



**M.Sc., DIETETICS AND FOOD MANAGEMENT
SYLLABUS**

(for affiliated colleges)

ACADEMIC YEAR 2026-2027

MANONMANIAM SUNDARANAR UNIVERSITY

TIRUNELVELI – 12

M.Sc. Dietetics and Food Management
MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI

OUTCOME BASED EDUCATION - CHOICE BASED CREDIT SYSTEM
OPERATIONAL GUIDELINES FOR FRAMING CURRICULUM

VISION AND MISSION OF THE UNIVERSITY

Vision

"To provide quality education to reach the un-reached"

Mission

- ❖ To conduct research, teaching and outreach programmes to improve conditions of human living
- ❖ To offer a wide variety of off-campus educational and training programs, including the use of information technology, to individuals and groups.
- ❖ To develop partnership with industries and government so as to improve the quality of the workplace and to serve as catalyst for economic and cultural development
- ❖ To provide quality / inclusive education, especially for the rural and un-reached segments of economically downtrodden students including women, socially oppressed and differently abled

PREAMBLE

- ❖ Outcome Based Education (OBE) has emerged as an effective approach in higher education to ensure quality, skill oriented and learner centered education. The Choice Based Credit System (CBCS) provides flexibility in curriculum design enables students to acquire knowledge, skills and competencies according to their interests and career aspirations. The curriculum is designed to promote flexibility, critical thinking, problem solving ability and lifelong learning through effective teaching, learning, and assessment practices. The revised curriculum framework integrates Programme Educational Outcomes (PEOs), Programme Outcomes (POs), Programme Specific Outcomes (PSOs), and Course Outcomes (COs) in alignment with the Vision and Mission of the University. The adoption of Revised Bloom's Taxonomy (RBT) ensures effective attainment of knowledge, skills, ethical values, and employability among learners. The

courses are systematically designed and mapped to ensure that the outcomes of all courses collectively contribute to the achievement of the programme outcomes and the holistic development of students.

PROGRAMME EDUCATIONAL OUTCOMES (PEO)

In alignment with the Vision and Mission of the University, the following have been defined as the PEO for the graduates.

PEO1: Developing strong positive attitude to learn independently the concepts in the field of study

PEO2: Ensuring confidence among the learners to apply the knowledge and skills gained to solve real life issues

PEO3: Habituating ethical values among the learners to succeed in personal and professional life

PROGRAMME OUTCOMES (PO)

Programme Outcomes for the Undergraduate and Postgraduate Degree Programmes of the University are articulated as under.

After the successful completion of the Undergraduate Programme from the University, the learner should be able to

PO1: Comprehend the knowledge acquired and communicate the same to others.

PO2: Analyse and compare the factual data/situation to comprehend and to critically evaluate to find solution to the problem ahead.

PO3: Apply theories and philosophies learned in solving the problem in a scientific manner.

PO4: Think reflectively on the earlier activities and attempt for self-directed lifelong learning process.

PO5: Understand multicultural existence and identify the means to prolong moral/ethical values in personal and professional life.

PO6: Explore through multiple sources and get exposed to the digital literacy and information explosion with latest technology.

PO7: Act as a responsible member in the varied teams with facilitating capability and formulate teams as a leader for defined purposes.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

On successful completion of Bachelor of B programme, the student should be able to:

PSO1: Disciplinary Knowledge:

Understand the fundamental principles, concepts, and theories related to B. Also, exhibit proficiency in performing experiments in the laboratory.

PSO2: Critical Thinking:

Analyse complex problems, evaluate information, synthesize information, apply theoretical concepts to practical situations, identify assumptions and biases, make informed decisions and communicate effectively.

PSO3: Problem Solving:

Employ theoretical concepts and critical reasoning ability with B and practical skills to solve problems, acquire data, analyze their physical significance and explore new scientific findings.

PSO4: Analytical & Scientific Reasoning:

Apply scientific methods, collect and analyse data, test hypotheses, evaluate evidence, apply statistical techniques and use computational models.

PSO5: Research related skills:

Formulate research questions, conduct literature reviews, design and execute research studies, communicate research findings and collaborate in research projects.

PSO6: Self-directed & Lifelong Learning:

Continuously update the knowledge by lifelong learning and contribute to the growth and development of science and technology.

PSO7: Employability and Entrepreneurship

Develop skills for employability, entrepreneurship, and career readiness in industry, education, and technology-driven sectors.

Each Course has to address a minimum of 4 PSOs

Level of contribution of the Course towards attaining PSOs

0 – No Contribution 1 – Low Level 2 – Medium Level 3 – High Level

COURSE OUTCOMES (CO)

Four Course Outcomes (COs) for each course that can be achieved by the learners on completion of that particular course are as follows:

Considering outcomes related to

- i. K1 and K2 level of evaluation in all the Units as CO1
- ii. K3 level of evaluation in all the Units as CO2
- iii. K4 level of evaluation in all the Units as CO3
- iv. K5 and K6 level of evaluation in all the Units as CO4.

All the COs proposed in each of the courses should be mapped with POs based on the relevance.

Level of Correlation between COs and POs

0 – No Correlation 1 – Low 2 – Medium 3 – High

G. Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) can be carried out accordingly, assigning the appropriate level in the grids:

	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1														
CO2														
CO3														
CO4														

Programme Details:

Eligibility criteria: B.Sc. Food Science, Nutrition & Dietetics, Home Science, or any Science degree with Chemistry.

Medium of instruction: English **Duration of the programme:** 2 years

MEASUREMENT OF ATTAINMENT OF COURSE OUTCOME

The Course Outcomes (COs) are measured through the performance of learners by direct and indirect assessment methods for that particular course.

i. Internal Assessment (25 Marks)

Tests – 15 Marks

Seminar & Assignments/Attention (Participation) in Class – 5+5 Marks

ii. Semester End Examinations (75 Marks)

Written exams, Practical, Project report, and Comprehensive Viva Voce

Note: In both Internal and Semester End Examinations

Higher Order Thinking (K1, K2, & K3) – 60 % in each part

Lower Order Thinking (K4, K5, & K6) – 40 % in each part

EVALUATION SCHEME

- M.Sc Dietetics and Food Management curriculum is divided and studied in four semesters.
- The internal assessments and external examination are the two parts of evaluation scheme.
- The external theory and practical examinations will be conducted by the university at the end of each semester.
- There is a separate passing minimum of 50% for the external and overall components.

DISTRIBUTION OF MARKS BETWEEN INTERNAL AND EXTERNAL ASSESSMENT FOR CORE, SKILL ENHANCEMENT AND ELECTIVE COURSES.

* Theory Marks 25: 75

* Practical Marks 50: 50

Pass a minimum of 50% for external and overall components.

1. Internal Assessment

Internal Marks for Theory shall be allotted in the following manner

The average of the best two tests from three compulsory tests. Each test is of one hour duration	15 marks
Assignment	05 marks
Seminar	05 marks
Total	25 Marks

2. Marks for the Practical / Major Project shall be allotted in the following manner

Internal Marks: 50; External Marks: 50

3. External evaluation of Project:

Project report evaluation and Viva-Voce will be conducted by both the External examiner and the Guide at the end of the semester.

4. Internship / Industrial Activity Credits: 2

Students shall undergo Internship / Industrial Activity / Field-Based Training in a relevant industry, institution, research laboratory, hospital, NGO, government organization, or any other approved establishment related to the programme of study.

At the end of the internship, students shall submit a comprehensive Internship Report duly certified by the concerned organization along with an Attendance/Completion Certificate. The report should include details of the organization, objectives, activities undertaken, observations, outcomes, and learning experiences gained during the internship period.

The Internship Report shall be evaluated at the end of the programme along with the Project Viva-Voce examination by the Department/External Examiner.

Evaluation Scheme

Component	Marks
Internal Assessment	50
External Assessment	50
Total	100

Internal Assessment (50 Marks)

Criteria	Marks
Attendance and Discipline	10
Performance Evaluation by the Organization Supervisor	15
Internship Diary / Record Maintenance	10
Seminar / Presentation	15
Total	50

External Assessment (50 Marks)

Criteria	Marks
Internship Report	25
Viva-Voce Examination	25
Total	50

Students must successfully complete the internship and submit the required documents for the award of credits.

5. Extension Activity:

The student should participate in outreach programmes and the examination / report / evaluation will be conducted at the end of the fourth semester.

6. Internship / Industrial Activity / Field-Based Training in a relevant industry

Credits: 2

Students shall undergo Internship / Industrial Activity / Field-Based Training in a relevant industry, institution, research laboratory, hospital, NGO, government organization, or any other approved establishment related to the programme of study.

At the end of the internship, students shall submit a comprehensive Internship Report duly certified by the concerned organization along with an Attendance/Completion Certificate. The report should include details of the organization, objectives, activities undertaken, observations, outcomes, and learning experiences gained during the internship period.

The Internship Report shall be evaluated at the end of the programme along with the Project Viva-Voce examination by the Department/External Examiner.

7. Evaluation Scheme

The question pattern for all theory courses shall be as follows.

Duration of Exam: 3 Hours

Component	Marks
Internal Assessment	50
External Assessment	50
Total	100

Internal Assessment (50 Marks)

Criteria	Marks
Attendance and Discipline	10
Performance Evaluation by the Organization Supervisor	15
Internship Diary / Record Maintenance	10
Seminar / Presentation	15
Total	50

External Assessment (50 Marks)

Criteria	Marks
Internship Report	25
Viva-Voce Examination	25
Total	50

Students must complete the internship and submit the required documents for the award of credits.

5. The question pattern for all theory courses shall be as follows.

Duration of Exam: 3 Hours

Section	Type of questions	Mark Distribution
Part A	Fifteen multiple-choice questions (Three questions from each unit compulsory)	15 x 1=15 Marks
Part B	Five Internal Choice questions (One question from each unit: Either or choice)	5 x 4 =20 marks
Part C	Five Internal Choice questions (One question from each unit: Either or choice)	5 x 8 =40 marks
Total		75 Marks

ADVANCES IN FOOD SCIENCE

Time: Three Hours

Maximum Marks: 75

PART – A (15 × 1 = 15 Marks)

Answer ALL the questions. Choose the correct answer.

No.	Questions	BT Level
1	Which property helps colloidal particles scatter light? a) Osmosis b) Tyndall effect c) Coagulation d) Adsorption	K1
2	The process in which starch granules absorb water and swell on heating is called a) Retrogradation b) Gelation c) Gelatinization d) Fermentation	K1
3	Gluten is formed when a) Fat mixes with water b) Wheat flour is mixed with water c) Sugar is heated d) Protein is denatured	K2
4	Which factor commonly causes protein denaturation? a) Cold storage b) Heat c) Vacuum packing d) Filtration	K1
5	Which among the following is a simple protein? a) Glycoprotein b) Lipoprotein c) Albumin d) Metalloprotein	K1
6	The enzyme responsible for the breakdown of fats is a) Amylase b) Protease c) Lipase d) Maltase	K1
7	Which sugar is naturally the sweetest? a) Lactose b) Maltose c) Fructose d) Glucose	K1
8	One major function of fats in the body is to a) Provide insulation b) Form enzymes c) Carry oxygen d) Produce hormones only	K2
9	The yellow colour of butter is mainly due to a) Riboflavin b) Chlorophyll c) Carotene d) Iron	K1
10	Average fat percentage in cow's milk is about a) 2% b) 4% c) 8% d) 12%	K1
11	The shell colour of egg mainly depends upon a) Feed intake b) Breed of hen c) Size of egg d) Storage condition	K2
12	Pasteurization of milk is mainly done to a) Increase sweetness b) Improve colour c) Destroy harmful microorganisms d) Increase fat content	K2
13	Which sugar is commonly known as milk sugar? a) Sucrose b) Fructose c) Lactose d) Maltose	K1
14	Preservatives are added to foods mainly to a) Improve texture b) Extend shelf life c) Increase protein d) Add sweetness	K2
15	Artificial colours are mainly used to a) Improve appearance b) Increase nutrients c) Reduce spoilage d) Enhance fibre content	K2

PART – B (5 × 4 = 20 Marks)

Answer ALL questions.

No.	Questions	BT Level
16 a	Explain the physical properties of foods with suitable examples.	K2
	OR	
16 b	Analyze the factors influencing starch gelatinization.	K4
17 a	Explain the biological functions of proteins.	K2

	OR	
17 b	Analyze the role of enzymes in food processing.	K4
18 a	Explain the nutritional importance of edible oils.	K2
	OR	
18 b	Analyze the functional properties of sugars in food preparation.	K4
19 a	Describe fermented milk products and their characteristics.	K2
	OR	
19 b	Analyze the factors affecting the coagulation of egg proteins.	K4
20 a	Explain artificial sweetening agents and their uses.	K2
	OR	
20 b	Evaluate the advantages and limitations of natural and artificial flavouring agents.	K5

PART – C (5 × 8 = 40 Marks)

Answer ALL questions.

No.	Questions	BT Level
21 a	Analyze the characteristics and applications of colloids in foods with suitable examples.	K4
	OR	
21 b	Analyze the structure, classification and functions of starch.	K4
22 a	Evaluate the classification and nutritional significance of proteins in food systems.	K5
	OR	
22 b	Analyze the factors affecting enzyme activity in foods.	K4
23 a	Assess the nutritional implications of different types of fats in human health.	K5
	OR	
23 b	Evaluate the physical and chemical properties of sugars in food preparation.	K5
24 a	Evaluate the factors affecting the quality and storage of eggs.	K5
	OR	
24 b	Analyze the preparation and importance of non-fermented milk products.	K4
25 a	Assess the role of sugar-based products in food processing.	K5
	OR	
25 b	Develop a classification chart showing the functions and applications of food additives.	K6

PG COURSES – AFFILIATED COLLEGES

Course Structure for M.Sc. (Dietetics & Food Management)

(With effect from the academic year 2026- 2027 onwards)

Choice Based Credit System (CBCS), Learning Outcomes-Based Curriculum Framework (LOCF)

First Year – Semester – I

Part	List of Courses	Credits	No. of Hours
	Core – I	5	6
	Core – II	5	6
	Core – III	4	6
	Core – 1 Practical	2	4
	Elective – I	2	4
	Elective – II practical	2	4
		20	30

First Year – Semester – II

Part	List of Courses	Credits	No. of Hours
	Core – IV	5	6
	Core – V	5	6
	Core – VI	4	6
	Elective – III	3	4
	Elective – IV	3	4
	Skill Enhancement Course [SEC] - I	2	4
		22	30

Second Year – Semester – III

Part	List of Courses	Credits	No. of Hours
	Core – VII	5	6
	Core – VIII	5	6
	Core – IX	5	6
	Core (Industry Module) – X	4	6
	Elective – V	3	3
	Skill Enhancement Course - II	2	3
	Internship / Industrial Activity [Credits]	2	-
		26	30

Second Year – Semester – IV

Part	List of Courses	Credits	No. of Hours
	Core – XI	5	6
	Core – XII	5	6
	Project with Viva Voce	7	10
	Elective – VI (Industry Entrepreneurship)	3	4
	Skill Enhancement Course – III / Professional Competency Skill	2	4
	Extension Activity	1	-
		23	30

Total 91 Credits for PG Courses

SEMESTER-I

Part	List of Courses	Course Code	Credits	Hours Per Week (L/T/P)
Core- I	Advances in Food Science		5	6
Core –II	Advances in Human Physiology		5	6
Core- III	Macronutrients		4	6
Core I Practical	Advances in Food Science Practical		2	4
Elective - I	Emerging Technologies in Food Processing Or Applied Food Technology		2	4
Elective – II Practical	Emerging Technologies in Food Processing Practical Or Applied Food Technology Practical		2	4
			20	30

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II**

Part	List of Courses	Credits	Hours Per Week (L/T/P)
Core-IV	Advanced Methods in Nutrition Research	5	6
Core-V	Therapeutic Dietetics	5	6
Core-VI	Therapeutic Dietetics- Practical	4	6
Elective-III	Contemporary Sports Nutrition Or Maternal and Child Nutrition	3	4
Elective – IV	Functional Foods and Health Or Nutrigenomics	3	4
Skill Enhancement Course SEC – I NME	Nutrition in Special Conditions	2	4
		22	30

SEMESTER -III

Part	List of Courses	Credits	Hours Per Week (L/T/P)
Core - VII	Micronutrients	5	6
Core - VIII	Food Microbiology	5	6
Core - IX	Nutritional Biochemistry	5	6
Core - X (Industry Module)	Techniques in Food Analysis	4	6
Elective - V	Perspectives of Home Science OR Communication and Programme Planning for Health Promotion	3	3
Skill Enhancement Course - II	Scientific Writing and Research Presentation Skills	2	3
	Internship / Industrial Activity	2	-
		26	30

Semester-IV

Part	List of Courses	Credits	Hours Per Week (L/T/P)
Core – XI	Applied Ergonomics and Human Factors	5	6
Core - XII	Food Quality Control	5	6
Core - XIII	Project Work with Viva Voce	7	10

Elective - VI	Hospital Administration OR Pathophysiology And Metabolism in Disease	3	4
Skill Enhancement Course – III/ Professional Competency Skill	Food Quality Control- Practical	2	4
Extension Activity	Extension Activity	1	-
		23	30
Grand Total		91	120

Semester – I

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CI A	External	Total
	Advances in Food Science	Core I	6	6	-	-	5	25	75	100

Course Outcomes (COs)		
	Upon successful completion of the course, the students will be able to:	
CO1:	Analyze the physicochemical properties, rheological behaviour, and functional characteristics of food constituents and food systems.	
CO2:	Evaluate the structure–function relationships of proteins and enzymes and their applications in food processing and product development.	
CO3:	Examine the physicochemical changes, functional properties, and industrial applications of fats, oils, sugars, milk, and eggs.	
CO4:	Assess the role of food additives, flavours, sweeteners, and emerging food ingredients in enhancing food quality, safety, and consumer acceptability.	
Unit	Topic	Hours
I	Properties of Foods and Starch Systems: Food constituents and food systems, solutions, colloids and dispersions, rheological behaviour of foods, viscoelastic properties, measurement of viscosity and texture, structure and stability of gels, sols, emulsions and foams, starch chemistry, modified starches, functional starches, resistant starch, starch interactions in food systems, gluten network formation and quality characteristics.	20
II	Proteins and Enzymes: Protein structure–function relationships, protein denaturation, gelation and texturization, functional properties of food proteins, protein concentrates, isolates and hydrolysates, plant-based proteins, enzyme kinetics, factors affecting enzyme activity, enzyme technology in food processing, immobilized enzymes, enzyme-assisted food modifications and industrial applications.	18
III	Fats, Oils and Sugar Systems: Physical and chemical properties of fats and oils, crystallization behaviour of lipids, hydrogenation, interesterification and winterization, lipid oxidation mechanisms, flavour reversion, rancidity control, trans-fat alternatives, fat replacers, sugar chemistry, crystallization and inversion, functional properties of sugars, sugar substitutes and reduced-calorie sweeteners.	20
IV	Milk and Egg Science: Milk chemistry, casein micelle structure, whey proteins, physicochemical changes during processing, coagulation mechanisms, non-enzymatic browning reactions, fermented dairy products, functional dairy ingredients, egg chemistry, egg proteins, functional properties, egg quality evaluation, egg substitutes and applications in food formulations.	17
V	Food Additives, Flavours and Sweeteners: Food additives, regulatory and safety aspects, natural and synthetic additives, flavour chemistry, flavour generation during processing, encapsulation of flavours, food colour chemistry, natural pigments, artificial and natural sweeteners, emerging sweeteners, clean-label ingredients and current trends in food product development.	15

Total	90
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Text Books

1. Food Chemistry, Springer International Publishing, Latest Edition.
2. Fennema's Food Chemistry, CRC Press, Latest Edition.
3. Introduction to Food Chemistry, CRC Press, Latest Edition.
4. Food Science, CBS Publishers & Distributors, Latest Edition.
5. Principles of Food Science, Academic Press, Latest Edition.

Reference Books

1. Food Processing Technology: Principles and Practice, Woodhead Publishing, Latest Edition.
2. Food Biochemistry and Food Processing, Wiley-Blackwell, Latest Edition.
3. Food Proteins and Their Applications, CRC Press, Latest Edition.
4. Handbook of Food Science, Technology and Engineering, CRC Press, Latest Edition.
5. Food Lipids: Chemistry, Nutrition and Biotechnology, CRC Press, Latest Edition.
6. Dairy Chemistry and Biochemistry, Springer, Latest Edition.
7. Egg Science and Technology, CRC Press, Latest Edition.
8. Food Additives, CRC Press, Latest Edition.

Journals for Advanced Reading

1. Journal of Food Science
2. Food Chemistry
3. Food Research International
4. International Journal of Food Science and Technology
5. Trends in Food Science and Technology

Web Resources

1. [Food Safety and Standards Authority of India \(FSSAI\)](#)
2. [Institute of Food Technologists \(IFT\)](#)
3. [Food and Agriculture Organization \(FAO\)](#)
4. [Codex Alimentarius Commission](#)
5. [National Institute of Nutrition \(NIN\)](#)
6. [International Food Information Council \(IFIC\)](#)
- 7.

CO – PO – PSO Mapping (Course Articulation Matrix)\

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	1	3	1	–	–	3	3	2	1	–	–	–
CO2	3	3	3	2	2	1	–	3	3	3	2	1	–	–
CO3	3	3	2	2	3	1	1	3	2	3	3	1	–	–
CO4	2	3	3	2	2	2	2	2	2	3	3	2	1	1

Correlation Level: 3 = High Correlation 2 = Moderate Correlation 1 = Low Correlation Blank = No Correlation

MSU

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CI A	External	Total
	Advances in Human Physiology	Core II	6	6	-	-	5	25	75	100
Course Outcomes (COs)										
	Upon successful completion of the course, students will be able to:									
CO1:	Explain the structure and functions of cells, tissues, blood, and the cardiovascular system in maintaining normal body functions.									
CO2:	Analyze the physiological mechanisms involved in respiration, immunity, and endocrine regulation.									
CO3:	Examine the processes of digestion, absorption, reproduction, and hormonal control in human physiology.									
CO4:	Evaluate the functions of the nervous, excretory, and integumentary systems in maintaining homeostasis.									
Unit	Content									No. of Hours
I	Cell and Tissue Physiology Cell: Structure and functions of the cell. Cell membrane and transport mechanisms across the membrane. Cell theory and cell cycle. Mitosis and meiosis: stages and differences. Stem cells: types and functions. Tissues: Classification, structure, and functions of epithelial, connective, muscular, and nervous tissues.									15
II	Blood and Cardiovascular Physiology Blood: Composition and functions of blood. Blood groups: ABO and Rh systems. Hemostasis and blood coagulation. Cardiovascular System: Structure and functions of the heart and blood vessels. Systemic and pulmonary circulation. Cardiac cycle and conduction system of the heart. Heart rate, cardiac output, and electrocardiogram (ECG). Blood pressure and its regulation.									15
III	Respiratory System: Structure and function. Gas Laws pertaining to Gas Exchange (Meaning only)-Henry's Law of Partial Pressure, Boyle - Mariotte's Law of Volume and Pressure, Dalton's Law of Partial Pressure, Charles's Law of Ideal Gas Equation and Fick's Law of Diffusion. Mechanism of respiration. Circulation and Exchange of Respiratory Gases. Internal and External Respiration. Chloride shift. Definitions of Lung volumes and Lung capacities. Ventilation and Artificial Respiration. Immunity: Definition and types -Innate and Acquired immunity. Endocrine System: Hormones and their types. Syndromes resulting from hypo and hyperactivity of the Pituitary, Thyroid, Adrenals and Pancreas.									20
IV	Gastrointestinal System: Structure and function of GI tract and its accessory organs. Digestion and absorption of carbohydrates, proteins, and Fats.									20

	Reproductive System: Role of hormones in reproduction and Lactation. Menstrual Cycle and Menopause. In vitro (IV) fertilisation Spermatogenesis.	
V	Nervous, Excretory, and Skin Physiology Structure and functions of neurons. Afferent and efferent nerves. Conduction of nerve impulses: synapses, neurotransmitters, summation, and action potential. Sympathetic and parasympathetic nervous systems. Cerebrospinal fluid (CSF): composition and functions. Blood–brain barrier (BBB). Electroencephalogram (EEG) and its significance. Excretory system: organs of the urinary system. Structure and functions of the nephron and juxtaglomerular apparatus. Mechanism of urine formation. Role of kidneys in the regulation of blood pressure, water balance, electrolyte balance, and acid–base balance. Skin: structure and functions of the skin. Regulation of body temperature and thermoregulation.	20
	Total Hours	90

REFERENCES	
Textbooks	
1	Sembulingam, K., & Sembulingam, P. (2019). <i>Essentials of medical physiology</i> (8th ed.). Jaypee Brothers Medical Publishers.
2	Waugh, A., & Grant, A. (2018). <i>Ross and Wilson anatomy and physiology in health and illness</i> (13th ed.). Elsevier.
3	Chatterjee, C. C. (2020). <i>Human physiology</i> (13th ed.). CBS Publishers & Distributors.
4	Khurana, I. (2020). <i>Medical physiology for undergraduate students</i> (2nd ed.). Elsevier.
5	Pal, G. K. (2019). <i>Textbook of human physiology</i> (3rd ed.). Elsevier.
Reference Books	
1	Guyton, A. G., & Hall, J. B. (2005). <i>Textbook of medical physiology</i> (9th ed.). W.B. Saunders Company.
2	Wilson, K. J. W., & Waugh, A. (2003). <i>Ross and Wilson's Anatomy and Physiology in Health and Illness</i> (8th ed.). Churchill Livingstone.
3	Jain, A. K. (n.d.). <i>Textbook of physiology</i> (Vols. I & II). Avichal Publishing Company.
4	McArdle, W. D., Katch, F. I., & Katch, V. L. (2001). <i>Exercise physiology: Energy, nutrition and human performance</i> (4th ed.). Williams & Wilkins.
5	Ganong, W. F. (1985). <i>Review of medical physiology</i> (12th ed.). Lange Medical Publications.
6	Moran Campbell, E. J., Dickinson, C. J., Slater, J. D., Edwards, C. R. W., & Sikora, K. (1984). <i>Clinical physiology</i> (5th ed.). Blackwell Scientific Publications.
7	McArdle, W. D., Katch, F. I., & Katch, V. L. (1996). <i>Exercise Physiology: Energy, Nutrition and Human Performance</i> (4th ed.). Williams & Wilkins.
8	Jain, A. K. (n.d.). <i>Textbook of Physiology</i> (Vols. I & II). Avichal Publishing Company.
9	Sears. (n.d.). <i>Anatomy and physiology for nurses</i> . Edward Arnold.

10	Chatterjee, C. C. (n.d.). <i>Textbook of Medical Physiology</i> . W.B. Saunders.
Web Resources	
1	https://youtu.be/MZDy0RvA52Y -Osmosis
2	https://youtu.be/TgcyiVQnVBs - Respiratory system
3	https://youtu.be/44B0ms3XPKU - Nervous system

CO–PO–PSO Mapping (Course Articulation Matrix)

CO s	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	2	1	2	1	–	–	3	2	1	–	–	–	–
CO 2	3	3	2	2	1	1	–	3	3	2	1	–	–	–
CO 3	3	3	2	2	2	1	–	3	2	3	2	1	–	–
CO 4	3	3	2	3	2	2	1	3	2	2	3	2	1	1
	12	11	7	9	6	4	1	12	9	8	6	3	1	1

Correlation Level: 3 = High Correlation 2 = Moderate Correlation 1 = Low Correlation Blank = No Correlation

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CI A	External	Total
	Macronutrients	Core III	6	6	-	-	4	25	75	100
Course Outcomes (COs)										
	Upon successful completion of the course, students will be able to:									
CO1:	Analyze energy metabolism, energy balance, and factors influencing energy requirements in health and disease.									
CO2:	Evaluate the digestion, absorption, metabolism, and physiological functions of carbohydrates and their role in health and disease.									
CO3:	Examine the metabolism, functions, and health implications of proteins and lipids, including their role in disease prevention and management.									
CO4:	Assess water and electrolyte balance, fluid regulation mechanisms, and disorders associated with fluid and electrolyte imbalance.									
Unit	Contents									Hours
I	Energy Metabolism and Energy Balance: Energy content and physiological fuel value of foods, direct and indirect calorimetry, energy metabolism and energy balance, estimation of energy requirements, Basal Metabolic Rate (BMR), Resting Metabolic Rate (RMR), Resting Energy Expenditure (REE), Thermic Effect of Food (TEF), physical activity and Total Energy Expenditure (TEE), factors affecting energy expenditure, regulation of food intake, hunger and satiety mechanisms, body composition and energy balance, obesity and metabolic implications, adaptive thermogenesis.									20
II	Carbohydrates: Classification, digestion, absorption and transport of carbohydrates, carbohydrate metabolism, glycolysis, glycogenesis, glycogenolysis, gluconeogenesis and pentose phosphate pathway, glycemic index and glycemic load, dietary fibre and resistant starch, sugar substitutes and alternative sweeteners, therapeutic applications of carbohydrates, carbohydrate-related metabolic disorders including lactose intolerance, galactosemia and hereditary fructose intolerance, role of carbohydrates in health and disease.									20
III	Proteins: Classification, structure and properties of proteins, digestion, absorption and transport of amino acids, amino acid metabolism, transamination, deamination and decarboxylation, protein synthesis and turnover, nitrogen balance, protein quality evaluation methods, protein requirements across the life cycle, bioactive peptides, protein-energy malnutrition, therapeutic applications of proteins, role of proteins in health and disease.									15
IV	Lipids: Classification and properties of lipids, visible and invisible fats, digestion, absorption and transport of lipids, essential fatty acids, SFA, MUFA, PUFA, omega-3 and omega-6 fatty acids, lipid metabolism, lipogenesis and lipolysis, ketogenesis, lipoproteins and									20

	their functions, adipose tissue metabolism, storage and mobilization of body fat, dyslipidemia and cardiovascular diseases, fat substitutes, functional lipids and hypocholesterolemic foods.	
V	Water and Electrolyte Balance: Body water compartments and distribution, sources, functions and requirements of water, water balance and regulation, electrolyte balance, sodium, potassium, chloride, calcium and magnesium metabolism, acid-base balance, role of antidiuretic hormone (ADH), aldosterone and renin–angiotensin system, dehydration, water intoxication, edema and electrolyte imbalance disorders, fluid management in clinical conditions.	15
Total Hours		90

References

Text Books

1. Gropper, S.S., Smith, J.L. and Carr, T.P. (2023). *Advanced Nutrition and Human Metabolism* (8th Edition). Cengage Learning, Boston, USA.
2. McGuire, M. and Beerman, K.A. (2021). *Nutritional Sciences: From Fundamentals to Food* (5th Edition). Cengage Learning, Boston, USA.
3. Geissler, C. and Powers, H. (2017). *Human Nutrition* (13th Edition). Wiley-Blackwell, Oxford, UK.
4. Ross, A.C., Caballero, B., Cousins, R.J., Tucker, K.L. and Ziegler, T.R. (2020). *Modern Nutrition in Health and Disease* (12th Edition). Wolters Kluwer, Philadelphia, USA.
5. Berdanier, C.D., Dwyer, J.T. and Heber, D. (2014). *Nutrition and Metabolism* (2nd Edition). CRC Press/Taylor & Francis, Boca Raton, USA.

Reference Books

1. Stipanuk, M.H. and Caudill, M.A. (2018). *Biochemical, Physiological and Molecular Aspects of Human Nutrition* (4th Edition). Elsevier Academic Press, London, UK.
2. Marriott, B.P., Birt, D.F., Stallings, V.A. and Yates, A.A. (Eds.) (2020). *Present Knowledge in Nutrition* (11th Edition). Wiley-Blackwell, Hoboken, New Jersey, USA.
- 3.Sizer, F.S. and Whitney, E.N. (2023). *Nutrition: Concepts and Controversies* (16th Edition). Cengage Learning, Boston, USA.
4. Bamji, M.S., Krishnaswamy, K. and Brahman, G.N.V. (2017). *Textbook of Human Nutrition* (4th Edition). New Age International Publishers, New Delhi, India.
5. Geissler, C. and Powers, H. (2017). *Human Nutrition* (13th Edition). Wiley-Blackwell, Oxford, UK.

Journals

1. The American Journal of Clinical Nutrition
2. The Journal of Nutrition
3. Nutrition Reviews
4. European Journal of Clinical Nutrition
5. Nutrition Research
6. Public Health Nutrition
7. Current Developments in Nutrition
8. Advances in Nutrition

Web Resources

- [National Institute of Nutrition \(NIN\)](#)
- [Indian Council of Medical Research \(ICMR\)](#)
- [Food Safety and Standards Authority of India \(FSSAI\)](#)
- [World Health Organization – Nutrition](#)
- [Food and Agriculture Organization \(FAO\) – Nutrition Division](#)
- [United Nations Children's Fund \(UNICEF\) – Nutrition](#)
- National Health Portal of India
- [Nutrition Society of India](#)

CO–PO–PSO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	2	2	1	–	–	3	3	2	1	–	–	–
CO2	3	3	2	2	2	1	–	3	3	3	2	1	–	–
CO3	3	3	3	2	2	1	1	3	2	3	3	2	1	–
CO4	3	2	2	3	2	2	1	3	2	2	3	2	1	1

Correlation Level: 3 = High Correlation 2 = Moderate Correlation 1 = Low Correlation
Blank = No Correlation

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CI A	External	Total
	Advances in Food Science Practical	Core I Practical	-	-	4	-	2	50	50	100
Course Outcomes (COs)										
	Upon successful completion of the course, students will be able to:									
CO1:	Perform sensory evaluation techniques and assess the functional properties of starch and gluten in food systems.									
CO2:	Evaluate the cooking quality of pulses and the physicochemical changes occurring in fruits during processing.									
CO3:	Analyze the effects of processing on vegetables, milk, sugars, fats, and oils using standard laboratory techniques.									
CO4:	Determine physical properties, quality characteristics, and adulteration in food samples using appropriate analytical methods.									
UNIT	Content								No. of Hours	
I	Sensory evaluation – Taste sensitivity threshold test, Duo–Trio test, Multiple sample difference test, Hedonic rating scale, Ranking test, Sensory score card preparation’ Starch – Microscopic structure, Gelatinization, Factors affecting gelatinization, Sag test, Gluten formation.								10	
II	Pulses – Factors affecting cooking quality, Fruits – Enzymatic browning, Effect of anti-browning agents, Pectin test, Firmness of gel, Rehydration ratio of dehydrated fruits and vegetables.								10	
III	Vegetables – Effect of various cooking methods on fat-soluble and water-soluble pigments. Milk – Detection of starch, soda, urea, detergent and formalin adulteration, Determination of pH, Lactometer test, Effect of acid on milk, Effect of heat on milk proteins, Maillard reaction.								15	
IV	Sugars – Relative sweetness of sucrose, maltose, lactose, fructose, dextrose, glucose and artificial sweeteners, Stages of sugar cookery, Effect of dextrose, jaggery, honey and cream of tartar on sucrose Fats and oils – Smoke point determination, Cooking temperature and fat absorption, Emulsion stability, Rancidity assessment.								15	
V	Physical properties – Thousand grain weight, Thousand grain volume, Hydration capacity, Hydration index, Swelling capacity, Specific gravity, Seed displacement test, Bulk density, Water absorption capacity, Oil absorption capacity, Viscosity by line								10	

	spread test and viscometer.	
	Food adulteration- Food adulteration tests, Food label analysis and interpretation.	
	Total Hours	60

References

Laboratory Manuals

1. Handbook of Food Analytical Chemistry, Wiley. Nielsen, S. S. (2017). *Food Analysis Laboratory Manual* (3rd ed.). Springer, New York.
2. Nielsen, S. S. (2017). *Food Analysis* (5th ed.). Springer, Cham.
3. Swaminathan, M. (2003). *Experimental Food Science* (2nd ed.). BAPPCO Publications, Bangalore.
4. Rahman, M. S. (2007). *Handbook of Food Preservation* (2nd ed.). CRC Press, Boca Raton. (Useful for food science laboratory applications and quality evaluation techniques.)
5. Wrolstad, R. E., Acree, T. E., Decker, E. A., Penner, M. H., Reid, D. S., Schwartz, S. J., Shoemaker, C. F., Smith, D. M., & Sporns, P. (2005). *Handbook of Food Analytical Chemistry* (Vols. 1 & 2). Wiley-Interscience, New Jersey.

Reference Books

6. Damodaran, S., Parkin, K. L., & Fennema, O. R. (2017). *Fennema's Food Chemistry* (5th ed.). CRC Press, Boca Raton.
7. Belitz, H. D., Grosch, W., & Schieberle, P. (2009). *Food Chemistry* (4th ed.). Springer, Berlin.
8. Fellows, P. J. (2017). *Food Processing Technology: Principles and Practice* (4th ed.). Woodhead Publishing, Oxford.
9. Parker, R. (2012). *Introduction to Food Science* (2nd ed.). Cengage Learning, New Delhi.
10. Potter, N. N., Hotchkiss, J. H., Balakumar, S., & Balasubramaniam, V. M. (2012). *Food Science* (5th ed.). CBS Publishers & Distributors, New Delhi.

Web Resources

11. Food Safety and Standards Authority of India (FSSAI). Available at: <https://www.fssai.gov.in>
12. AOAC International (Association of Official Analytical Collaboration). Available at: <https://www.aoac.org>
13. Institute of Food Technologists (IFT). Available at: <https://www.ift.org>
14. Food and Agriculture Organization (FAO). Available at: <https://www.fao.org>
15. Codex Alimentarius Commission. Available at: <https://www.codexalimentarius.org>

CO–PO–PSO Mapping (Course Articulation Matrix)

CO s	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	2	2	3	3	–	–	3	3	2	–	–	–	–
CO 2	3	3	2	3	3	–	–	3	3	3	1	–	–	–
CO 3	3	3	3	3	3	1	–	3	2	3	3	1	–	–
CO 4	3	3	2	3	3	2	1	3	2	2	3	2	1	1

Correlation Level: 3 = High Correlation 2 = Moderate Correlation 1 = Low Correlation Blank = No Correlation

Subj ect Code	Subject Name	Category	L	T	P	S	Credit s	Marks		
								CI A	Extern al	Tota l
	Emerging Technologies in Food Processing	Elective I — Option 1	4	-	-	-	2	25	75	100
Course Outcomes (COs)										
Upon successful completion of the course, students will be able to:										
CO1:	Explain principles of food processing technologies and evaluate their effects on the physicochemical, nutritional and sensory properties of foods.									
CO2:	Analyze processing methods used for cereals, pulses, oilseeds, fruits, vegetables and dairy products, including by-product utilization and value addition.									
CO3:	Assess processing, preservation, storage and quality characteristics of animal foods and post-harvest technologies used to minimize losses and enhance food quality.									
CO4:	Evaluate modern food processing innovations, sustainability practices, waste management approaches and their applications in food industries and food systems.									
UNIT	Contents									Hrs
I	Principles of Food Processing and Emerging Technologies : Processing of foods, traditional and modern processing technologies, effects of processing on nutritional and physicochemical properties, enzymes in food processing, enzyme inhibitors, enzymatic browning, emerging food processing technologies.									10
II	Processing and Technology of Cereals, Pulses, Nuts and Oilseeds: Cereal processing and technology, pulse processing and technology, nuts and oilseed processing and technology, extrusion technology, by-product utilization, effect of processing on nutritive value and physicochemical properties.									10
III	Processing and Technology of Fruits, Vegetables and Milk: Vegetable processing and technology, fruit processing and technology, browning reactions and prevention, waste utilization, milk processing and technology, functional dairy products, effect of processing on nutritive value and physicochemical properties.									10
IV	Processing and Preservation of Animal Foods: Egg processing and technology, meat processing and technology, poultry processing and technology, fish processing and technology, preservation methods, quality characteristics, effect of processing on nutritive value and physicochemical properties.									15
V	Post-Harvest Technology, Storage and Sustainability: Post-harvest technology of agricultural produce, post-harvest losses and management, technologies to reduce losses, cold chain management, storage systems, packaging technologies, food waste utilization and sustainability approaches.									
Total Hours									60	

References

Text Books

1. Fellows, P.J. *Food Processing Technology: Principles and Practice*. Woodhead Publishing.
2. Rao, D.G. *Fundamentals of Food Engineering*. PHI Learning.
3. Potter, N.N. and Hotchkiss, J.H. *Food Science*. CBS Publishers.
4. Singh, R.P. and Heldman, D.R. *Introduction to Food Engineering*. Academic Press.
5. Srilakshmi, B. *Food Science*. New Age International.
6. Manay, N.S. and Shadaksharaswamy, M. *Foods: Facts and Principles*. New Age International.
7. Kader, A.A. *Postharvest Technology of Horticultural Crops*. University of California.
8. Frazier, W.C. and Westhoff, D.C. *Food Microbiology*. McGraw Hill.
9. Sharma, H.K. and Chauhan, O.P. *Food Processing and Preservation*. CBS Publishers.
10. Tewari, G. and Juneja, V.K. *Advances in Thermal and Non-Thermal Food Preservation*. Wiley-Blackwell.

Journals

1. Institute of Food Technologists Journal of Food Science
2. Food Chemistry
3. LWT – Food Science and Technology
4. Food Research International
5. International Journal of Food Science and Technology
6. Journal of Food Engineering
7. Food Control
8. Trends in Food Science and Technology

Web Resources

- [Food Safety and Standards Authority of India \(FSSAI\)](#)
- [National Institute of Food Technology Entrepreneurship and Management \(NIFTEM\)](#)
- [Indian Council of Agricultural Research \(ICAR\)](#)
- [Food and Agriculture Organization \(FAO\)](#)
- [Institute of Food Technologists \(IFT\)](#)
- [Codex Alimentarius Commission](#)
- [US Food and Drug Administration – Food Section](#)

CO–PO–PSO Mapping (Course Articulation Matrix)

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	2	1	2	1	1	1	3	2	2	1	1	1	1
CO2	3	3	2	2	2	1	1	3	3	2	2	1	1	1
CO3	2	3	3	2	2	2	1	2	3	3	2	2	1	1
CO4	2	2	3	3	2	3	3	2	2	2	3	3	2	3
Total	10	10	9	9	7	7	6	10	10	9	8	7	5	6

Correlation Level: 3 = High Correlation 2 = Moderate Correlation 1 = Low Correlation Blank = No Correlation

(OR)

Subj	Subject	Category	L	T	P	S	Credit	Marks
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ect Cod e	Name						s	CI A	Extern al	Tota l
	Applied Food Technology	Elective I - Option 2	4	-	-	-	2	25	75	100

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

CO1: Explain the principles of food technology, food preservation methods, food safety concepts, and the functional properties of food constituents.

CO2: Apply various food processing technologies for cereals, pulses, fruits, vegetables, dairy, meat, fish, and poultry products.

CO3: Analyze food formulation techniques, ingredient interactions, fortification methods, and the development of special dietary foods.

CO4: Evaluate food quality, safety management systems, packaging technologies, and emerging applications in the food industry.

UNIT	Contents	No.o f Hou rs
I	Fundamentals of Food Technology Scope and significance of food technology, composition and functional properties of food constituents, principles of food preservation, food spoilage and control measures, food safety concepts, food standards and regulations, emerging trends in food processing, role of food technology in nutrition and public health.	12
II	Food Processing Technologies Processing of cereals and millets, pulses and legumes, fruits and vegetables, milk and dairy products, meat, fish and poultry products, thermal processing methods, non-thermal processing technologies, fermentation technology, extrusion cooking, dehydration and concentration techniques.	12
III	Food Ingredients and Formulation Technologies Functional food ingredients, food additives and their applications, sweeteners, emulsifiers, stabilizers and preservatives, ingredient interactions in food systems, formulation principles, nutritional enhancement of foods, fortification techniques, development of convenience and ready-to-eat foods, special dietary foods.	12
IV	Quality Assurance and Food Safety Management Quality control concepts, quality assurance systems, sensory evaluation techniques, physical, chemical and microbiological analysis of foods, HACCP, GMP, GHP, food packaging systems, shelf-life evaluation, food labeling requirements, traceability and food safety management systems.	12
V	Emerging Technologies and Food Industry Applications Novel food processing technologies, nanotechnology in foods, biotechnology applications in food processing, functional and nutraceutical foods, sustainable food processing practices, waste utilization and value addition, entrepreneurship in food industries, commercialization of food products, current trends and future prospects in food technology.	12

References

1. Fellows, P.J. Food Processing Technology: Principles and Practice. 5th Edition, Woodhead Publishing, 2022.
2. Potter, N.N. and Hotchkiss, J.H. Food Science. 5th Edition, CBS Publishers & Distributors.
3. Ramaswamy, H. and Marcotte, M. Food Processing: Principles and Applications. CRC Press.
4. Srilakshmi, B. Food Science. 8th Edition, New Age International Publishers.
5. Manay, N.S. and Shadaksharaswamy, M. Foods: Facts and Principles. New Age International Publishers.
6. Subbulakshmi, G. and Udipi, S.A. Food Processing and Preservation. New Age International Publishers.
7. Toledo, R.T. Fundamentals of Food Process Engineering. Springer.
8. Winton, A.L. and Winton, K.B. Techniques of Food Analysis. Allied Scientific Publishers.

Web Resources

1. [Food and Agriculture Organization \(FAO\)](#)
2. [World Health Organization \(WHO\) – Food Safety](#)
3. [Food Safety and Standards Authority of India \(FSSAI\)](#)
4. [Institute of Food Technologists \(IFT\)](#)
5. [United States Food and Drug Administration \(FDA\) – Food](#)
6. [Codex Alimentarius Commission](#)
7. [National Institute of Food Technology Entrepreneurship and Management \(NIFTEM\)](#)
8. [Central Food Technological Research Institute \(CFTRI\)](#)
9. [International Food Information Council \(IFIC\)](#)
10. Food Processing Technology Resources – Springer Nature

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	2	–	–	–	–	2	3	2	–	–	–	–	2
CO 2	3	3	2	–	2	–	2	3	3	2	–	2	–	2
CO 3	3	3	3	2	2	–	2	3	3	3	2	2	–	2
CO 4	3	3	2	3	2	2	3	2	3	2	3	2	2	3
Total	12	11	7	5	6	2	9	11	11	7	5	6	2	9

Correlation Level: 3 = High Correlation 2 = Moderate Correlation 1 = Low Correlation Blank = No Correlation

Subjec	Subject	Category	L	T	P	S	Credit	Marks
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t Code	Name					s	CI A	Extern al	Tota l	
	Emerging Technologie s in Food Processing Practical	Elective II Practica l— option 1	-	-	4	-	2	50	50	100
Course Outcomes (COs)										
Upon successful completion of the course, students will be able to:										
CO1:	Perform food processing and preservation techniques and assess their effects on food quality and stability.									
CO2:	Apply analytical and instrumental methods to determine physicochemical and nutritional properties of food products.									
CO3:	Analyze the impact of processing, storage, and post-harvest handling on food quality, functionality, and shelf life.									
CO4:	Evaluate food quality parameters and interpret analytical data for quality assurance and product development.									
S.No.	List of Exercises									No. of Hou rs
1.	Moisture Content Determination (Muffle Furnace / Oven Drying) • Estimation of moisture in cereals, pulses and processed foods • Calculation of dry matter and its significance in shelf life									4
2.	Ash Content Analysis (Muffle Furnace) • Determination of total ash content in food samples • Assessment of mineral content and food purity									4
3.	Colour Quality Analysis (Colourimeter) (Demonstration) • Measurement of L*, a*, b* values of raw and processed foods									4
4.	Colour Quality Analysis (Colourimeter) (Demonstration) • Effect of processing on colour stability									4
5.	Protein Estimation (Spectrophotometer – Biuret Method) • Quantitative estimation of protein in food samples • Preparation of the standard curve and interpretation									4
6.	Reducing Sugar Estimation (Spectrophotometer – DNS Method) • Estimation of sugar content in cereals and fruits • Effect of processing on sugar availability									4

7.	Vitamin C Estimation (Spectrophotometric Analysis) - Ascorbic acid content in fresh and processed foods - Effect of heat and storage on vitamin retention	4
8.	Fruit Product Standardization (Advanced Physicochemical Analysis) - Preparation of fruit juice/pulp - Measurement of pH, acidity, TSS, vitamin C, and color values - Quality comparison of fresh vs processed product	4
9.	Browning Reaction Analysis (Spectrophotometer) - Enzymatic browning in fruits (apple/banana/potato) - Effect of temperature, pH, and inhibitors	4
10.	Starch Functional Property Analysis - Gelatinization and retrogradation studies - Effect of processing on cereal starch behaviour	4
11.	Protein Functional Properties in Pulses - Emulsification, foaming and solubility tests - Effect of processing on protein quality	4
12.	Milk Quality Evaluation (Instrumental + Chemical) - Determination of acidity and fat stability - Effect of pasteurization on quality parameters	4
13.	Microbial Spoilage Indicators (Demonstration) - Detection of spoilage signs in food samples - Interpretation of quality deterioration	4
14.	Shelf-life Study of Processed Foods - Monitoring changes in moisture, colour and acidity - Storage stability analysis	4
15.	Post-Harvest Loss Assessment - Evaluation of weight loss, spoilage and quality deterioration - Comparison of storage techniques	4
Total Hours		60

References

1. Fellows, P.J. Food Processing Technology: Principles and Practice. 5th Edition, Woodhead Publishing, 2022.
2. Ranganna, S. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. Tata McGraw-Hill Publishing Co.
3. Srilakshmi, B. Food Science. 8th Edition, New Age International Publishers.
4. Manay, N.S. and Shadaksharaswamy, M. Foods: Facts and Principles. New Age International Publishers.
5. Nielsen, S.S. Food Analysis. Springer Publications.
6. Ramaswamy, H.S. and Marcotte, M. Food Processing: Principles and Applications. CRC Press.
7. Desrosier, N.W. and Desrosier, J.N. The Technology of Food Preservation. CBS Publishers.
8. Pomeranz, Y. and Meloan, C.E. Food Analysis: Theory and Practice. Springer.
9. Frazier, W.C. and Westhoff, D.C. Food Microbiology. McGraw-Hill Education.
10. Damodaran, S., Parkin, K.L. and Fennema, O.R. Fennema's Food Chemistry. CRC Press.

Web Resources

- [Food Safety and Standards Authority of India \(FSSAI\)](#)
- [Food and Agriculture Organization \(FAO\)](#)
- [Central Food Technological Research Institute \(CFTRI\)](#)
- [Institute of Food Technologists \(IFT\)](#)
- [Codex Alimentarius Commission](#)
- [National Institute of Food Technology Entrepreneurship and Management \(NIFTEM\)](#)
- [United States Food and Drug Administration – Food](#)
- [International Association for Food Protection \(IAFP\)](#)

CO–PO–PSO Mapping (Course Articulation Matrix)

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	2	2	–	2	–	2	3	2	2	–	2	–	2
CO 2	3	3	3	2	2	–	2	3	3	3	2	2	–	2
CO 3	3	3	2	3	2	2	3	2	3	2	3	2	2	3
CO 4	3	3	3	3	2	2	3	3	3	3	3	2	2	3
Total	12	11	10	8	8	4	10	11	11	10	8	8	4	10

Correlation Level: 3 = High Correlation 2 = Moderate Correlation 1 = Low Correlation Blank = No Correlation

OR

Subject Code	Subject Name	Category	L T		P	S	Credits	Marks		
								CI A	External	Total
	Applied Food Technology (Practical)	Elective II Practical— option 2	-	-	4	-	2	50	50	100
Course Outcomes (COs)										
Upon successful completion of the course, students will be able to:										
CO1:	Perform sensory evaluation and quality assessment of food products using standard sensory and analytical techniques.									
CO2:	Apply food processing techniques such as fermentation, germination, malting, and formulation modifications for food product improvement.									
CO3:	Develop and standardize nutritionally enhanced and health-oriented food products for diverse consumer groups.									
CO4:	Evaluate the acceptability, nutritional quality, packaging, labeling, and commercialization potential of developed food products.									
S.No.	List of Exercises									No. of Hours
1.	Preparation and presentation of food samples for sensory evaluation.									4
2.	Consumer-oriented and product-oriented sensory evaluation of food products.									4
3.	Product matching and product mapping of commercial food products.									4
4.	Detection and prevention of taints and off-flavours in foods.									4
5.	Preparation of reduced-viscosity foods for special dietary requirements.									4
6.	Development of energy-dense food formulations.									4
7.	Germination of cereals and legumes and assessment of quality changes.									4
8.	Malting of grains and evaluation of functional properties.									4
9.	Preparation and evaluation of fermented food products.									4
10.	Development of low-calorie food products using artificial sweeteners.									4
11.	Formulation of high-fibre and low-sodium food products.									4
12.	Preparation of protein-enriched foods using protein concentrates and whey.									4

13.	Development of functional foods using health-promoting ingredients.	4
14.	Modification and nutritional enhancement of traditional food products.	4
15.	Development, standardization, nutritional analysis, packaging, labeling and consumer acceptability evaluation of a novel food product.	4
Total Hours		60

References

1. Fellows, P.J. *Food Processing Technology: Principles and Practice*. Woodhead Publishing.
2. Srilakshmi, B. *Food Science*. New Age International Publishers.
3. Manay, N.S. and Shadaksharaswamy, M. *Foods: Facts and Principles*. New Age International Publishers.
4. Lawless, H.T. and Heymann, H. *Sensory Evaluation of Food: Principles and Practices*. Springer.
5. Meilgaard, M., Civille, G.V. and Carr, B.T. *Sensory Evaluation Techniques*. CRC Press.

CO–PO–PSO Mapping (Course Articulation Matrix)

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	2	2	2	–	–	2	3	2	2	–	–	–	2
CO 2	3	3	2	2	2	–	2	3	3	2	2	2	–	2
CO 3	3	3	3	2	2	–	2	3	3	3	2	2	–	3
CO 4	3	3	2	3	2	2	3	2	3	2	3	2	2	3
Total	12	11	9	9	6	2	9	11	11	9	7	6	2	10

Correlation Level: 3 = High Correlation 2 = Moderate Correlation 1 = Low Correlation Blank = No Correlation

SEMESTER – II

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CI A	External	Total
	Advanced Methods in Nutrition Research	Core-IV	6	-	-	-	5	25	75	100
Course Outcomes (COs)										
Upon successful completion of the course, students will be able to:										
CO1:	Explain the concepts, principles, research designs, sampling methods, and ethical considerations involved in nutrition research.									
CO2:	Apply appropriate research methodologies, sampling techniques, nutrition assessment tools, and data collection procedures in nutrition and dietetics research.									
CO3:	Analyze research data using suitable statistical methods and interpret findings in the context of nutrition and health research.									
CO4:	Evaluate scientific evidence and design research proposals, reports, dissertations, and scholarly publications using appropriate research methodologies, statistical tools, and ethical practices.									
Unit	Contents									Hrs
I	Foundations of Nutrition Research and Research Design : Concept, scope, objectives, and significance of research in Nutrition, Dietetics, Food Science, and Public Health, research process and stages of scientific inquiry, identification, selection, and formulation of research problems, development of research objectives and research questions, hypothesis: meaning, characteristics, formulation, types, and testing, variables and operational definitions, research designs: exploratory, descriptive, analytical, cross-sectional, longitudinal, retrospective, prospective, cohort, case-control, experimental, quasi-experimental, randomized controlled trials (RCTs), in vivo, in vitro, and community-based studies, research ethics, informed consent, confidentiality, institutional ethical clearance, and Good Clinical Practice (GCP).									18
II	Sampling Techniques and Measurement Tools in Nutrition Research: Population, sampling frame, sampling unit, and sample, characteristics of a good sample, census and sample surveys, probability sampling: simple random, systematic, stratified, cluster, and multistage sampling, non-probability sampling: convenience, purposive, quota, and snowball sampling, sample size determination and power analysis, sampling and non-sampling errors, measurement and scaling techniques, nominal, ordinal, interval, and ratio scales, comparative and non-comparative scales, Likert scale, Semantic									18

	Differential Scale, Stapel Scale, and rating scales, development, validation, reliability, and standardization of nutrition assessment tools and questionnaires.	
III	Data Collection Methods in Food Science, Nutrition, and Dietetics Research: Primary data collection methods: interviews, questionnaires, observation methods, Focus Group Discussions (FGD), Key Informant Interviews (KII), case studies, and surveys, dietary assessment methods: 24-hour dietary recall, Food Frequency Questionnaire (FFQ), diet history method, food records, and food diaries, nutritional assessment: anthropometric, clinical, biochemical, and dietary assessment, food science research methods: sensory evaluation techniques, consumer acceptability studies, shelf-life studies, food quality assessment, physicochemical analysis, proximate composition analysis, product development trials, laboratory methods and food sample preparation, secondary data sources: national surveys, government databases, published and unpublished sources, reliability, validity, and quality assurance procedures, data editing, coding, classification, tabulation, and database management.	18
IV	Biostatistics and Data Analysis in Nutrition Research: Role of biostatistics in nutrition research, data presentation through tables, charts, graphs, and diagrams, descriptive statistics: mean, median, mode, range, variance, standard deviation, percentiles, and z-scores, probability concepts and normal distribution, inferential statistics: confidence intervals, hypothesis testing, p-value, and statistical significance, correlation and regression analysis, parametric tests: t-test, one-way ANOVA, and two-way ANOVA, non-parametric tests: Chi-square test, Mann–Whitney U test, Wilcoxon Signed Rank test, and Kruskal–Wallis test, interpretation of statistical outputs and research findings.	18
V	Scientific Writing, Evidence Synthesis, and Digital Tools for Research: Literature review and critical appraisal of scientific literature, evidence-based nutrition practice, introduction to systematic reviews and meta-analysis, scientific report writing: thesis and dissertation preparation, research articles, conference papers, and posters, referencing styles: APA and Vancouver, bibliography, appendices, footnotes, glossary, and endnotes, publication ethics, plagiarism, predatory journals, and authorship ethics, literature search databases: PubMed, Google Scholar, Scopus, and ResearchGate, statistical software: Microsoft Excel, SPSS, and R Software, reference management tools: Mendeley and Zotero, AI-assisted tools in nutrition research and responsible use of artificial intelligence.	18
Total		90

Text Books

1. Kothari, C.R. & Garg, G. *Research Methodology: Methods and Techniques*. New Age International Publishers.
2. Creswell, J.W. & Creswell, J.D. *Research Design: Qualitative, Quantitative and Mixed Methods Approaches*. Sage Publications.
3. Polit, D.F. & Beck, C.T. *Nursing Research: Generating and Assessing Evidence for Nursing Practice*. Wolters Kluwer.
4. Hulley, S.B., Cummings, S.R., Browner, W.S., Grady, D. & Newman, T.B. *Designing Clinical Research*. Wolters Kluwer.
5. Daniel, W.W. & Cross, C.L. *Biostatistics: A Foundation for Analysis in the Health Sciences*. Wiley.

Reference Books

1. Montgomery, D.C. *Design and Analysis of Experiments*. Wiley.
2. Pagano, M. & Gauvreau, K. *Principles of Biostatistics*. CRC Press.
3. Suresh, K.P. & Chandrashekar, S. *Sample Size Estimation and Power Analysis for Clinical Research Studies*.
4. Greenhalgh, T. *How to Read a Paper: The Basics of Evidence-Based Medicine*. Wiley-Blackwell.
5. Bhandari, P. *Research Methodology and Statistical Techniques*. Pearson.
6. Elston, R.C. & Johnson, W.D. *Basic Biostatistics for Geneticists and Epidemiologists*. Wiley.
7. World Health Organization. *Basic Epidemiology*. WHO Publications.
8. Ahuja, R. *Research Methods*. Rawat Publications.

Web Resources

1. [PubMed](#)
2. [National Center for Biotechnology Information \(NCBI\)](#)
3. World Health Organization Research Resources
4. [Scopus](#)
5. [Mendeley Reference Manager](#)
6. [Zotero Reference Manager](#)
7. [IBM SPSS Statistics](#)
8. [R Project for Statistical Computing](#)

CO–PO–PSO Mapping (Course Articulation Matrix)

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	3	2	2	1	1	2	3	2	2	1	1	2	2
CO2	2	3	3	2	2	1	2	3	3	2	2	1	2	2
CO3	2	3	3	3	3	2	2	2	3	3	2	2	3	2
CO4	2	2	2	3	3	3	3	2	2	2	3	3	2	3
Total	9	11	10	10	9	7	9	10	10	9	8	7	9	9

Correlation Level: 3 = High Correlation 2 = Moderate Correlation 1 = Low Correlation Blank = No Correlation

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CI A	External	Total
	Therapeutic Dietetics	Core V	6	-	-	-	5	25	75	100
Course Outcomes (COs)										
Upon successful completion of the course, students will be able to:										
CO1	Evaluate the pathophysiology, clinical manifestations, diagnostic parameters, and nutritional requirements of gastrointestinal, hepatobiliary, pancreatic, cardiovascular, renal, and pulmonary disorders.									
CO2	Formulate evidence-based medical nutrition therapy plans for acute and chronic disease conditions using current clinical guidelines.									
CO3	Assess nutritional status and interpret biochemical, clinical, and anthropometric data for disease-specific nutrition care.									
CO4	Design and monitor enteral and parenteral nutrition support and advanced nutrition interventions for specialized clinical conditions.									
Unit	Course Contents									No. of Hours
I	Medical Nutrition Therapy for Gastrointestinal Disorders a) Upper Gastrointestinal Disorders: Etiology, pathophysiology, clinical manifestations, complications, diagnostic investigations, and nutritional management of Gastroesophageal Reflux Disease (GERD), Esophagitis, Dyspepsia, Gastritis, Peptic Ulcer Disease, diseases and cancers of the oral cavity, esophagus and stomach, and post-gastric surgery conditions. b) Lower Gastrointestinal Disorders: Etiology, pathophysiology, clinical manifestations, complications, diagnostic investigations, and nutritional management of Constipation, Diarrhoea, Steatorrhea, Celiac Disease, Lactose Intolerance, Inflammatory Bowel Disease (Ulcerative Colitis and Crohn's Disease), Irritable Bowel Syndrome, Diverticular Disease, Short Bowel Syndrome, Ileostomy, Colostomy, Protein-Losing Enteropathy, and colorectal cancers. Role of gut microbiome, probiotics, prebiotics, and synbiotics in gastrointestinal health.									20
II	Medical Nutrition Therapy for Liver, Biliary, Pancreatic and Endocrine Disorders a) Liver Disorders: Physiology and metabolic functions of the liver. Nutritional management of Acute and Chronic Hepatitis, Non-Alcoholic Fatty Liver Disease (NAFLD), Non-Alcoholic Steatohepatitis (NASH), Cirrhosis, Hepatic Encephalopathy, Wilson's Disease, liver cancer, and liver transplantation. b) Biliary Disorders: Cholelithiasis, Cholecystitis, Gallbladder cancer, Cholecystectomy, and nutritional interventions. c) Pancreatic and Endocrine Disorders: Acute and Chronic Pancreatitis, Pancreatic Cancer, Type 1 Diabetes Mellitus, Type 2									15

	Diabetes Mellitus, Gestational Diabetes Mellitus, Continuous Glucose Monitoring (CGM), and Medical Nutrition Therapy based on current diabetes guidelines.	
III	Medical Nutrition Therapy for Cardiovascular, Renal and Pulmonary Disorders a) Cardiovascular Disorders: Atherosclerosis, Dyslipidemia, Hypertension, Coronary Artery Disease, Angina Pectoris, Myocardial Infarction, Congestive Heart Failure, and evidence-based dietary approaches including DASH, Mediterranean, and Portfolio Diets. b) Renal Disorders: Pathophysiology, diagnostic investigations, and dietary management of Glomerulonephritis, Nephrotic Syndrome, Nephrolithiasis, Acute Kidney Injury (AKI), Chronic Kidney Disease (CKD), Kidney Cancer, Dialysis, and Renal Transplantation. c) Pulmonary Disorders: Asthma, Chronic Obstructive Pulmonary Disease (COPD), Tuberculosis, Lung Cancer, and nutritional management in respiratory care.	20
IV	Medical Nutrition Therapy for Weight Management and Other Clinical Conditions a) Obesity: Etiology, classification, energy balance, body composition, metabolic syndrome, nutritional management, pharmacotherapy overview, and post-bariatric surgery nutrition. b) Underweight and Endocrine Disorders: Nutritional management of Underweight, Hyperthyroidism, Hypothyroidism, Polycystic Ovary Syndrome (PCOS), and endocrine-related cancers where applicable. c) Special Clinical Conditions: Burns, HIV/AIDS, Gout, Anemia, Fever, Pressure Injuries, Sarcopenia, Frailty, Cancer Cachexia, and hydration assessment and fluid management.	20
V	Advanced Nutrition Support and Clinical Nutrition Intervention a) Enteral Nutrition Support: Assessment, indications, contraindications, routes of administration, formula selection, nutrient calculations, monitoring, complications, and home enteral nutrition. b) Parenteral Nutrition Support: Assessment, indications, contraindications, central and peripheral access, formulation, calculations, monitoring, complications, and home parenteral nutrition. c) Nutrition Care Process (NCP), PES Statements, Nutrition-focused Physical Examination (NFPE), evidence-based clinical decision-making, and nutrition support in critically ill and oncology patients.	15
Total Hours		90

Text Books

1. Raymond, J.L. & Morrow, K. (2023). *Krause and Mahan's Food and the Nutrition Care Process* (16th ed.). Elsevier.
2. Nelms, M., Sucher, K.P. & Lacey, K. (2023). *Nutrition Therapy and Pathophysiology* (5th ed.). Cengage Learning.
3. Escott-Stump, S. (2020). *Nutrition and Diagnosis-Related Care* (9th ed.). Wolters Kluwer.

4. Gropper, S.S. & Smith, J.L. (2023). *Advanced Nutrition and Human Metabolism* (8th ed.). Cengage Learning.
5. Chan, L.N., Lord, L.M. & Guenter, P. (2025). *ASPEN Adult Nutrition Support Core Curriculum* (4th ed.). ASPEN.

Reference Books

1. Ross, A.C., Caballero, B., Tucker, K.L. & Ziegler, T.R. (2024). *Modern Nutrition in Health and Disease* (12th ed.). Wolters Kluwer.
2. Coulston, A.M., Boushey, C.J., Ferruzzi, M.G. & Delahanty, L.M. (2023). *Nutrition in the Prevention and Treatment of Disease* (5th ed.). Academic Press.
3. Shils, M.E., Shike, M., Ross, A.C., Caballero, B. & Cousins, R.J. (2006). *Modern Nutrition in Health and Disease* (10th ed.). Lippincott Williams & Wilkins.
4. Escott-Stump, S. (2012). *Krause's Food and Nutrition Therapy* (13th ed.). Elsevier.
5. Williams, S.R. (2013). *Williams' Essentials of Nutrition and Diet Therapy* (11th ed.). Elsevier.
6. Gibney, M.J., Lanham-New, S.A., Cassidy, A. & Vorster, H.H. (2013). *Introduction to Human Nutrition* (2nd ed.). Wiley-Blackwell.
7. Mann, J. & Truswell, A.S. (2017). *Essentials of Human Nutrition* (5th ed.). Oxford University Press.
8. Whitney, E. & Rolfes, S.R. (2022). *Understanding Nutrition* (16th ed.). Cengage Learning.
9. Sareen, G. (2021). *Advanced Nutrition and Dietetics in Obesity*. Wiley-Blackwell.
10. Srilakshmi, B. (2018). *Dietetics* (8th ed.). New Age International Publishers.
11. Srilakshmi, B. (2023). *Nutrition Science* (7th ed.). New Age International Publishers.
12. Bamji, M.S., Krishnaswamy, K. & Brahmam, G.N.V. (2017). *Textbook of Human Nutrition* (4th ed.). Oxford & IBH Publishing.
13. Mudambi, S.R. & Rajagopal, M.V. (2012). *Fundamentals of Foods, Nutrition and Diet Therapy* (6th ed.). New Age International.
14. Swaminathan, M. (2009). *Handbook of Food and Nutrition* (6th ed.). BAPPCO Publications.
15. Mueller, C.M. (2022). *The ASPEN Adult Nutrition Support Core Curriculum* (Clinical Reference Edition). ASPEN.
16. Gottschlich, M.M. (2017). *The Science and Practice of Nutrition Support: A Case-Based Core Curriculum*. Kendall Hunt Publishing.
17. Matarese, L.E., Gottschlich, M.M. & Fuhrman, M.P. (2017). *Contemporary Nutrition Support Practice* (3rd ed.). Saunders.

18. Bankhead, R., Boullata, J. & Brantley, S. (2020). *Enteral Nutrition Practice Recommendations*. ASPEN.
19. American Diabetes Association. (2025). *Standards of Care in Diabetes*.
20. National Kidney Foundation. (2024). *KDOQI Clinical Practice Guidelines for Nutrition in Chronic Kidney Disease*.
21. Academy of Nutrition and Dietetics. (2024). *Evidence Analysis Library Guidelines*.
22. ASPEN. (2024). *Clinical Guidelines for Nutrition Support Therapy*.
23. ESPEN. (2025). *ESPEN Guidelines on Clinical Nutrition*.
24. World Health Organization. (2024). *Clinical Nutrition and Disease Management Guidelines*.

Web Resources

1. [Academy of Nutrition and Dietetics Evidence Analysis Library](#)
2. [American Society for Parenteral and Enteral Nutrition \(ASPEN\)](#)
3. [European Society for Clinical Nutrition and Metabolism \(ESPEN\)](#)
4. [American Diabetes Association \(ADA\)](#)
5. [National Kidney Foundation \(NKF\)](#)
6. [World Health Organization \(WHO\)](#)
7. Centers for Disease Control and Prevention – Nutrition Resources
8. [National Center for Biotechnology Information \(NCBI\)](#)
9. [PubMed Database](#)
10. [National Institute of Diabetes and Digestive and Kidney Diseases \(NIDDK\)](#)
11. [National Heart, Lung, and Blood Institute \(NHLBI\)](#)
12. [Food and Agriculture Organization \(FAO\) Nutrition Resources](#)
13. [Indian Council of Medical Research \(ICMR\)](#)
14. [National Institute of Nutrition \(NIN\) Hyderabad](#)
15. [FSSAI Eat Right India Initiative](#)

CO–PO–PSO Mapping Matrix

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7
CO1	3	3	2	2	1	1	2	3	3	2	2	1	2	2
CO2	3	3	3	3	2	2	2	3	3	3	2	2	3	2
CO3	2	3	3	3	3	2	2	3	3	3	2	2	3	3
CO4	2	2	3	3	3	3	3	2	2	3	3	3	2	3
Total	10	11	11	11	9	8	9	11	11	11	9	8	10	10

Correlation Level: 3 = High Correlation 2 = Moderate Correlation 1 = Low Correlation Blank = No Correlation

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CI A	External	Total
	Therapeutic Dietetics- Practical	Core VI	-	-	6	-	4	50	50	100
Course Outcomes (COs)										
Upon successful completion of the course, students will be able to:										
CO1	Perform nutritional screening, assessment, and diagnosis using standardized clinical nutrition tools and Nutrition Care Process (NCP).									
CO2	Plan, prepare, and evaluate therapeutic diets for various disease conditions based on nutritional requirements and clinical guidelines.									
CO3	Apply dietetic calculations, exchange lists, food labelling interpretation, and product evaluation in clinical nutrition practice.									
CO4	Formulate and monitor enteral nutrition support and specialized nutrition interventions using case-based approaches.									
Unit	Contents									Hours
I	Therapeutic Dietetics Practical – Dietitian Skills Training I (Nutrition Assessment and Diagnosis) a) Nutrition Screening and Assessment Tools: MUST, NRS-2002, Mini Nutritional Assessment (MNA), Subjective Global Assessment (SGA), and GLIM criteria for malnutrition assessment. b) Bedside Assessment Techniques: Nutrition-Focused Physical Examination (NFPE), anthropometric measurements, BMI, body composition analysis (BIA), hand-grip dynamometry, skin-fold thickness, waist-hip ratio, and interpretation of biochemical parameters related to disease conditions. c) Nutrition Care Process (NCP): Preparation of PES Statements (Problem, Etiology, Signs and Symptoms) using clinical case studies and patient records.									25
II	Preparation of Therapeutic Diets – I a) Planning, preparation, and nutritive value calculation of therapeutic diets for Typhoid, Jaundice, Hepatitis, Cirrhosis, Pancreatitis, Cholelithiasis, and other hepatobiliary disorders. b) Planning, preparation, and nutritive value calculation of diets for Hyperlipidemia, Obesity, Hypertension, Chronic Kidney Disease, Dialysis, and Renal Calculi. c) Carbohydrate counting, glycemic load estimation, and meal planning for Diabetes Mellitus.									20

III	Preparation of Therapeutic Diets – II (Case-Based Menu Planning) a) Planning and preparation of diets for Anemia and other micronutrient deficiency disorders. b) Planning, preparation, and nutritive value calculation of diets for Ulcerative Colitis, Crohn's Disease, Lactose Intolerance, Celiac Disease, Irritable Bowel Syndrome, and Short Bowel Syndrome. c) Menu planning for Constipation, Diarrhea, and nutritional support during gastrointestinal disorders.	15
IV	Dietitian Skills Training II a) Construction of Exchange Lists for Energy, Carbohydrate, Protein, Fat, Sodium, Potassium, and Renal Diet Planning. b) Nutrition Labelling: Interpretation of food labels, front-of-pack labels, nutrition claims, ingredient analysis, and regulatory standards. c) Market Survey and evaluation of medical foods, disease-specific formulas, fortified foods, and nutrition supplements.	15
V	Advanced Nutrition Intervention a) Familiarization, comparison, and evaluation of enteral formulas, oral nutritional supplements, and disease-specific nutrition products. b) Planning, preparation, calculation, administration, and monitoring of tube feeds based on clinical case studies. c) Enteral and Parenteral Nutrition Calculations, documentation, monitoring sheets, and case presentation.	15
Total		90

Recommended References

Text Books

1. Raymond, J.L. & Morrow, K. (2023). *Krause and Mahan's Food and the Nutrition Care Process* (16th ed.). Elsevier.
2. Nelms, M., Sucher, K.P. & Lacey, K. (2023). *Nutrition Therapy and Pathophysiology* (5th ed.). Cengage Learning.
3. Escott-Stump, S. (2020). *Nutrition and Diagnosis-Related Care* (9th ed.). Wolters Kluwer.
4. Gropper, S.S. & Smith, J.L. (2023). *Advanced Nutrition and Human Metabolism* (8th ed.). Cengage Learning.

5. Chan, L.N. et al. (2025). *ASPEN Adult Nutrition Support Core Curriculum* (4th ed.). ASPEN.

Reference Books

1. Ross, A.C. et al. (2024). *Modern Nutrition in Health and Disease* (12th ed.). Wolters Kluwer.
2. Coulston, A.M. et al. (2023). *Nutrition in the Prevention and Treatment of Disease* (5th ed.). Academic Press.
3. Srilakshmi, B. (2018). *Dietetics* (8th ed.). New Age International.
4. Srilakshmi, B. (2023). *Nutrition Science* (7th ed.). New Age International.
5. Bamji, M.S. et al. (2017). *Textbook of Human Nutrition* (4th ed.). Oxford & IBH.
6. Mudambi, S.R. & Rajagopal, M.V. (2012). *Fundamentals of Foods, Nutrition and Diet Therapy* (6th ed.). New Age International.
7. Academy of Nutrition and Dietetics (2024). *Evidence Analysis Library Guidelines*.
8. ASPEN Clinical Practice Guidelines (2024).
9. ESPEN Clinical Nutrition Guidelines (2025).
10. American Diabetes Association (2025). *Standards of Care in Diabetes*.

Web Resources

1. [Academy of Nutrition and Dietetics Evidence Analysis Library](#)
2. [ASPEN Nutrition Support Resources](#)
3. [ESPEN Clinical Nutrition Resources](#)
4. [American Diabetes Association](#)
5. [PubMed Database](#)
6. [National Institute of Nutrition \(NIN\)](#)
7. [FSSAI Eat Right India](#)
8. [National Kidney Foundation](#)

CO-PO-PSO Mapping Matrix

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	3	2	2	2	1	2	3	3	2	2	1	2	2
CO 2	3	3	3	2	2	2	2	3	3	3	2	2	2	2
CO 3	2	3	3	3	3	2	2	2	3	3	3	2	3	2
CO 4	2	2	3	3	3	3	3	2	2	3	3	3	2	3
Total	10	11	11	10	10	8	9	10	11	11	10	8	9	9

Correlation Level: 3 = High Correlation 2 = Moderate Correlation 1 = Low Correlation Blank = No Correlation

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	Contemporary Sports Nutrition	Elective III—Option I	4	-	-	-	3	25	75	100
Course Outcomes (COs)										
Upon successful completion of the course, students will be able to:										
CO1	Analyze physiological adaptations, body composition, and energy metabolism associated with exercise and sports performance.									
CO2	Evaluate nutritional requirements and formulate dietary strategies for athletes engaged in various sports and training regimens.									
CO3	Assess the role of hydration, micronutrients, ergogenic aids, and dietary supplements in exercise performance and recovery.									
CO4	Design evidence-based sports nutrition plans and critically appraise contemporary issues in sports nutrition practice.									

Unit	Course Content	Hours
I	Exercise Physiology, Body Composition and Weight Management a) Principles of exercise training and adaptation. Classification and characteristics of endurance, strength, power and team-sport athletes. b) Exercise physiology: skeletal muscle structure, muscle fibre types, muscular contraction, cardiopulmonary adaptations, endocrine responses to exercise. c) Body composition assessment: Anthropometry, BMI, skinfold measurements, Bioelectrical Impedance Analysis (BIA), Dual-energy X-ray Absorptiometry (DEXA), and their relationship to athletic performance. d) Weight management strategies for athletes: weight loss, weight gain, body recomposition, making weight for competition, Relative Energy Deficiency in Sport (RED-S).	12
II	Energy Systems and Macronutrient Nutrition for Athletes a) Energy systems during exercise: ATP-PC system, anaerobic glycolysis, aerobic metabolism, substrate utilization and exercise intensity. b) Carbohydrates in sports nutrition: glycogen storage, carbohydrate loading, recommendations before, during and after exercise. c) Protein requirements for athletes: muscle protein synthesis, timing of protein intake, protein quality, vegetarian and vegan athletes. d) Fat metabolism during exercise, fat adaptation, ketogenic diets in sports, recommendations and limitations.	12

III	Hydration, Micronutrients and Recovery Nutrition a) Fluid and electrolyte balance during exercise. Dehydration, hypohydration, hyperhydration and exercise-associated hyponatremia. b) Hydration assessment and hydration strategies before, during and after exercise. c) Vitamins and minerals in sports performance: Iron, Calcium, Zinc, Magnesium, Vitamin D and antioxidant vitamins. d) Recovery nutrition: glycogen restoration, muscle recovery, inflammation, oxidative stress and recovery meal planning.	12
IV	Sports Supplements and Ergogenic Aids a) Nutritional ergogenic aids: definition, classification and mechanisms of action. b) Evidence-based supplements: Creatine, Caffeine, Beta-Alanine, Sodium Bicarbonate, Nitrate, Protein Supplements and Probiotics. c) Risks and safety concerns associated with dietary supplements. d) Anti-doping regulations, banned substances, supplement contamination and athlete safety.	12
V	Contemporary Approaches in Sports Nutrition a) Nutrition periodization and individualized sports nutrition planning. b) Sports nutrition across the life cycle: young athletes, female athletes and masters athletes. c) Female Athlete Triad and Relative Energy Deficiency in Sport (RED-S). d) Sports nutrition counselling, wearable technologies, mobile applications, and emerging trends in sports nutrition. e) Development of sport-specific nutrition plans and case studies.	12
	Total	60

References

Text Books

1. Jeukendrup, A. & Gleeson, M. (2024). *Sport Nutrition* (4th ed.). Human Kinetics.
2. Burke, L.M. & Deakin, V. (2021). *Clinical Sports Nutrition* (6th ed.). McGraw-Hill Education.

3. Dunford, M. & Doyle, J.A. (2023). *Nutrition for Sport and Exercise* (5th ed.). Cengage Learning.
4. Benardot, D. (2022). *Advanced Sports Nutrition* (3rd ed.). Human Kinetics.
5. Maughan, R.J. & Shirreffs, S.M. (2023). *Nutrition and Enhanced Sports Performance* (3rd ed.). Academic Press.

Reference Books

1. Bean, A. (2022). *The Complete Guide to Sports Nutrition* (10th ed.). Bloomsbury Publishing.
2. McArdle, W.D., Katch, F.I. & Katch, V.L. (2022). *Exercise Physiology: Nutrition, Energy and Human Performance* (10th ed.). Wolters Kluwer.
3. Lanham-New, S., Stear, S., Shirreffs, S. & Collins, A. (2020). *Sport and Exercise Nutrition*. Wiley-Blackwell.
4. Potgieter, S. (2023). *Sports Nutrition: A Practical Manual for Professionals* (2nd ed.).
5. Williams, M.H. (2019). *Nutrition for Health, Fitness and Sport* (12th ed.). McGraw-Hill.
6. Thompson, J. (2021). *Sports Nutrition for Young Athletes*. Meyer & Meyer Sport.
7. ACSM (2024). *ACSM's Guidelines for Exercise Testing and Prescription* (12th ed.).
8. Kreider, R.B., Kerksick, C.M. & Antonio, J. (2022). *ISSN Exercise and Sports Nutrition Review Update*.

Web Resources

1. [International Society of Sports Nutrition \(ISSN\)](#)
2. [American College of Sports Medicine \(ACSM\)](#)
3. [Australian Institute of Sport Sports Nutrition Hub](#)
4. [World Anti-Doping Agency \(WADA\)](#)
5. [International Olympic Committee \(IOC\) Athlete Resources](#)
6. [Gatorade Sports Science Institute \(GSSI\)](#)
7. [National Institute of Nutrition \(NIN\), India](#)
8. [PubMed Database](#)

CO-PO-PSO Mapping Matrix

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	3	2	2	1	1	2	3	2	2	1	1	2	2
CO2	3	3	3	2	2	2	2	3	3	3	2	2	2	2
CO3	2	3	3	3	3	2	2	2	3	3	3	2	3	2
CO4	2	2	3	3	3	3	3	2	2	3	3	3	2	3
Total	10	11	11	10	9	8	9	10	10	11	9	8	9	9

Correlation Level: 3 = High Correlation 2 = Moderate Correlation 1 = Low Correlation Blank = No Correlation

OR

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	Maternal & Child Nutrition	Elective III-option 2	4	-	-	-	3	25	75	100
Course Outcomes (COs)										
Upon successful completion of the course, students will be able to:										
CO1	Analyze maternal nutritional requirements and physiological adaptations during preconception, pregnancy, and lactation.									
CO2	Evaluate growth, development, and nutritional needs from fetal life through adolescence using current scientific evidence.									
CO3	Assess the causes, consequences, prevention, and management of maternal and child malnutrition and related health challenges.									
CO4	Critically appraise national and global maternal-child nutrition policies, programs, and interventions and develop life-cycle nutrition strategies.									

Course Content

Unit	Contents	Hours
I	Contemporary Perspectives in Maternal and Child Nutrition a) Current nutritional and health status of women, infants, children, and adolescents in India and globally. b) Life-cycle approach to maternal and child nutrition. c) Double burden of malnutrition, hidden hunger, obesity, and micronutrient deficiencies. d) Emerging issues and controversies in maternal and child nutrition, sustainable diets, food security, and nutrition transition.	12
II	Maternal Nutrition and Pregnancy a) Preconception nutrition and nutritional assessment of women of reproductive age. b) Physiology and endocrinology of pregnancy; embryonic, placental, and fetal growth and development. c) Nutritional requirements during pregnancy and gestational weight gain recommendations. d) Adolescent pregnancy, multiple pregnancy, advanced maternal age, and high-risk pregnancies. e) Maternal undernutrition, anemia, obesity, gestational diabetes mellitus, hypertensive disorders, intrauterine growth restriction, congenital anomalies, fetal alcohol spectrum	12

	disorders, pregnancy associated with tuberculosis and HIV/AIDS.	
	f) Antenatal care and maternal nutrition interventions.	
III	Lactation and Infant Feeding a) Development of mammary glands and hormonal regulation of lactation. b) Physiology and endocrinology of lactation; milk synthesis and secretion. c) Human milk composition and factors influencing breast milk production. d) Exclusive breastfeeding, complementary feeding, Baby-Friendly Hospital Initiative (BFHI), Kangaroo Mother Care (KMC). e) Breastfeeding challenges and management: sore nipples, engorgement, mastitis, inverted nipples, low milk supply. f) Breastfeeding in special situations: preterm infants, HIV/AIDS, maternal illness, working mothers.	12
IV	Growth, Development and Nutritional Problems Across Childhood a) Principles of growth and development from infancy to adolescence. b) Growth assessment methods, growth standards and growth monitoring. c) Nutritional requirements during infancy, preschool years, school age, and adolescence. d) Adolescent nutrition, puberty, body composition changes and eating behaviors. e) Protein-energy malnutrition, stunting, wasting, underweight, micronutrient deficiencies, childhood obesity, and developmental disorders. f) Nutritional management of common childhood nutrition-related disorders.	12
V	Maternal and Child Nutrition Policies, Programmes and Emerging Issues a) National nutrition policies and programmes for maternal and child health. b) POSHAN Abhiyaan, ICDS, PMMVY, Anaemia Mukht Bharat, Mid-Day Meal Scheme/PM POSHAN, RMNCH+A and related initiatives. c) UNICEF, WHO, FAO and Sustainable Development Goals related to maternal and child nutrition. d) Nutrition counselling, behaviour change communication and community-based interventions. e) Emerging concepts: Developmental Origins of Health and Disease (DOHaD), first 1000 days, epigenetics, microbiome and maternal-child health.	12
	Total	60

References

Text Books

1. Brown, J.E. (2023). *Nutrition Through the Life Cycle* (8th ed.). Cengage Learning.

2. Wardlaw, G.M. & Smith, A.M. (2022). *Contemporary Nutrition* (12th ed.). McGraw-Hill.
3. Spear, B.A. (2022). *Nutrition Through the Life Cycle* (7th ed.). McGraw-Hill.
4. Sharma, S. & Nagar, S. (2021). *Maternal and Child Nutrition*. CBS Publishers.
5. Gropper, S.S. & Smith, J.L. (2023). *Advanced Nutrition and Human Metabolism* (8th ed.). Cengage Learning.

Reference Books

1. Black, R.E. & Hurley, K.M. (2024). *Maternal and Child Nutrition: Global Challenges and Interventions*. Academic Press.
2. Gibney, M.J., Lanham-New, S.A. & Cassidy, A. (2019). *Introduction to Human Nutrition* (3rd ed.). Wiley-Blackwell.
3. Bamji, M.S., Krishnaswamy, K. & Brahmam, G.N.V. (2017). *Textbook of Human Nutrition* (4th ed.). Oxford & IBH.
4. Srilakshmi, B. (2023). *Nutrition Science* (7th ed.). New Age International.
5. Srilakshmi, B. (2018). *Dietetics* (8th ed.). New Age International.
6. Swaminathan, M. (2009). *Handbook of Food and Nutrition* (6th ed.). BAPPCO.
7. UNICEF. (2024). *State of the World's Children Report*.
8. WHO. (2024). *Guidelines on Maternal, Infant and Young Child Nutrition*.
9. ICMR-NIN. (2024). *Dietary Guidelines for Indians*.
10. FAO. (2023). *Nutrition and Food Systems Report*.

Web Resources

1. [World Health Organization \(WHO\) – Maternal, Newborn, Child and Adolescent Health](#)
2. [UNICEF Nutrition Resources](#)
3. [National Institute of Nutrition \(NIN\)](#)
4. [Indian Council of Medical Research \(ICMR\)](#)
5. [POSHAN Abhiyaan](#)
6. Ministry of Women and Child Development
7. [PubMed Database](#)
8. [Food and Agriculture Organization \(FAO\) Nutrition Gateway](#)

CO-PO-PSO Mapping Matrix

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	3	2	2	1	1	2	3	3	2	1	1	2	2
CO 2	3	3	3	2	2	2	2	3	3	3	2	2	2	2
CO 3	2	3	3	3	2	2	2	2	3	3	3	2	3	2
CO 4	2	2	3	3	3	3	3	2	2	3	3	3	2	3
Total	10	11	11	10	8	8	9	10	11	11	9	8	9	9

Correlation Level: 3 = High Correlation 2 = Moderate Correlation 1 = Low Correlation Blank = No Correlation

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	Functional Foods and Health	Elective-IV Option 1	4	-	-	-	3	25	75	100
Course Outcomes (COs)										
Upon successful completion of the course, students will be able to:										
CO1	Analyze the concepts, classifications, regulatory aspects, and health benefits of functional foods and nutraceuticals.									
CO2	Evaluate the role of probiotics, prebiotics, synbiotics, and postbiotics in human health and disease prevention.									
CO3	Assess bioactive compounds and their mechanisms in promoting health and reducing the risk of chronic diseases.									
CO4	Develop evidence-based applications of functional foods, nutraceuticals, and Indian superfoods for health promotion and therapeutic nutrition.									
	Course content									
Unit	Contents									Hours
I	Concept of Functional Foods and Nutraceuticals a) Functional foods and nutraceuticals: definitions, history, evolution, classification, and current trends. b) Conventional foods, fortified foods, enriched foods, designer foods, medical foods, nutraceuticals, and dietary supplements. c) Role of functional foods in health promotion, disease prevention, and healthy ageing. d) Global and Indian nutraceutical industry, market trends, consumer acceptance, challenges, and opportunities. e) Regulatory frameworks for functional foods and nutraceuticals: FSSAI, Codex Alimentarius, FDA, EFSA.									10
II	Probiotics, Prebiotics, Synbiotics and Postbiotics a) Probiotics: definition, characteristics, selection criteria, mechanisms of action, and health benefits. b) Probiotic microorganisms: Lactobacillus, Bifidobacterium, Saccharomyces and emerging strains.									12

	c) Probiotic foods: dairy and non-dairy probiotic products, safety considerations and quality assessment. d) Prebiotics: definition, sources, physiological effects, and disease prevention. e) Synbiotics, postbiotics, paraprobiotics, and next-generation microbiome-based functional foods.	
III	Bioactive Components and Functional Ingredients a) Dietary fibre, resistant starch, oligosaccharides, β-glucans, gums, and their physiological effects. b) Polyphenols, flavonoids, catechins, tannins, anthocyanins, carotenoids, phytosterols, glucosinolates, organosulphur compounds, phytates, and bioactive peptides. c) Sources, bioavailability, metabolism, and mechanisms of action of bioactive compounds. d) Nutrigenomics and personalized nutrition: emerging concepts.	14
IV	Functional Foods in Disease Risk Reduction and Clinical Applications a) Functional foods in cardiovascular diseases, obesity, diabetes mellitus, metabolic syndrome, gastrointestinal disorders, cancer prevention, bone health, and immune function. b) Antioxidants, anti-inflammatory compounds, and gut microbiome modulation. c) Evidence-based evaluation of health claims and scientific substantiation. d) Clinical applications of nutraceuticals and functional foods in medical nutrition therapy.	14
V	Indian Functional Foods, Superfoods and Future Perspectives a) Therapeutic potential of Indian spices and condiments: turmeric, ginger, garlic, cinnamon, fenugreek, black pepper, and cardamom. b) Herbs and medicinal plants: tulsi, ashwagandha, amla, moringa, giloy, aloe vera and medicinal mushrooms. c) Millets, traditional rice varieties, pulses, fermented foods, spirulina, chlorella and seaweeds. d) Functional food product development, commercialization, sustainability, and future innovations in nutraceutical research.	10
Total		60

References

Text Books

1. Wildman, R.E.C. & Wallace, T.C. (2024). *Handbook of Nutraceuticals and Functional Foods* (4th ed.). CRC Press.
2. Gupta, R.C., Lall, R. & Srivastava, A. (2022). *Nutraceuticals: Efficacy, Safety and Toxicity* (3rd ed.). Academic Press.
3. Bagchi, D. (2021). *Nutraceutical and Functional Food Regulations in the United States and Around the World* (3rd ed.). Academic Press.
4. Gibson, G.R. & Rastall, R.A. (2023). *Prebiotics and Probiotics Science and Technology*. Springer.
5. Aluko, R.E. (2023). *Functional Foods and Nutraceuticals*. Springer Nature.

Reference Books

1. Shi, J. (2020). *Functional Food Ingredients and Nutraceuticals*. CRC Press.
2. Charalampopoulos, D. & Rastall, R.A. (2021). *Prebiotics and Probiotics in Food, Health and Disease*. Springer.
3. Biesalski, H.K. (2022). *Nutraceuticals and Functional Foods in Human Health and Disease Prevention*. CRC Press.
4. Gupta, C. & Prakash, D. (2019). *Phytochemicals as Functional Foods*. CAB International.
5. Das, A.K. & Nanda, P.K. (2022). *Functional Foods and Their Implications for Health Promotion*. Springer.
6. Srilakshmi, B. (2023). *Nutrition Science* (7th ed.). New Age International.
7. Bamji, M.S., Krishnaswamy, K. & Brahmam, G.N.V. (2017). *Textbook of Human Nutrition* (4th ed.). Oxford & IBH.
8. Shahidi, F. (2023). *Nutraceutical and Functional Food Components*. CRC Press.
9. Rastall, R.A. & Gibson, G.R. (2022). *Dietary Modulation of the Human Gut Microbiota*. CRC Press.
10. Swaminathan, M. (2009). *Handbook of Food and Nutrition* (6th ed.). BAPPCO.

Web Resources

1. [Food Safety and Standards Authority of India \(FSSAI\)](#)
2. [International Scientific Association for Probiotics and Prebiotics \(ISAPP\)](#)
3. [International Food Information Council \(IFIC\)](#)

4. European Food Safety Authority (EFSA)
5. United States Food and Drug Administration (FDA)
6. National Institute of Nutrition (NIN)
7. PubMed Database
8. Food and Agriculture Organization (FAO) Nutrition Gateway

CO–PO–PSO Mapping Matrix

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	3	2	2	1	1	2	3	2	2	1	1	2	2
CO2	3	3	3	2	2	2	2	3	3	3	2	2	2	2
CO3	2	3	3	3	2	2	2	2	3	3	3	2	3	2
CO4	2	2	3	3	3	3	3	2	2	3	3	3	2	3
Total	10	11	11	10	8	8	9	10	10	11	9	8	9	9

Correlation Level: 3 = High Correlation 2 = Moderate Correlation 1 = Low Correlation Blank = No Correlation

OR

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	Nutrigenomics	Elective-IV Option 2	4	-	-	-	3	25	75	100

CO	Course Outcomes
	Upon successful completion of the course, students will be able to:
CO1	Explain the molecular basis of genetics, gene expression, and genomic mechanisms underlying nutrient-gene interactions.
CO2	Analyze nutrigenomic and nutrigenetic approaches used to investigate the influence of nutrients on gene regulation and metabolic pathways.
CO3	Evaluate genomic, proteomic, metabolomic, and bioinformatic technologies used in personalized nutrition research.
CO4	Assess the role of nutrigenomics in disease prevention, precision nutrition, and personalized dietary interventions.

	Course Content	
Unit	Contents	Hours
I	Fundamentals of Genetics and Molecular Nutrition a) Introduction to genetics, genomics, nutrigenetics and nutrigenomics. b) Structure and functions of chromosomes, DNA, RNA and genes. c) Watson–Crick model, genetic code and Central Dogma of Molecular Biology. d) DNA replication, repair mechanisms and mutations. e) Gene expression and regulation in human nutrition.	12
II	Gene Expression, Epigenetics and Gene–Nutrient Interactions a) Transcription, translation and post-transcriptional modifications. b) Structure and functions of mRNA, tRNA, rRNA, miRNA and non-coding RNAs. c) Epigenetics: DNA methylation, histone modification and chromatin remodeling. d) Gene polymorphisms and nutrient metabolism. e) Nutrient regulation of gene expression. f) Transporter gene polymorphisms and micronutrient interactions.	12
III	Gut Microbiome and Nutrigenomics a) Human gut microbiota and host interactions. b) Diet–microbiome interactions and metabolic health. c) Role of probiotics, prebiotics, synbiotics and postbiotics in gene regulation. d) Nutrigenomic approaches for studying complex foods and dietary patterns. e) Precision nutrition and microbiome-based dietary interventions.	12
IV	Omics Technologies and Bioinformatics in Nutrition Research a) Genomics technologies: PCR, RT-PCR, SNP genotyping, microarrays, next-generation sequencing (NGS), whole genome sequencing and transcriptomics. b) Proteomics: electrophoresis, protein profiling, peptide sequencing and biomarker discovery. c) Metabolomics: chromatography, mass spectrometry, metabolite profiling and nutritional biomarkers. d) Bioinformatics tools, databases, data mining, primer design and systems biology approaches. e) Artificial Intelligence and machine learning applications in nutritional genomics research.	12
V	Clinical Applications of Nutrigenomics and Personalized Nutrition a) Nutrigenomics in obesity and metabolic syndrome. b) Nutrigenomics in diabetes mellitus. c) Nutrigenomics in cardiovascular diseases. d) Nutrigenomics in cancer prevention and management. e) Nutrigenomics in inflammatory bowel disease and malnutrition. f) Personalized nutrition, direct-to-consumer genetic testing, ethical, legal and social implications (ELSI). g) Future perspectives in precision nutrition and precision health.	12

	Total	60
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References

Text Books

1. Ferguson, L.R. (2013). *Nutrigenomics and Nutrigenetics in Functional Foods and Personalized Nutrition*. CRC Press.
2. Carlberg, C. & Molnár, F. (2019). *Nutrigenomics: From Molecular Nutrition to Prevention of Disease* (2nd ed.). Springer.
3. Kohlmeier, M. (2016). *Nutrigenetics: Applying the Science of Personal Nutrition*. Academic Press.
4. Kaput, J. & Rodriguez, R.L. (2021). *Nutritional Genomics: Discovering the Path to Personalized Nutrition*. Wiley.
5. De Caterina, R., Martinez, J.A. & Kohlmeier, M. (2020). *Principles of Nutrigenetics and Nutrigenomics*. Academic Press.

Reference Books

1. Sales, N.M.R., Pelegrini, P.B. & Goersch, M.C. (2021). *Nutrigenomics and Personalized Diets*. Springer.
2. Trujillo, E. & Davis, C.D. (2022). *Precision Nutrition and Metabolic Health*. Elsevier.
3. Mutch, D.M. & Wahli, W. (2020). *Nutrigenomics and Proteomics in Health and Disease*. CRC Press.
4. Ordovas, J.M., Ferguson, L.R. & Tai, E.S. (2023). *Personalized Nutrition: Translating Nutrigenetic and Nutrigenomic Research into Practice*. Academic Press.
5. Gibney, M.J., Lanham-New, S.A., Cassidy, A. & Vorster, H.H. (2019). *Introduction to Human Nutrition* (3rd ed.). Wiley-Blackwell.
6. Gropper, S.S. & Smith, J.L. (2023). *Advanced Nutrition and Human Metabolism* (8th ed.). Cengage Learning.
7. Watson, J.D., Baker, T.A., Bell, S.P., Gann, A. & Levine, M. (2020). *Molecular Biology of the Gene* (8th ed.). Pearson.
8. Lodish, H., Berk, A. & Kaiser, C.A. (2021). *Molecular Cell Biology* (9th ed.). W.H. Freeman.
9. Brown, T.A. (2023). *Genomes* (5th ed.). Garland Science.
10. Alberts, B. et al. (2022). *Molecular Biology of the Cell* (7th ed.). Garland Science.

Journals

1. Nutrigenomics and related articles in *Nutrients*.

2. Nutritional Genomics research in *The Journal of Nutrition*.
3. *Genes & Nutrition*.
4. *Molecular Nutrition and Food Research*.
5. *Nutrition Reviews*.
6. *Current Developments in Nutrition*.

Web Resources

1. [National Center for Biotechnology Information \(NCBI\)](#)
2. [PubMed Database](#)
3. [National Human Genome Research Institute \(NHGRI\)](#)
4. [Ensembl Genome Browser](#)
5. [European Bioinformatics Institute \(EMBL-EBI\)](#)
6. [National Institute of Nutrition \(NIN\)](#)
7. [Human Microbiome Project](#)
8. World Health Organization (WHO) Nutrition

CO–PO–PSO Mapping Matrix

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	3	2	2	1	1	1	3	2	2	1	1	2	2
CO 2	3	3	3	3	2	2	2	3	3	3	2	2	2	2
CO 3	2	3	3	3	3	2	2	2	3	3	3	2	3	2
CO 4	2	2	3	3	3	3	3	2	2	3	3	3	2	3
Tot al	10	11	11	11	9	8	8	10	10	11	9	8	9	9

Correlation Level: 3 = High Correlation 2 = Moderate Correlation 1 = Low Correlation Blank = No Correlation

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	Nutrition in Special Conditions	Skill Enhancement Course	4	-	-	-	2	25	75	100
Course Outcomes										
Upon successful completion of the course, students will be able to:										
CO1	Explain physiological adaptations and nutritional requirements under extreme environmental and occupational conditions.									
CO2	Evaluate specialized nutrition strategies for space missions, military personnel, seafarers, and individuals exposed to harsh environments.									
CO3	Assess nutritional challenges and intervention measures during emergencies, disasters, and humanitarian crises.									
CO4	Develop evidence-based nutrition plans and food support strategies for special populations in unique environmental and occupational settings.									
Course Content										
Unit	Contents									Hours
I	Space and Aviation Nutrition a) Human physiology in space: effects of microgravity on musculoskeletal, cardiovascular, gastrointestinal and immune systems. b) Nutritional challenges during space missions: bone loss, muscle wasting, oxidative stress, radiation exposure, and fluid balance. c) Space foods: characteristics, processing technologies, packaging requirements, shelf-life and food safety. d) Nutrition for astronauts and future long-duration missions. e) Aviation nutrition and nutritional considerations during long-duration air travel and high-altitude exposure.									12
II	Nutrition in Extreme Environments a) Physiological adaptations to cold environments, polar regions, glaciers and high-altitude conditions. b) Nutritional requirements in hot climates, desert environments and heat stress conditions. c) Hydration, electrolyte balance and thermal regulation. d) Specialized food products and nutritional supplements for extreme environments.									12

	e) Climate change and emerging nutritional challenges.	
III	Marine, Offshore and Occupational Nutrition a) Nutritional challenges among seafarers and offshore workers. b) Stress, fatigue, shift work and circadian rhythm disturbances affecting dietary intake. c) Food service management and catering regulations in ships and offshore facilities. d) Nutritional problems during prolonged sea voyages and confined environments. e) Occupational nutrition and workplace wellness programmes.	12
IV	Military and Tactical Nutrition a) Physiological demands of military training and combat operations. b) Military dietary guidelines, combat rations and field feeding systems. c) Nutritional strategies for endurance, cognition, resilience and recovery. d) Nutritional supplements and performance optimization in military personnel. e) Nutrition in law enforcement, firefighters, disaster-response teams and tactical occupations.	12
V	Nutrition in Emergencies, Disasters and Humanitarian Settings a) Types of disasters: natural, technological, biological and complex emergencies. b) Nutritional assessment and surveillance during emergencies. c) Nutritional problems among vulnerable populations: infants, children, pregnant women, elderly and displaced populations. d) Emergency feeding programmes, therapeutic feeding and supplementary feeding. e) Sphere standards, humanitarian nutrition, food security and disaster preparedness. f) Community resilience and nutrition interventions during public health emergencies and pandemics.	12
Total		60

References

Text Books

1. Smith, S.M. & Zwart, S.R. (2023). *Nutrition and Human Adaptation to Spaceflight*. Springer.
2. Marriott, B.M. (2022). *Not Eating Enough: Overcoming Underconsumption of Military Operational Rations*. National Academies Press.
3. Lieberman, H.R. & Kanarek, R.B. (2020). *Nutrition and Military Performance*. CRC Press.
4. Geissler, C. & Powers, H. (2023). *Human Nutrition* (14th ed.). Oxford University Press.
5. Whitney, E. & Rolfes, S.R. (2022). *Understanding Nutrition* (16th ed.). Cengage Learning.

Reference Books

1. Gibney, M.J., Lanham-New, S.A., Cassidy, A. & Vorster, H.H. (2019). *Introduction to Human Nutrition* (3rd ed.). Wiley-Blackwell.
2. Brown, J.E. (2023). *Nutrition Through the Life Cycle* (8th ed.). Cengage Learning.
3. WHO. (2024). *Guidelines for Nutrition in Emergencies*.
4. FAO. (2023). *Food Security and Nutrition in Emergencies*.
5. UNICEF. (2024). *Programming Guide for Infant and Young Child Feeding in Emergencies*.
6. Sphere Association. (2018). *The Sphere Handbook: Humanitarian Charter and Minimum Standards in Humanitarian Response*.
7. Mahan, L.K. & Raymond, J.L. (2024). *Krause's Food and the Nutrition Care Process* (16th ed.). Elsevier.
8. Srilakshmi, B. (2023). *Nutrition Science* (7th ed.). New Age International.
9. Bamji, M.S., Krishnaswamy, K. & Brahmam, G.N.V. (2017). *Textbook of Human Nutrition* (4th ed.). Oxford & IBH.
10. Swaminathan, M. (2009). *Handbook of Food and Nutrition* (6th ed.). BAPPCO.

Web Resources

1. [World Health Organization \(WHO\) – Nutrition in Emergencies](#)
2. [Food and Agriculture Organization \(FAO\) Emergency Nutrition Resources](#)
3. [UNICEF Nutrition in Emergencies](#)
4. [Sphere Standards](#)
5. [National Aeronautics and Space Administration \(NASA\) Human Research Program](#)
6. [European Space Agency \(ESA\) Human Spaceflight and Nutrition](#)
7. [National Institute of Nutrition \(NIN\)](#)
8. [PubMed Database](#)

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Tot al	10	10	11	10	8	8	10	10	10	10	9	8	9	9

Correlation Level: 3 = High Correlation 2 = Moderate Correlation 1 = Low Correlation Blank
= No Correlation