality Management Systems for the Food Industry* (2nd Edition). Blackie Academic & Professional, London, UK.
5. **Food Safety and Standards Authority of India.** *Food Safety and Standards Regulations Manual*. FSSAI, New Delhi, India.

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5. Food Safety and Standards Authority of India (FSSAI)
<https://www.fssai.gov.in>
6. Food and Agriculture Organization (FAO) E-Learning Academy
<https://elearning.fao.org>
7. World Health Organization (WHO) – Food Safety Programme
<https://www.who.int>
8. Codex Alimentarius Commission
<https://www.codexalimentarius.org>
9. Institute of Food Technologists (IFT)
<https://www.ift.org>
10. PubMed – National Library of Medicine
<https://pubmed.ncbi.nlm.nih.gov>
11. International Organization for Standardization (ISO)
<https://www.iso.org>
12. European Food Safety Authority (EFSA)
<https://www.efsa.europa.eu>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the principles of food safety, food quality, and food safety management systems.	K2
CO2	Apply food quality assurance practices and national and international food safety standards in food industries.	K3
CO3	Analyze food hazards, quality parameters, and regulatory requirements for ensuring food safety.	K4
CO4	Evaluate food safety management systems, quality control procedures, and food safety auditing practices.	K5
CO5	Design comprehensive food safety and quality assurance programmes for food processing and food service organizations.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	–	–	–	–	–	3	2	–
CO2	3	3	2	2	1	–	–	–	3	3	2
CO3	3	3	3	3	2	1	–	–	3	3	2
CO4	3	3	3	3	3	2	1	–	3	3	3
CO5	3	3	3	3	3	3	2	2	3	3	3

Semester II	Elective Theory: B. Quantity Food Production Management
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Course Objectives

- To provide comprehensive knowledge of quantity food production principles, menu planning, and institutional food service operations.
- To develop competencies in procurement, production planning, quality control, hygiene, and cost management in large-scale food production.
- To enable students to manage quantity food production systems efficiently using modern technologies, quality standards, and sustainable food service practices.

UNIT I: Principles of Quantity Food Production

Concept, scope, and objectives of quantity food production, principles of large-scale food production, classification of food service systems, organization and layout of quantity kitchens, kitchen planning and workflow, institutional food service operations, kitchen equipment and their selection, safety measures in quantity food production.

UNIT II: Menu Planning and Food Production Management

Principles of menu planning, factors influencing menu planning, standardization of recipes, recipe modification, quantity recipe calculation, food purchasing, procurement procedures, receiving and storage of food materials, inventory management, production scheduling, portion control, and yield management.

UNIT III: Food Production Operations and Quality Control

Food preparation methods for large-scale production, cooking techniques, bulk cooking, cook-chill and cook-freeze systems, quality control during food production, sensory quality evaluation, food safety, sanitation, personal hygiene, Good Manufacturing Practices (GMP), Hazard Analysis and Critical Control Point (HACCP), waste management and sustainability in food production.

UNIT IV: Cost Control and Food Service Management

Food cost control, labor cost control, overhead cost management, food budgeting, pricing strategies, cost analysis, financial management in food service operations, record maintenance, purchasing control, inventory control, productivity assessment, and quality assurance in institutional food service.

UNIT V: Modern Trends in Quantity Food Production Management

Computer applications in food production management, food production software, automation in institutional kitchens, sustainable food production practices, green kitchen concepts, nutrition-sensitive menu planning, catering management, event and banquet food production, entrepreneurship opportunities in food production, recent advances and future trends in quantity food production management.

Text Books

1. Sethi, M. & Malhan, S. *Catering Management: An Integrated Approach*. New Age International (P) Ltd., New Delhi, India.
2. West, B.B., Wood, L. & Harger, V.F. *Food Service in Institutions*. John Wiley & Sons, New York, USA.
3. Bali, P. *Food Production Operations*. Oxford University Press, New Delhi, India.
4. Gisslen, W. *Professional Cooking* (9th Edition). John Wiley & Sons, Hoboken, New Jersey, USA.

Reference Books

1. Spears, M.C. & Gregoire, M.B. *Foodservice Organizations: A Managerial and Systems Approach* (9th Edition). Pearson Education, Boston, USA.
2. Payne-Palacio, J. & Theis, M. *Foodservice Management: Principles and Practices* (14th Edition). Pearson Education, Boston, USA.
3. Kazarian, E.A. *Foodservice Facilities Planning*. John Wiley & Sons, New York, USA.
4. Kotschevar, L.H. & Luciani, V. *Presenting Service: The Ultimate Guide for the Foodservice Professional*. John Wiley & Sons, Hoboken, New Jersey, USA.
5. Juneja, M. *Institutional Food Management*. Orient BlackSwan Pvt. Ltd., Hyderabad, India.

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1. SWAYAM – Study Webs of Active Learning for Young Aspiring Minds
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<https://epgp.inflibnet.ac.in>
4. National Digital Library of India (NDLI)
<https://ndl.iitkgp.ac.in>

5. Food Safety and Standards Authority of India (FSSAI)
<https://www.fssai.gov.in>
6. Food and Agriculture Organization (FAO) E-Learning Academy
<https://elearning.fao.org>
7. Institute of Food Technologists (IFT)
<https://www.ift.org>
8. Academy of Nutrition and Dietetics – Foodservice Systems Management Resources
<https://www.eatrightpro.org>
9. National Institute of Open Schooling (NIOS) – Hospitality and Catering Resources
<https://nios.ac.in>
10. PubMed – National Library of Medicine
<https://pubmed.ncbi.nlm.nih.gov>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the principles and organization of quantity food production and institutional food service management.	K2
CO2	Apply menu planning, recipe standardization, procurement, and production management techniques in large-scale food service operations.	K3
CO3	Analyze food production systems, quality control measures, food safety practices, and cost management techniques.	K4
CO4	Evaluate institutional food service operations using quality assurance, financial management, and food safety standards.	K5
CO5	Design and manage efficient, sustainable, and cost-effective quantity food production systems for institutional and commercial food service establishments.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	–	–	–	–	–	3	2	–
CO2	3	3	2	2	1	–	–	–	3	3	2
CO3	3	3	3	3	2	1	–	–	3	3	2
CO4	3	3	3	3	3	2	1	–	3	3	3
CO5	3	3	3	3	3	3	2	2	3	3	3

Course Objectives

- To introduce the basic concepts of nutrition and healthy eating.
- To create awareness about balanced diets and healthy lifestyle practices.
- To promote healthy food choices for disease prevention and overall well-being.

UNIT I: Basics of Nutrition

Concept of nutrition, nutrients and their functions, food groups, balanced diet, Recommended Dietary Allowances (RDA), importance of nutrition in health promotion.

UNIT II: Healthy Eating Practices

Food pyramid, My Plate concept, meal planning, healthy cooking methods, hydration, healthy eating habits, nutrition across the life cycle.

UNIT III: Food Safety and Hygiene

Food contamination, food spoilage, foodborne diseases, personal hygiene, kitchen hygiene, safe food handling, food storage, food labels and expiry dates.

UNIT IV: Nutrition and Lifestyle Disorders

Causes and prevention of obesity, diabetes mellitus, hypertension, cardiovascular diseases, role of diet and physical activity in healthy living.

UNIT V: Functional Foods and Healthy Lifestyle

Functional foods, nutraceuticals, dietary fibre, probiotics, prebiotics, stress management, yoga, physical activity, healthy lifestyle practices.

Text Books

1. Srilakshmi, B. *Nutrition Science*. New Age International (P) Ltd., New Delhi.
2. Bamji, M.S., Rao, N.P. & Reddy, V. *Textbook of Human Nutrition*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Wardlaw, G.M. & Smith, A.M. *Contemporary Nutrition*. McGraw-Hill Education, New York.

Reference Books

1. Whitney, E. & Rolfes, S.R. *Understanding Nutrition*. Cengage Learning.
2. Mahan, L.K. & Raymond, J.L. *Krause's Food & the Nutrition Care Process*. Elsevier.
3. Park, K. *Park's Textbook of Preventive and Social Medicine*. Banarsidas Bhanot Publishers.

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1. SWAYAM – <https://swayam.gov.in>
2. NPTEL – <https://nptel.ac.in>
3. National Digital Library of India – <https://ndl.iitkgp.ac.in>
4. ICMR–National Institute of Nutrition – <https://www.nin.res.in>
5. Food Safety and Standards Authority of India – <https://www.fssai.gov.in>
6. World Health Organization – <https://www.who.int>

Semester III	Core Theory-Clinical Nutrition and Diet Therapy – II
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Course Objectives

- To provide advanced knowledge of Medical Nutrition Therapy for endocrine, renal, neurological, respiratory, musculoskeletal, and critical care disorders.
- To develop competencies in nutritional assessment, evidence-based diet planning, and
- To enable students to design comprehensive nutrition care plans for specialized clinical conditions using the Nutrition Care Process (NCP).

UNIT I: Nutritional Management of Renal Disorders

Structure and functions of the kidney, nutritional assessment in renal diseases, acute kidney injury, chronic kidney disease, nephrotic syndrome, nephritis, renal replacement therapy, hemodialysis, peritoneal dialysis, fluid and electrolyte management, protein and mineral modifications, Medical Nutrition Therapy for renal disorders.

UNIT II: Nutritional Management of Endocrine and Metabolic Disorders

Medical Nutrition Therapy for thyroid disorders including hypothyroidism and hyperthyroidism, metabolic syndrome, gout and hyperuricemia, osteoporosis, osteomalacia, metabolic bone diseases, nutritional management of adrenal disorders, evidence-based dietary approaches for endocrine disorders.

UNIT III: Nutritional Management of Respiratory, Neurological and Musculoskeletal Disorders

Medical Nutrition Therapy for chronic obstructive pulmonary disease (COPD), asthma, cystic fibrosis, stroke, Parkinson's disease, Alzheimer's disease, epilepsy, multiple sclerosis, arthritis, rheumatoid arthritis, osteoporosis, nutritional rehabilitation and dietary modifications.

UNIT IV: Nutritional Support in Critical Care and Special Clinical Conditions

Nutrition in surgical patients, trauma and burns, sepsis, intensive care nutrition, enteral nutrition, parenteral nutrition, immunonutrition, nutrition support teams, perioperative nutritional management, nutrition for cancer patients, palliative and supportive nutrition care.

UNIT V: Nutrition Care Process and Recent Advances in Clinical Nutrition

Nutrition Care Process (NCP), nutrition diagnosis, nutrition intervention, monitoring and evaluation, evidence-based dietetics, personalized nutrition, precision nutrition, nutrigenomics in clinical practice, functional foods in disease management, tele-nutrition, recent advances in clinical nutrition and diet therapy.

Text Books

1. Kathleen L. Mahan & Janice L. Raymond. *Krause's Food & the Nutrition Care Process* (16th Edition). Elsevier, St. Louis, Missouri, USA.
2. Sylvia Escott-Stump. *Nutrition and Diagnosis-Related Care* (9th Edition). Lippincott Williams & Wilkins, Philadelphia, USA.
3. Sara Long Roth. *Nutrition and Diet Therapy* (12th Edition). Cengage Learning, Boston, USA.
4. B. Srilakshmi. *Dietetics* (8th Edition). New Age International (P) Ltd., New Delhi, India.

Reference Books

1. Williams, P. *Williams' Essentials of Nutrition and Diet Therapy* (12th Edition). Elsevier, St. Louis, Missouri, USA.
2. Shils, M.E., Shike, M., Ross, A.C., Caballero, B. & Cousins, R.J. *Modern Nutrition in Health and Disease* (11th Edition). Lippincott Williams & Wilkins, Philadelphia, USA.
3. Gordon M. Wardlaw & Anne M. Smith. *Contemporary Nutrition* (10th Edition). McGraw-Hill Education, New York, USA.
4. Nelms, M., Sucher, K., Lacey, K. & Roth, S.L. *Nutrition Therapy and Pathophysiology* (4th Edition). Cengage Learning, Boston, USA.
5. Marian, M., Williams, J. & Worthington, P. *The ASPEN Adult Nutrition Support Core Curriculum* (3rd Edition). American Society for Parenteral and Enteral Nutrition (ASPEN), Maryland, USA.

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<https://epgp.inflibnet.ac.in>
4. **National Digital Library of India (NDLI)**
<https://ndl.iitkgp.ac.in>
5. **ICMR – National Institute of Nutrition (NIN)**
<https://www.nin.res.in>
6. **World Health Organization (WHO)**
<https://www.who.int>
7. **Academy of Nutrition and Dietetics – Evidence Analysis Library**
<https://www.andeal.org>
8. **American Society for Parenteral and Enteral Nutrition (ASPEN)**
<https://www.nutritioncare.org>

9. **ESPEN – European Society for Clinical Nutrition and Metabolism**
<https://www.espen.org>
10. **PubMed – National Library of Medicine**
<https://pubmed.ncbi.nlm.nih.gov>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the principles of Medical Nutrition Therapy for renal, endocrine, neurological, respiratory, and critical care disorders.	K2
CO2	Apply nutritional assessment techniques and therapeutic dietary modifications for patients with specialized clinical conditions.	K3
CO3	Analyze the nutritional management of renal, endocrine, neurological, respiratory, and musculoskeletal disorders.	K4
CO4	Evaluate evidence-based nutrition support strategies, enteral and parenteral nutrition, and advanced clinical nutrition interventions.	K5
CO5	Design comprehensive nutrition care plans using the Nutrition Care Process for patients with acute and chronic diseases.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	–	–	–	–	–	3	3	–
CO2	3	3	3	2	–	1	–	–	3	3	2
CO3	3	3	3	3	1	1	–	–	3	3	2
CO4	3	3	3	3	2	2	1	–	3	3	3
CO5	3	3	3	3	3	2	2	1	3	3	3

Semester III	Core Theory-Nutraceuticals and Functional Foods
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Course Objectives

- To provide comprehensive knowledge of nutraceuticals, functional foods, bioactive compounds, and their role in health promotion and disease prevention.
- To develop competencies in the identification, formulation, evaluation, and application of functional foods and nutraceuticals for improving nutritional status.
- To enable students to critically evaluate scientific evidence, regulatory aspects, and emerging innovations in nutraceutical and functional food development.

UNIT I: Fundamentals of Nutraceuticals and Functional Foods

Concept, scope, and significance of nutraceuticals and functional foods, history and evolution, classification of nutraceuticals and functional foods, bioactive food components, functional ingredients, relationship between nutrition and health, role of nutraceuticals in preventive healthcare, functional foods versus dietary supplements, global trends and market potential.

UNIT II: Bioactive Compounds and Functional Ingredients

Phytochemicals, polyphenols, flavonoids, carotenoids, glucosinolates, phytosterols, omega-3 fatty acids, dietary fibre, prebiotics, probiotics, synbiotics, postbiotics, bioactive peptides, antioxidants, mechanisms of action, bioavailability, metabolism, and health-promoting properties of functional ingredients.

UNIT III: Nutraceuticals in Health Promotion and Disease Prevention

Role of nutraceuticals in cardiovascular diseases, diabetes mellitus, obesity, metabolic syndrome, gastrointestinal disorders, cancer prevention, bone health, immune modulation, neurodegenerative disorders, healthy ageing, maternal and child health, sports nutrition, personalized nutrition, evidence-based applications of nutraceuticals in clinical practice.

UNIT IV: Development, Quality Evaluation and Regulatory Aspects

Selection of functional ingredients, formulation of nutraceutical products, product development, quality evaluation, stability studies, bioavailability assessment, food fortification, encapsulation technologies, packaging of functional foods, labeling requirements, health claims, safety evaluation, Food Safety and Standards Authority of India (FSSAI), Codex Alimentarius, national and international regulations governing nutraceuticals.

UNIT V: Emerging Trends in Nutraceuticals and Functional Foods

Foodomics, nutrigenomics, nutrigenetics, metabolomics, precision nutrition, designer foods, functional beverages, plant-based functional foods, fermented functional foods, nanotechnology in nutraceutical delivery systems, artificial intelligence in product development, sustainability, indigenous functional foods, recent advances and future perspectives in nutraceutical research.

Text Books

1. Robert E.C. Wildman & Richard S. Bruno. *Handbook of Nutraceuticals and Functional Foods* (3rd Edition). CRC Press, Taylor & Francis Group, Boca Raton, USA.
2. Geoffrey P. Webb. *Dietary Supplements and Functional Foods* (2nd Edition). Wiley-Blackwell, Oxford, UK.
3. Chukwuebuka Egbuna & K.G. Dable-Tupas. *Functional Foods and Nutraceuticals: Bioactive Components, Formulations and Innovations*. Springer Nature, Cham, Switzerland.
4. B. Srilakshmi. *Food Science* (7th Edition). New Age International (P) Ltd., New Delhi, India.

Reference Books

1. Gibson, G.R. & Williams, C.M. *Functional Foods: Concept to Product*. Woodhead Publishing, Cambridge, UK.
2. Shahidi, F. *Nutraceutical and Functional Food Components: Effects of Innovative Processing Techniques*. CRC Press, Taylor & Francis Group, Boca Raton, USA.
3. Bagchi, D. *Nutraceutical and Functional Food Regulations in the United States and Around the World* (3rd Edition). Academic Press, Elsevier, London, UK.
4. M. Shafiur Rahman. *Handbook of Food Preservation* (3rd Edition). CRC Press, Taylor & Francis Group, Boca Raton, USA.
5. Michael J. Gibney, Hester H. Vorster & Frans J. Kok. *Introduction to Human Nutrition* (3rd Edition). Wiley-Blackwell, Oxford, UK.

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4. **National Digital Library of India (NDLI)**
<https://ndl.iitkgp.ac.in>
5. **ICMR – National Institute of Nutrition (NIN)**
<https://www.nin.res.in>
6. **Food Safety and Standards Authority of India (FSSAI)**
<https://www.fssai.gov.in>
7. **Food and Agriculture Organization (FAO) E-Learning Academy**
<https://elearning.fao.org>
8. **International Food Information Council (IFIC)**
<https://foodinsight.org>
9. **PubMed – National Library of Medicine**
<https://pubmed.ncbi.nlm.nih.gov>
10. **Academy of Nutrition and Dietetics – Evidence Analysis Library**
<https://www.andeal.org>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the concepts, classifications, and health benefits of nutraceuticals and functional foods.	K2
CO2	Apply knowledge of bioactive compounds and functional ingredients in promoting health and preventing diseases.	K3
CO3	Analyze the therapeutic applications, formulation, quality evaluation, and regulatory requirements of nutraceutical products.	K4
CO4	Evaluate scientific evidence supporting the role of nutraceuticals and functional foods in disease prevention and personalized nutrition.	K5
CO5	Design innovative nutraceutical and functional food products using evidence-based, sustainable, and consumer-oriented approaches.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	–	–	–	–	–	3	2	–
CO2	3	3	2	2	1	–	–	–	3	3	2
CO3	3	3	3	3	2	1	–	–	3	3	2
CO4	3	3	3	3	3	2	1	–	3	3	3
CO5	3	3	3	3	3	3	2	2	3	3	3

Semester III	Core Theory-Public Health Nutrition
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Course Objectives

- To provide comprehensive knowledge of public health nutrition, nutritional epidemiology, and community-based nutrition interventions.
- To develop competencies in nutritional assessment, programme planning, implementation, monitoring, and evaluation for improving community nutritional status.
- To enable students to apply evidence-based public health nutrition strategies, national nutrition programmes, and policies for disease prevention and health promotion.

UNIT I: Foundations of Public Health Nutrition

Concept, scope, principles, and objectives of public health nutrition, determinants of nutritional health, nutrition transition, burden of malnutrition, public health approaches to nutrition, nutritional epidemiology, nutrition surveillance, nutrition indicators, nutrition across the life cycle, role of public health nutritionists in community health.

UNIT II: Assessment of Nutritional Status and Community Nutrition

Methods of nutritional assessment at the community level, anthropometric assessment, dietary assessment methods, clinical assessment, biochemical assessment, nutrition screening, nutritional surveillance systems, community diagnosis, nutrition information systems, assessment of vulnerable population groups, interpretation of nutrition data.

UNIT III: Public Health Nutrition Programmes and Policies

National Nutrition Policy, National Health Policy, Integrated Child Development Services (ICDS), POSHAN Abhiyaan, PM POSHAN Scheme, Anaemia Mukt Bharat, Vitamin A Supplementation Programme, National Iodine Deficiency Disorders Control Programme (NIDDCP), Food Fortification Programme, Public Distribution System (PDS), Mid-Day Meal initiatives, Sustainable Development Goals (SDGs) related to nutrition.

UNIT IV: Nutrition Education, Health Promotion and Disease Prevention

Principles of nutrition education, behaviour change communication, Information, Education and Communication (IEC), social and behaviour change communication (SBCC), community participation, nutrition counselling, health promotion strategies, prevention and control of protein-energy malnutrition, micronutrient deficiencies, obesity, diabetes, cardiovascular diseases, food security and household nutrition.

UNIT V: Emerging Issues and Research in Public Health Nutrition

Public health nutrition research, programme planning, monitoring and evaluation, nutrition intervention strategies, emergency nutrition, disaster nutrition management, nutrition in humanitarian settings, food security, sustainable diets, climate change and nutrition, digital health technologies, nutrition informatics, recent advances and current trends in public health nutrition.

Text Books

1. Michael J. Gibney, Barrie M. Margetts, John M. Kearney & Lenore Arab. *Public Health Nutrition* (2nd Edition). Wiley-Blackwell, Oxford, UK.
2. Mahtab S. Bamji, N. Prahlad Rao & Vinodini Reddy. *Textbook of Human Nutrition* (4th Edition). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, India.
3. B. Srilakshmi. *Nutrition Science* (8th Edition). New Age International (P) Ltd., New Delhi, India.
4. K. Park. *Park's Textbook of Preventive and Social Medicine* (27th Edition). Banarsidas Bhanot Publishers, Jabalpur, India.

Reference Books

1. Judith E. Brown. *Nutrition Through the Life Cycle* (7th Edition). Cengage Learning, Boston, USA.
2. Kathleen L. Mahan & Janice L. Raymond. *Krause's Food & the Nutrition Care Process* (16th Edition). Elsevier, St. Louis, Missouri, USA.
3. Gordon M. Wardlaw & Anne M. Smith. *Contemporary Nutrition* (10th Edition). McGraw-Hill Education, New York, USA.
4. World Health Organization. *Essential Nutrition Actions: Improving Maternal, Newborn, Infant and Young Child Health and Nutrition*. World Health Organization, Geneva, Switzerland.
5. Food and Agriculture Organization of the United Nations. *Human Nutrition in the Developing World*. FAO, Rome, Italy.

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4. National Digital Library of India (NDLI)
<https://ndl.iitkgp.ac.in>
5. ICMR – National Institute of Nutrition (NIN)
<https://www.nin.res.in>
6. World Health Organization (WHO)
<https://www.who.int>
7. UNICEF – Nutrition Learning Resources
<https://www.unicef.org/nutrition>
8. POSHAN Abhiyaan
<https://poshanabhiyaan.gov.in>
9. PubMed – National Library of Medicine
<https://pubmed.ncbi.nlm.nih.gov>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the concepts, principles, and scope of public health nutrition and community nutrition programmes.	K2
CO2	Apply methods of nutritional assessment, surveillance, and community diagnosis for population health.	K3
CO3	Analyze public health nutrition problems, national nutrition programmes, and policy interventions.	K4
CO4	Evaluate nutrition education strategies, health promotion programmes, and disease prevention approaches for communities.	K5
CO5	Design evidence-based public health nutrition interventions, programme evaluation strategies, and community nutrition action plans.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	–	1	–	–	–	3	2	–
CO2	3	3	2	1	2	–	–	–	3	2	1
CO3	3	3	3	2	2	1	–	–	3	3	2
CO4	3	3	3	3	2	2	1	–	3	3	2
CO5	3	3	3	3	3	2	2	1	3	3	3

Semester III	Core Theory-Clinical Nutrition and Diet Therapy Practical
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Course Objectives

- To develop practical skills in nutritional assessment, therapeutic diet planning, and Medical Nutrition Therapy (MNT) for various disease conditions.
- To provide hands-on training in nutritional counseling, hospital diet planning, nutritional screening, and patient care using the Nutrition Care Process.
- To enable students to formulate evidence-based therapeutic diets and nutrition care plans for patients with acute and chronic diseases.

Practical Exercise

1. Planning and preparation of normal hospital diet.
2. Planning and preparation of soft diet.
3. Planning and preparation of clear liquid and full liquid diets.
4. Planning and preparation of high-protein and high-energy diets.
5. Planning and preparation of low-protein therapeutic diets.
6. Planning and preparation of sodium-restricted diets.
7. Planning and preparation of fat-modified diets.
8. Planning and preparation of fibre-modified diets.
9. Medical Nutrition Therapy and diet planning for Diabetes Mellitus.
10. Medical Nutrition Therapy and diet planning for Obesity.
11. Medical Nutrition Therapy and diet planning for Hypertension and Cardiovascular Diseases.
12. Medical Nutrition Therapy and diet planning for Chronic Kidney Disease and Dialysis.
13. Medical Nutrition Therapy and diet planning for Liver Disorders.
14. Medical Nutrition Therapy and diet planning for Gastrointestinal Disorders.
15. Medical Nutrition Therapy and diet planning for Cancer patients.
16. Medical Nutrition Therapy and diet planning for Burns and Trauma patients.
17. Planning enteral nutrition formulas and tube feeding schedules.
18. Case study presentation and comprehensive nutritional management of selected clinical cases.

Text Books

1. Kathleen L. Mahan & Janice L. Raymond. *Krause's Food & the Nutrition Care Process* (16th Edition). Elsevier, St. Louis, Missouri, USA.
2. Sylvia Escott-Stump. *Nutrition and Diagnosis-Related Care* (9th Edition). Lippincott Williams & Wilkins, Philadelphia, USA.
3. Sara Long Roth. *Nutrition and Diet Therapy* (12th Edition). Cengage Learning, Boston, USA.
4. B. Srilakshmi. *Dietetics* (8th Edition). New Age International (P) Ltd., New Delhi, India.

Reference Books

1. Williams, P. *Williams' Essentials of Nutrition and Diet Therapy* (12th Edition). Elsevier, St. Louis, Missouri, USA.
2. Shils, M.E., Shike, M., Ross, A.C., Caballero, B. & Cousins, R.J. *Modern Nutrition in Health and Disease* (11th Edition). Lippincott Williams & Wilkins, Philadelphia, USA.

- Gordon M. Wardlaw & Anne M. Smith. *Contemporary Nutrition* (10th Edition). McGraw-Hill Education, New York, USA.

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<https://epgp.inflibnet.ac.in>
- National Digital Library of India (NDLI)**
<https://ndl.iitkgp.ac.in>
- ICMR – National Institute of Nutrition (NIN)**
<https://www.nin.res.in>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Demonstrate skills in nutritional assessment and therapeutic diet planning for various disease conditions.	K3
CO2	Apply the Nutrition Care Process and Medical Nutrition Therapy in clinical practice.	K3
CO3	Analyze clinical, biochemical, dietary, and anthropometric data for nutritional management of patients.	K4
CO4	Evaluate therapeutic diets, nutrition support, and patient counseling strategies based on evidence-based guidelines.	K5
CO5	Design comprehensive nutrition care plans and therapeutic dietary interventions for patients with acute and chronic diseases.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	1	–	–	–	–	3	2	2
CO2	3	3	2	2	1	–	–	–	3	3	2
CO3	3	3	3	3	2	1	–	–	3	3	2
CO4	3	3	3	3	3	2	1	–	3	3	3
CO5	3	3	3	3	3	3	2	2	3	3	3

Semester III	Core Practical-Food Quality Control Practical
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Course Objectives

- To develop practical skills in food quality evaluation, quality assurance, and food safety assessment using standard quality control techniques.
- To provide hands-on training in food preservation methods, packaging, storage, and shelf-life evaluation of food products.
- To enable students to apply food quality standards, food safety regulations, and quality management systems for ensuring the production of safe and high-quality foods.

Practical Exercises

1. Quality evaluation of cereals and cereal products.
2. Quality evaluation of pulses and legumes.
3. Quality evaluation of fresh fruits and vegetables.
4. Quality evaluation of milk and milk products.
5. Quality evaluation of edible oils and fats.
6. Detection of common food adulterants in milk, edible oils, spices, cereals, and pulses.
7. Evaluation of food packaging materials for quality and suitability.
8. Evaluation of food labels according to Food Safety and Standards Authority of India (FSSAI) regulations.
9. Sensory evaluation of food products using the Nine-Point Hedonic Rating Scale.
10. Shelf-life evaluation of food products under different storage conditions.
11. Preparation of Standard Operating Procedures (SOPs) for food quality control.
12. Preparation of Hazard Analysis and Critical Control Point (HACCP) plan for selected food products.
13. Preparation and quality evaluation of dehydrated fruits and vegetables.
14. Preparation and quality evaluation of fermented food products.
15. Preparation and quality evaluation of Ready-to-Serve (RTS) fruit beverage.

Text Books

1. B. Srilakshmi. *Food Science* (7th Edition). New Age International (P) Ltd., New Delhi, India.
2. Norman N. Potter & Joseph H. Hotchkiss. *Food Science* (5th Edition). Springer Science & Business Media, New York, USA.
3. N. Manay & M. Shadaksharaswamy. *Foods: Facts and Principles* (3rd Edition). New Age International (P) Ltd., New Delhi, India.

Reference Books

1. M. Shafiur Rahman. *Handbook of Food Preservation* (3rd Edition). CRC Press, Taylor & Francis Group, Boca Raton, USA.
2. Leo M.L. Nollet & Fidel Toldrá. *Handbook of Food Analysis* (4th Edition). CRC Press, Taylor & Francis Group, Boca Raton, USA.
3. Geoffrey P. Webb. *Dietary Supplements and Functional Foods*. Wiley-Blackwell, Oxford, UK.

- Food Safety and Standards Authority of India (FSSAI). *Manual of Methods of Analysis of Foods*. Ministry of Health & Family Welfare, Government of India, New Delhi.
- Bureau of Indian Standards (BIS). *Indian Standards for Food Products*. Bureau of Indian Standards, New Delhi, India.

E-Learning Resources

- SWAYAM – Study Webs of Active Learning for Young Aspiring Minds
<https://swayam.gov.in>
- NPTEL – National Programme on Technology Enhanced Learning
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- e-PG Pathshala (UGC–INFLIBNET Centre)
<https://epgp.inflibnet.ac.in>
- Food Safety and Standards Authority of India (FSSAI)
<https://www.fssai.gov.in>
- Food and Agriculture Organization (FAO) E-Learning Academy
<https://elearning.fao.org>
- Codex Alimentarius Commission
<https://www.fao.org/fao-who-codexalimentarius>
- AOAC INTERNATIONAL – Official Methods of Analysis
<https://www.aoac.org>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the principles of food quality control, food preservation, and food safety regulations.	K2
CO2	Demonstrate practical skills in food quality evaluation, preservation, packaging, and sensory analysis.	K3
CO3	Analyze quality characteristics, shelf-life, and safety parameters of food products using standard quality control methods.	K4
CO4	Evaluate food quality management systems, food standards, labeling regulations, and HACCP principles for quality assurance.	K5
CO5	Design appropriate food preservation techniques and quality assurance plans for the production of safe and high-quality food products.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	–	–	–	–	–	3	2	–
CO2	3	3	2	2	1	–	–	–	3	3	2
CO3	3	3	3	2	2	1	–	–	3	3	2
CO4	3	3	3	3	3	2	1	–	3	3	3
CO5	3	3	3	3	3	3	2	2	3	3	3

Semester III	Elective Theory-Sports Nutrition
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Course Objectives

- To provide comprehensive knowledge of the role of nutrition in enhancing sports performance, physical fitness, and exercise recovery.
- To develop competency in assessing nutritional requirements and planning diets for recreational, competitive, and elite athletes.
- To enable students to apply evidence-based sports nutrition strategies for improving athletic performance, recovery, and overall health.

UNIT I: Fundamentals of Sports Nutrition

Concept, scope, and objectives of sports nutrition. Role of nutrition in physical fitness and athletic performance. Energy systems during exercise. Energy expenditure and energy balance. Assessment of nutritional status of athletes. Body composition and methods of assessment. Nutritional requirements of recreational, competitive, and elite athletes.

UNIT II: Macronutrients, Micronutrients, and Hydration (

Carbohydrate, protein, and fat requirements for athletes. Glycogen loading and carbohydrate periodization. Protein quality, amino acid supplementation, and muscle protein synthesis. Role of dietary fats in exercise performance. Vitamins and minerals in sports performance. Fluid and electrolyte balance. Hydration strategies before, during, and after exercise. Sports drinks and electrolyte replacement.

UNIT III: Nutrition for Exercise, Training, and Recovery

Pre-event, during-event, and post-event nutrition. Recovery nutrition and glycogen replenishment. Nutrition for strength, endurance, and power athletes. Nutrition for team sports and individual sports. Nutrition during resistance training and aerobic exercise. Weight management strategies for athletes. Meal planning for training and competition.

UNIT IV: Ergogenic Aids and Sports Supplements

Concept and classification of ergogenic aids. Nutritional supplements used in sports. Protein supplements, creatine, caffeine, beta-alanine, nitrate, branched-chain amino acids (BCAA), and probiotics. Safety, efficacy, and adverse effects

of sports supplements. Anti-doping regulations and World Anti-Doping Agency (WADA) guidelines. Ethical issues in sports nutrition.

UNIT V: Sports Nutrition in Special Populations and Emerging Trends

Nutrition for child and adolescent athletes. Nutrition for female athletes. Nutrition for masters and elderly athletes. Sports nutrition for para-athletes. Nutrition for vegetarian and vegan athletes. Personalized sports nutrition. Nutrigenomics in sports nutrition. Recent advances and emerging trends in sports nutrition research.

Text Books

1. Louise M. Burke & Vicki Deakin. *Clinical Sports Nutrition* (6th Edition). McGraw-Hill Education, Sydney, Australia.
2. Dan Benardot. *Advanced Sports Nutrition* (3rd Edition). Human Kinetics Publishers, Champaign, Illinois, USA.
3. Ronald J. Maughan, Louise M. Burke & Ira Jacobs. *Sports Nutrition* (2nd Edition). Wiley-Blackwell, Oxford, UK.
4. Melvin H. Williams. *Nutrition for Health, Fitness and Sport* (12th Edition). McGraw-Hill Education, New York, USA.

Reference Books

1. American Dietetic Association, Dietitians of Canada & American College of Sports Medicine. *Nutrition and Athletic Performance*. Human Kinetics Publishers, Champaign, Illinois, USA.
2. Jeukendrup, A. & Gleeson, M. *Sport Nutrition: An Introduction to Energy Production and Performance* (3rd Edition). Human Kinetics Publishers, USA.
3. Ron Maughan. *The Encyclopaedia of Sports Medicine: Sports Nutrition*. Wiley-Blackwell, Oxford, UK.
4. Mike Greenwood, Douglas Kalman & Jose Antonio. *Nutritional Supplements in Sports and Exercise*. Humana Press, New York, USA.
5. Institute of Medicine. *Dietary Reference Intakes for Energy, Carbohydrate, Protein, Fat, Fatty Acids, Cholesterol, Fiber, and Amino Acids*. National Academies Press, Washington, DC, USA.

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<https://swayam.gov.in>
2. **NPTEL – National Programme on Technology Enhanced Learning**
<https://nptel.ac.in>
3. **e-PG Pathshala (UGC–INFLIBNET Centre)**
<https://epgp.inflibnet.ac.in>
4. **National Digital Library of India (NDLI)**
<https://ndl.iitkgp.ac.in>

5. **International Society of Sports Nutrition (ISSN)**
<https://www.sportsnutritionssociety.org>
6. **American College of Sports Medicine (ACSM)**
<https://www.acsm.org>
7. **World Anti-Doping Agency (WADA)**
<https://www.wada-ama.org>
8. **Australian Institute of Sport (AIS) – Sports Nutrition**
<https://www.ais.gov.au/nutrition>
9. **PubMed – National Library of Medicine**
<https://pubmed.ncbi.nlm.nih.gov>
10. **Food and Agriculture Organization (FAO) E-Learning Academy**
<https://elearning.fao.org>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the principles of sports nutrition and nutritional requirements for athletes.	K2
CO2	Apply nutritional strategies for training, competition, hydration, and recovery.	K3
CO3	Analyze the influence of nutrients, body composition, and exercise on athletic performance.	K4
CO4	Evaluate the use of sports supplements, ergogenic aids, and anti-doping regulations.	K5
CO5	Design evidence-based nutrition plans for athletes participating in different sports and exercise programmes.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	–	–	–	–	–	3	2	–
CO2	3	3	2	2	1	–	–	–	3	3	2
CO3	3	3	3	2	2	1	–	–	3	3	2
CO4	3	3	3	3	2	2	1	–	3	3	3
CO5	3	3	3	3	3	2	2	2	3	3	3

Semester III	Elective Theory-B. Institutional Food Service Management
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Course Objectives

- To provide comprehensive knowledge of institutional food service systems, organization, planning, and management.
- To develop competencies in menu planning, quantity food production, procurement, quality assurance, and food safety in institutional settings.
- To enable students to apply managerial principles for efficient, economical, and sustainable food service operations.

UNIT I: Fundamentals of Institutional Food Service Management

Concept, scope, objectives, and evolution of institutional food service management. Types of food service institutions including hospitals, educational institutions, industrial canteens, hostels, defence services, and commercial establishments. Classification of food service systems. Functions and responsibilities of food service managers. Principles of food service organization and administration. Organizational structure and management functions.

UNIT II: Menu Planning and Quantity Food Production

Principles and factors affecting menu planning. Menu planning for hospitals, schools, colleges, industries, and special institutions. Standardization of recipes. Quantity food production methods. Food purchasing, receiving, storage, inventory control, and stock management. Portion control and yield management. Kitchen layout and workflow planning.

UNIT III: Food Safety, Sanitation, and Quality Assurance

Food hygiene and sanitation in institutional food services. Personal hygiene and safe food handling practices. Cleaning and sanitation of food service facilities and equipment. Food Safety and Standards Authority of India (FSSAI) regulations. Hazard Analysis and Critical Control Point (HACCP). Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP). Quality assurance and quality control in food service operations.

UNIT IV: Human Resource and Financial Management

Human resource planning, recruitment, selection, training, supervision, and performance appraisal. Leadership, motivation, communication, and team management. Budget preparation and financial management. Cost control in food service operations. Pricing strategies. Waste management and cost-effective resource utilization. Record keeping and documentation.

UNIT V: Modern Trends in Institutional Food Service Management

Computer applications in food service management. Food service information systems. Green and sustainable food service practices. Customer satisfaction and quality improvement programmes. Accreditation and quality standards in healthcare food services. Entrepreneurship opportunities in institutional food services. Emerging trends and innovations in institutional food service management.

Text Books

1. B. Srilakshmi. *Food Service Management*. New Age International (P) Ltd., New Delhi, India.
2. Mohini Sethi & Surjeet Malhan. *Catering Management: An Integrated Approach*. New Age International (P) Ltd., New Delhi, India.
3. Katharine E. Gregoire. *Foodservice Organizations: A Managerial and Systems Approach* (9th Edition). Pearson Education, Boston, USA.
4. Marian C. Spears & Velma B. Gregoire. *Foodservice Organizations: A Managerial and Systems Approach*. Pearson Education, USA.

Reference Books

1. June Payne-Palacio & Monica Theis. *Foodservice Management: Principles and Practices* (13th Edition). Pearson Education, USA.
2. Dennis R. Reynolds & Imran S. Rahman. *Introduction to Hospitality: An Overview of the Hospitality Industry*. John Wiley & Sons, Hoboken, USA.
3. Paul Insel, R. Elaine Turner & Don Ross. *Nutrition* (6th Edition). Jones & Bartlett Learning, Burlington, USA.
4. Food Safety and Standards Authority of India (FSSAI). *Food Safety and Standards Regulations and Guidance Documents*. FSSAI, Ministry of Health & Family Welfare, Government of India, New Delhi.
5. World Health Organization. *Five Keys to Safer Food Manual*. World Health Organization, Geneva, Switzerland.

E-Learning Resources

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2. NPTEL – National Programme on Technology Enhanced Learning
<https://nptel.ac.in>
3. e-PG Pathshala (UGC–INFLIBNET Centre)
<https://epgp.inflibnet.ac.in>
4. National Digital Library of India (NDLI)
<https://ndl.iitkgp.ac.in>
5. Food Safety and Standards Authority of India (FSSAI)
<https://www.fssai.gov.in>
6. Indian Institute of Food Processing Technology (IIFPT)
<https://www.iifpt.edu.in>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the principles, organization, and management of institutional food service systems.	K2
CO2	Apply menu planning, quantity food production, procurement, and inventory management principles in institutional food services.	K3
CO3	Analyze food safety, sanitation, quality assurance, and regulatory requirements in institutional food service operations.	K4
CO4	Evaluate financial, human resource, and operational management practices for efficient food service administration.	K5
CO5	Design effective management strategies for quality improvement, sustainability, and innovation in institutional food service organizations.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	–	–	–	–	–	3	2	–
CO2	3	3	2	2	1	–	–	–	3	3	2
CO3	3	3	3	2	2	1	–	–	3	3	2
CO4	3	3	3	3	3	2	1	–	3	3	3
CO5	3	3	3	3	3	3	2	2	3	3	3

Internship Training in Hospitals

(15 Days-To be carried out during the Summer Vacation at the end of the First Year)

- The Dietetic Internship is designed to provide students with comprehensive supervised practical training in clinical nutrition, dietetics, hospital food service management, and patient care. The internship enables students to integrate theoretical knowledge with professional practice and develop the competencies required for entry-level nutrition and dietetics professionals.
- At the end of the internship, each student shall submit a comprehensive Internship Report/Log Book certified by the supervising authority of the respective institution. The report shall be evaluated, followed by an individual **Viva Voce Examination** to assess the student's practical knowledge, professional skills, and learning outcomes.

Course Objectives

- To provide comprehensive knowledge of advanced food processing technologies and their applications in food industries.
- To develop an understanding of innovative processing methods for improving food quality, safety, shelf life, and nutritional value.
- To enable students to evaluate emerging food processing technologies for sustainable food production and product development.

UNIT I: Principles of Advanced Food Processing

Principles and objectives of food processing. Conventional and advanced food processing technologies. Effect of processing on nutritional quality, sensory characteristics, and food safety. Process optimization and quality assurance. Current trends in food processing industries.

UNIT II: Thermal and Non-Thermal Food Processing Technologies

Advanced thermal processing methods including microwave heating, ohmic heating, infrared heating, radio frequency heating, and aseptic processing. Non-thermal technologies including High Pressure Processing (HPP), Pulsed Electric Field (PEF), Cold Plasma Technology, Ultraviolet (UV) processing, irradiation, ultrasound processing, and ozone technology. Applications, advantages, and limitations of advanced processing technologies.

UNIT III: Membrane, Separation and Novel Processing Technologies

Membrane processing techniques including microfiltration, ultrafiltration, nanofiltration, and reverse osmosis. Freeze concentration and vacuum concentration. Extrusion cooking technology. Encapsulation and nanoencapsulation techniques. Microencapsulation of bioactive compounds. Application of biotechnology in food processing.

UNIT IV: Smart Food Processing and Packaging Technologies

Food process automation and digital technologies. Internet of Things (IoT) in food processing. Artificial Intelligence (AI) and machine learning applications in food industries. Robotics in food processing. Intelligent and smart packaging systems. Active packaging, edible coatings, biodegradable packaging materials, and nanotechnology in food packaging.

UNIT V: Emerging Trends and Sustainable Food Processing

Green food processing technologies. Sustainable processing practices. Valorization of food industry by-products. Clean label foods and minimally processed foods. 3D food printing technology. Precision fermentation and alternative protein processing. Food process innovation, industrial applications, and future prospects.

Text Books

1. Sun, D.W. *Emerging Technologies for Food Processing* (2nd Edition). Academic Press, Elsevier, London, UK.
2. Da-Wen Sun. *Handbook of Food Processing: Food Preservation* (2nd Edition). CRC Press, Taylor & Francis Group, Boca Raton, USA.
3. Gustavo V. Barbosa-Cánovas, M.S. Tapia & M.P. Cano. *Novel Food Processing Technologies*. CRC Press, Taylor & Francis Group, Boca Raton, USA.
4. P.J. Fellows. *Food Processing Technology: Principles and Practice* (5th Edition). Woodhead Publishing, Elsevier, Cambridge, UK.

Reference Books

1. Y.H. Hui. *Handbook of Food Science, Technology and Engineering*. CRC Press, Taylor & Francis Group, Boca Raton, USA.
2. R. Paul Singh & Dennis R. Heldman. *Introduction to Food Engineering* (6th Edition). Academic Press, Elsevier, USA.
3. Stephanie Clark, Stephanie Jung & Buddhi Lamsal. *Food Processing: Principles and Applications* (3rd Edition). Wiley-Blackwell, Ames, USA.
4. M. Shafiur Rahman. *Handbook of Food Preservation* (3rd Edition). CRC Press, Taylor & Francis Group, Boca Raton, USA.
5. Norman N. Potter & Joseph H. Hotchkiss. *Food Science* (5th Edition). Springer Science & Business Media, New York, USA.

E-Learning Resources

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3. **e-PG Pathshala (UGC–INFLIBNET Centre)**
<https://epgp.inflibnet.ac.in>
4. **National Digital Library of India (NDLI)**
<https://ndl.iitkgp.ac.in>
5. **Food and Agriculture Organization (FAO) E-Learning Academy**
<https://elearning.fao.org>
6. **Institute of Food Technologists (IFT)**
<https://www.ift.org>

7. **International Union of Food Science and Technology (IUFoST)**
<https://iufost.org>
8. **Food Safety and Standards Authority of India (FSSAI)**
<https://www.fssai.gov.in>
9. **PubMed – National Library of Medicine**
<https://pubmed.ncbi.nlm.nih.gov>
10. **ScienceDirect – Food Science and Technology Collection**
<https://www.sciencedirect.com>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the principles and applications of advanced food processing technologies.	K2
CO2	Apply advanced thermal and non-thermal processing techniques for food preservation and quality enhancement.	K3
CO3	Analyze novel processing technologies and their impact on food quality, safety, and nutritional value.	K4
CO4	Evaluate smart processing systems, innovative packaging technologies, and sustainable food processing approaches.	K5
CO5	Design appropriate advanced food processing strategies for the development of safe, high-quality, and value-added food products.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	–	–	–	–	–	3	2	–
CO2	3	3	2	2	1	–	–	–	3	3	2
CO3	3	3	3	2	2	1	–	–	3	3	2
CO4	3	3	3	3	3	2	1	–	3	3	3
CO5	3	3	3	3	3	3	2	2	3	3	3

Semester IV	Project work and Viva Voce
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Course Objectives

- To provide students with an opportunity to undertake independent research in the field of Nutrition and Dietetics.
- To develop competencies in research planning, data collection, analysis, interpretation, and scientific report writing.
- To enhance critical thinking, problem-solving abilities, and scientific communication through dissertation preparation and oral presentation.

Course Outcomes

CO	Course Outcomes	K level
CO1	Identify and formulate a research problem relevant to Nutrition and Dietetics.	K3
CO2	Apply appropriate research methods, data collection techniques, and statistical tools in conducting research.	K3
CO3	Analyze, interpret, and present research findings using scientific methods.	K4
CO4	Evaluate research outcomes and prepare a scientific dissertation following ethical and academic standards.	K5
CO5	Demonstrate professional competence through effective dissertation presentation and Viva Voce examination.	K6

General Guidelines

Students shall receive orientation and academic counseling regarding research facilities available in the Department, areas of specialization, and faculty members offering research guidance. Based on their research interest, students may select the project topic and supervisor at the beginning of the **Third Semester**, subject to departmental approval.

The dissertation shall be prepared in accordance with the prescribed University guidelines and submitted within the stipulated period. Any request for an extension of the submission deadline shall be governed by the rules and regulations of the University. The Project Viva Voce Examination shall be conducted jointly by the Internal Supervisor and the External Examiner.

Scheme of Evaluation

Maximum Marks: 100

Internal Assessment (Guide): 25 Marks

External Assessment: 75 Marks

- Quality of Project Work and Dissertation – **50 Marks**
- Oral Presentation – **15 Marks** , Viva Voce Examination – **10 Marks**

Semester IV	Elective Theory- A. Geriatric Nutrition and Care
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Course Objectives

- To provide comprehensive knowledge of the physiological, nutritional, and psychosocial changes associated with ageing.
- To develop competencies in nutritional assessment, dietary planning, and healthcare management for older adults.
- To enable students to apply evidence-based nutrition interventions for promoting healthy ageing and improving the quality of life of the elderly.

UNIT I: Fundamentals of Geriatric Nutrition

Concept, scope, and importance of geriatric nutrition. Demographic trends and ageing population. Biology of ageing and theories of ageing. Physiological, metabolic, psychological, and social changes during ageing. Nutritional requirements of older adults. Nutritional challenges and determinants of nutritional status in the elderly. Healthy ageing and active ageing concepts.

UNIT II: Nutritional Assessment and Dietary Management in Older Adults

Nutritional screening and assessment methods for the elderly. Anthropometric, biochemical, clinical, dietary, and functional assessment. Comprehensive Geriatric Assessment (CGA). Dietary guidelines for older adults. Meal planning and menu modification. Texture-modified diets and feeding assistance. Nutrition support for frail and institutionalized elderly.

UNIT III: Medical Nutrition Therapy in Geriatric Disorders

Medical Nutrition Therapy for osteoporosis, sarcopenia, frailty syndrome, dysphagia, constipation, dehydration, pressure ulcers, dementia, Alzheimer's disease, Parkinson's disease, diabetes mellitus, cardiovascular diseases, chronic kidney disease, and cancer in older adults. Drug–nutrient interactions and polypharmacy. Nutrition support in palliative and end-of-life care.

UNIT IV: Geriatric Care and Community Nutrition

Principles of geriatric healthcare. Long-term care and institutional care services. Home-based nutrition care. Nutrition counseling for older adults and

caregivers. Community support programmes for senior citizens. National Programme for Health Care of the Elderly (NPHCE). Integrated healthcare services and multidisciplinary geriatric care. Ethical issues in geriatric nutrition.

UNIT V: Emerging Trends in Geriatric Nutrition

Functional foods and nutraceuticals for healthy ageing. Immunonutrition in older adults. Personalized nutrition and precision nutrition in geriatrics. Digital health technologies and telehealth for elderly care. Healthy longevity and successful ageing. Current research trends and recent advances in geriatric nutrition and care.

Text Books

1. Brown, Judith E. *Nutrition Through the Life Cycle* (7th Edition). Cengage Learning, Boston, USA.
2. Mahan, L.K. & Raymond, J.L. *Krause's Food & the Nutrition Care Process* (16th Edition). Elsevier, St. Louis, Missouri, USA.
3. Whitney, E. & Rolfes, S.R. *Understanding Nutrition* (16th Edition). Cengage Learning, Boston, USA.
4. B. Srilakshmi. *Nutrition Science* (8th Edition). New Age International (P) Ltd., New Delhi, India.

Reference Books

1. Watson, Ronald Ross. *Handbook of Nutrition in the Aged* (5th Edition). CRC Press, Taylor & Francis Group, Boca Raton, USA.
2. Chernoff, Ronni. *Geriatric Nutrition: The Health Professional's Handbook* (4th Edition). Jones & Bartlett Learning, Burlington, USA.
3. Mauk, Kristen L. *Gerontological Nursing: Competencies for Care* (5th Edition). Jones & Bartlett Learning, Burlington, USA.
4. Morley, John E. *Nutrition and the Elderly*. CRC Press, Taylor & Francis Group, Boca Raton, USA.
5. World Health Organization. *World Report on Ageing and Health*. World Health Organization, Geneva, Switzerland.

E-Learning Resources

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3. **e-PG Pathshala (UGC–INFLIBNET Centre)**
<https://epgp.inflibnet.ac.in>

4. **National Digital Library of India (NDLI)**
<https://ndl.iitkgp.ac.in>
5. **ICMR – National Institute of Nutrition (NIN)**
<https://www.nin.res.in>
6. **World Health Organization (WHO)**
<https://www.who.int>
7. **National Institute of Social Defence (NISD)**
<https://nisd.gov.in>
8. **National Programme for Health Care of the Elderly (NPHCE)**
<https://main.mohfw.gov.in>
9. **PubMed – National Library of Medicine**
<https://pubmed.ncbi.nlm.nih.gov>
10. **Food and Agriculture Organization (FAO) E-Learning Academy**
<https://elearning.fao.org>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the physiological changes and nutritional requirements associated with ageing.	K2
CO2	Apply nutritional assessment methods and dietary management strategies for older adults.	K3
CO3	Analyze nutritional problems and Medical Nutrition Therapy for common geriatric disorders.	K4
CO4	Evaluate community-based geriatric care programmes and nutrition interventions for healthy ageing.	K5
CO5	Design evidence-based nutrition care plans to improve the health and quality of life of elderly individuals.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	–	–	–	–	–	3	2	–
CO2	3	3	2	2	1	–	–	–	3	3	2
CO3	3	3	3	2	2	1	–	–	3	3	2
CO4	3	3	3	3	2	2	1	–	3	3	3
CO5	3	3	3	3	3	3	2	2	3	3	3

Semester IV	Elective Theory- B. Digital Food Service and E- Commerce Management
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Course Objectives

- To provide comprehensive knowledge of digital technologies and e-commerce applications in modern food service management.
- To develop competencies in managing digital food service operations, online food businesses, and electronic commerce platforms.
- To enable students to apply innovative digital solutions for efficient food service management, customer engagement, and entrepreneurial development.

UNIT I: Fundamentals of Digital Food Service and E-Commerce

Concept, scope, and evolution of digital food service management. Digital transformation in the food service industry. Fundamentals of e-commerce and digital business models. Types of e-commerce (B2B, B2C, C2C, and D2C). Digital infrastructure for food service organizations. Opportunities and challenges in digital food businesses.

UNIT II: Digital Food Service Operations

Digital menu planning and recipe standardization. Point-of-Sale (POS) systems. Computerized food production scheduling. Inventory and procurement management software. Kitchen Display Systems (KDS). Cloud kitchens, ghost kitchens, and virtual restaurants. Automation and robotics in food production and service operations.

UNIT III: E-Commerce and Digital Marketing for Food Businesses

Online food ordering systems and food delivery platforms. E-commerce websites and mobile applications. Digital payment gateways and financial transactions. Customer Relationship Management (CRM). Digital branding and online customer engagement. Social media marketing, influencer marketing, and search engine optimization (SEO). Online reputation management and customer feedback systems.

UNIT IV: Digital Food Safety, Quality Assurance and Data Analytics

Digital food safety management systems. Electronic documentation for HACCP and food quality management. Food traceability using barcode, QR code, RFID, and blockchain technology. Internet of Things (IoT) applications in food service. Artificial Intelligence (AI) and Machine Learning in demand forecasting, inventory optimization, and customer analytics. Cybersecurity and data privacy in digital food businesses.

UNIT V: Emerging Trends in Digital Food Business

Smart restaurants and intelligent food service systems. Personalized nutrition through digital platforms. E-commerce entrepreneurship and food startups. Sustainable digital food service practices. Green logistics and digital supply chain management. Future trends in food technology, e-commerce innovations, and digital transformation in food service industries.

Text Books

1. Gregoire, M.B. *Foodservice Organizations: A Managerial and Systems Approach* (9th Edition). Pearson Education, Boston, USA.
2. Payne-Palacio, J. & Theis, M. *Foodservice Management: Principles and Practices* (13th Edition). Pearson Education, New York, USA.
3. Laudon, K.C. & Traver, C.G. *E-Commerce: Business, Technology, Society* (18th Edition). Pearson Education, New York, USA.
4. Chaffey, D. *Digital Business and E-Commerce Management* (8th Edition). Pearson Education Limited, Harlow, UK.

Reference Books

1. Laudon, K.C. & Laudon, J.P. *Management Information Systems: Managing the Digital Firm* (17th Edition). Pearson Education, New York, USA.
2. Kotler, P., Kartajaya, H. & Setiawan, I. *Marketing 5.0: Technology for Humanity*. Wiley, Hoboken, USA.
3. Buhalis, D. & Leung, R. *Smart Hospitality and Tourism*. Goodfellow Publishers, Oxford, UK.
4. Kotschevar, L.H. & Withrow, D. *Management by Menu*. Wiley, Hoboken, USA.
5. Food Safety and Standards Authority of India (FSSAI). *Food Safety and Standards Regulations and Guidance Documents*. FSSAI, New Delhi, India.

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2. **NPTEL – National Programme on Technology Enhanced Learning**
<https://nptel.ac.in>
3. **e-PG Pathshala (UGC–INFLIBNET Centre)**
<https://epgp.inflibnet.ac.in>
4. **National Digital Library of India (NDLI)**
<https://ndl.iitkgp.ac.in>
5. **Food Safety and Standards Authority of India (FSSAI)**
<https://www.fssai.gov.in>
6. **Institute of Food Technologists (IFT)**
<https://www.ift.org>
7. **Food and Agriculture Organization (FAO) E-Learning Academy**
<https://elearning.fao.org>

8. Coursera – Digital Business, E-Commerce and Hospitality Courses
<https://www.coursera.org>
9. Google Digital Garage – Digital Marketing and E-Commerce Learning
<https://learndigital.withgoogle.com/digitalgarage>
10. PubMed – National Library of Medicine
<https://pubmed.ncbi.nlm.nih.gov>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the concepts, principles, and applications of digital food service management and e-commerce.	K2
CO2	Apply digital technologies for food service operations, inventory management, and customer service.	K3
CO3	Analyze e-commerce platforms, digital marketing strategies, and online business models for food enterprises.	K4
CO4	Evaluate digital food safety systems, data analytics, and emerging technologies in food service industries.	K5
CO5	Design innovative digital food service and e-commerce solutions for sustainable and competitive food businesses.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	–	–	–	–	–	3	2	–
CO2	3	3	2	2	1	–	–	–	3	3	2
CO3	3	3	3	2	2	1	–	–	3	3	2
CO4	3	3	3	3	3	2	1	–	3	3	3
CO5	3	3	3	3	3	3	2	2	3	3	3

Semester IV	SEC-Start-up Development in Nutrition and Dietetics
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Course Objectives

- To introduce the fundamentals of entrepreneurship and start-up development in the field of Nutrition and Dietetics.
- To develop entrepreneurial skills for planning, establishing, and managing nutrition-related enterprises.
- To create awareness about government support, funding opportunities, and business ethics for nutrition professionals.

UNIT I: Introduction to Entrepreneurship

Concept and scope of entrepreneurship. Characteristics of an entrepreneur. Opportunities for start-ups in Nutrition and Dietetics. Role of nutrition professionals in entrepreneurship. Entrepreneurial competencies and business ethics.

UNIT II: Business Planning and Start-up Development

Identification of business opportunities. Preparation of a simple business plan. Business registration procedures. Sources of finance and government schemes for start-ups. Basics of costing, pricing, and budgeting.

UNIT III: Nutrition-Based Enterprises

Start-up opportunities in clinical nutrition, diet counseling, sports nutrition, food product development, nutraceuticals, community nutrition, wellness centres, catering services, and digital nutrition consulting. Branding and marketing strategies.

UNIT IV: Business Management and Digital Promotion

Basics of business management. Customer relationship management. Digital marketing through websites and social media. E-commerce platforms for nutrition products and services. Record keeping and legal compliance.

UNIT V: Innovation and Future Prospects

Innovation in nutrition entrepreneurship. Sustainable and socially responsible business practices. Success stories of nutrition entrepreneurs. Challenges and opportunities in start-up development. Preparation and presentation of a simple business proposal.

Text Books

1. Hisrich, R.D., Peters, M.P. & Shepherd, D.A. *Entrepreneurship*. McGraw-Hill Education, New York, USA.
2. Khanka, S.S. *Entrepreneurial Development*. S. Chand & Company Ltd., New Delhi, India.
3. Desai, V. *Dynamics of Entrepreneurial Development and Management*. Himalaya Publishing House, Mumbai, India.

Reference Books

1. Balaraju, T. *Entrepreneurship Development*. Atlantic Publishers & Distributors, New Delhi, India.
2. Zimmerer, T.W., Scarborough, N.M. & Wilson, D. *Essentials of Entrepreneurship and Small Business Management*. Pearson Education, New York, USA.
3. Government of India. *Startup India: Action Plan and Guidelines*. Department for Promotion of Industry and Internal Trade (DPIIT), New Delhi, India.

E-Learning Resources

1. **SWAYAM – Study Webs of Active Learning for Young Aspiring Minds**
<https://swayam.gov.in>
2. **NPTTEL – National Programme on Technology Enhanced Learning**
<https://nptel.ac.in>
3. **Startup India Learning Program**
<https://www.startupindia.gov.in>
4. **MSME – Ministry of Micro, Small and Medium Enterprises**
<https://msme.gov.in>

COURSE OUTCOMES

After successful completion of the course the students will be able to:

CO	Course Outcomes	K level
CO1	Explain the concepts of entrepreneurship and start-up development in Nutrition and Dietetics.	K2
CO2	Identify business opportunities and prepare a simple business plan.	K3
CO3	Apply basic management and marketing strategies for nutrition-related enterprises.	K3
CO4	Evaluate government schemes and financial support available for start-ups.	K5
CO5	Develop an innovative start-up proposal in the field of Nutrition and Dietetics.	K6

MAPPING (CO/PO/PSO):

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	2	2	1	–	–	–	2	–	2	1	–
CO2	2	2	2	1	–	–	2	–	2	2	1
CO3	2	3	2	2	1	–	2	1	2	3	2
CO4	2	2	3	2	1	1	2	1	2	2	2
CO5	3	3	3	2	2	1	3	2	3	3	3