UNIVERSITY OF DELHI

University of Delhi

Faculty of Science

Department of Home Science

1-Year M.Sc. Food and Nutrition Research Track

Course Credit Structure and Curriculum - NEP 2025

1-Year M.Sc (FOOD AND NUTRITION)

Introduction:

The Department of Home Science offers a 1- year M.Sc. Food and Nutrition, to the 4 -year graduates of B.Sc Home Science, Food and Nutrition specialisation, of University of Delhi. The programme covers key advanced aspects in three areas of specialization namely, Clinical Nutrition, Public Health Nutrition and Food Science and Processing. The programme endeavours to train a cadre of professionals who can create nutrition awareness for promotion of healthy lifestyle among the population. The courses of this programme have been designed to enhance the core competency of students in the fields of public health nutrition, dietetics and food science. The curriculum provides a strong theoretical base and also includes experiential learning through field placements and practical.

In addition to strengthening the advanced knowledge base, the programme aims to strengthen the research acumen of students who have developed a strong base in Food, Nutrition and Dietetics, to enable them to develop into academicians and researchers in the field of food science, nutrition and dietetics.

Programme Specific Objectives:

The objectives of M.Sc. Food and Nutrition programme are:

- To apply the understanding of the concepts of biochemistry, food chemistry, food microbiology, methods of assessing human nutritional requirements, nutritional assessment and diet planning in laboratory setting as per standard methods in the above-mentioned areas
- To understand the applications of nutritional sciences in clinical interventions communication for health promotion, food service management, food science and processing
- To improve understanding and develop skills to participate in planning, management and monitoring of public health nutrition programmes implemented by the government.
- To acquire skills to undertake systematic research in the area of food science, clinical nutrition and public health nutrition

Programme Specific Outcomes:

After completing this programme the student will be able to:

- Assess nutritional status and plan appropriate diets.
- Use the knowledge of nutritional sciences in clinical interventions and communication for health promotion
- Work as food scientists, quality assurance managers and analysts.
- Manage a food service establishment and its Research and Development
- Apply theoretical concepts and practical training for research in the field of food science, clinical nutrition and public health nutrition

Program Structure 3: M.Sc. Only Research

Semester	Core Courses		Elective Courses		Research Methodology		Research/Project		Total Credits
	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	
I	1	4	1	4	2	4	1	10	22
II	-	-	1	4	1	2	1	16	22
Total Credits for the Course	4		8		6		26		44

List of Courses to be offered to students opting for Structure-3 (Research) of M.Sc. in 1st and 2nd Semester of One- year course							
Type of Course	Course No.	Semester	Course Title	Credits for each Course			
				Theory	Tutorial	Practical	Total
SEMESTER I							
Discipline Specific Core Course	DSC 1	I	Methods of Investigation in Food and Nutrition Research	2	0	2	4
Discipline Specific Elective Course	DSE 1	I	Institutional Food Service management Social and Cultural Aspects in Public Health Improving Maternal, Infant, Young Child and Adolescent Nutrition Animal Products Processing and Unit Operations in Food Processing Exercise, Nutrition and Metabolism Sport-Specific Nutrition	As per the specific course			4
Advanced Research Methodology	ARM 1	I	Advanced Research Methodology	2	0	0	2
Tools for Research	TR 1	I	Tools for Research	2	0	0	2
Dissertation Project/ Entrepreneurship	IP 1	I	Dissertation/Academic project/ Entrepreneurship	0	0	10	10
SEMESTER II							
Discipline Specific Elective Course	DSE 2	II	Precision Nutrition Challenges in Clinical Nutrition Nutritional Care of the Elderly Programme Planning in Public Plant Products Processing and Preservation Food Processing Technologies Clinical Sports Nutrition	As per the specific course			4

			Doping, Supplements and Ergogenic Aids				
Techniques of Research Writing	TRW 1	II	Techniques of Research Writing	2	0	0	2
Dissertation Project/ Entrepreneurship	IP 2	II	Dissertation/Academic Project/ Entrepreneurship	0	0	16	16

List of PGCF courses of M.Sc. Food and Nutrition (Research) (Semester I and II of the One-year programme)

Pool of Discipline Specific Elective Courses offered in Semester I				
	Credits for each Course			
	Theory	Tutorial	Practical	Total
i. Statistics and Data Management (From the common Home Science pool)	3	0	1	4
ii. Medical Nutrition Therapy	3	0	1	4
iii. Institutional Food Service management	2	0	2	4
iv. Social and Cultural Aspects in Public Health Nutrition	3	0	1	4
v. Improving Maternal, Infant, Young Child and Adolescent Nutrition	2	0	2	4
vi. Animal Products Processing and Preservation	3	0	1	4
vii. Unit Operations in Food Processing	2	0	2	4
viii. Exercise, Nutrition and Metabolism	3	0	1	4
ix. Sport-Specific Nutrition	2	0	2	4
Pool of Discipline Specific Elective Courses offered in Semester II				
	Credits for each Course			
	Theory	Tutorial	Practical	Total
x. Precision Nutrition	3	0	1	4
xi. Challenges in Clinical Nutrition	2	0	2	4
xii. Nutritional Care of the Elderly	3	0	1	4
xiii. Programme Planning in Public Health Nutrition	2	0	2	4
xiv. Plant Products Processing and Preservation	3	0	1	4
xv. Food Processing Technologies	2	0	2	4
xvi. Clinical Sports Nutrition	2	0	2	4
xvii. Doping, Supplements and Ergogenic Aids	3	0	1	4

SEMESTER -I

DISCIPLINE SPECIFIC CORE COURSE
METHODS OF INVESTIGATION IN FOOD AND NUTRITION RESEARCH

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical		
Methods of Investigation in Food and Nutrition Research	**4**	**2**	**0**	**2**	**Nil**	**Nil**

Learning Objectives:

- To describe major emerging trends in food and nutrition research and explain their relevance to global health and food systems.
- To develop conceptual and practical knowledge of analytical techniques and their applications.
- To acquire a basic understanding of advanced techniques for structural and functional analysis of biomolecules.
- To understand basic epidemiological concepts and principles, and their application in nutritional epidemiology.
- To appreciate the role of dietary exposure assessment and nutrition-related health outcomes in establishing diet–disease relationships.

Learning Outcomes:

The students would be able to:

- Summarize key current directions in nutrition research and relate them to public health priorities and sustainable diets.
- Understand the principles of analytical techniques and apply them for separation, purification, and characterization of biomolecules in food and nutrition analysis.
- Interpret data from these methods, execute core laboratory procedures, and demonstrate analytical skills for biochemical research.
- Explain key concepts and principles of nutritional epidemiology and apply them to understand diet–disease relationships.
- Assess and interpret dietary exposures and nutrition-related health outcomes using appropriate epidemiological methods.

THEORY

(Credits 2; Hours 30)

UNIT I: Emerging Areas of Nutrition Research 4 Hours

This unit explores emerging frontiers in nutrition research, focusing on innovative methodologies. It addresses global health challenges through advanced nutritional science.

- Precision Nutrition
- Microbiome research
- Big data and machine learning in research
- Sustainability and food systems research

UNIT II: Methods of Analysis of Biomolecules 13 Hours

This unit examines the principles and applications of instrumental methods for the separation and characterization of food analytes in food and nutrition research.

- Spectroscopy & Separation Techniques:
    - UV-Vis Spectrophotometry, Atomic Absorption Spectroscopy
    - Centrifugation: Principle, types (differential, density gradient)
    - Chromatography: Gel Filtration chromatography, Ion Exchange Chromatography, HPLC
- Overview of Advanced Separation & Structural Analysis Techniques:
    - Electrophoresis: SDS-PAGE & 2D gel-electrophoresis
    - Mass Spectrometry: MALDI-TOF
    - Differential Scanning Calorimetry (DSC), X-ray Diffraction (XRD)

UNIT III: Nutritional Epidemiology: Concept, Methods and Applications 8 Hours

This unit introduces the principles of epidemiology and their application in the context of nutrition and potential errors in measurement of diet–disease relationships.

- Definition, purpose and measurements in epidemiology
- Epidemiologic study methods: design, steps, analysis and interpretation.
- Introduction to nutritional epidemiology: Definition and significance in public health nutrition, dietary variation and measurement of diet–disease relationship
- Potential errors in epidemiologic studies

UNIT IV: Exposures in Nutritional Epidemiology 5 Hours

This unit deals with various important exposures in nutritional epidemiology and review of their measurement method(s).

- Nutritional exposures: Relevant direct and indirect measures of nutritional assessment
    - Critical review of diet assessment methods: strengths and limitations, measurement errors, reproducibility and validity, analysis and interpretation.
    - Critical review of anthropometric and various direct measures of nutritional status: clinical, biochemical (nutritional biomarkers), biophysical and measures of body composition. Sources of errors, strengths and limitations of various measures. Relevance and use of various indices and indicators of nutritional status

PRACTICAL

(Credits 2; Hours 60)

1. Preparation of Acidic and Basic buffers.
2. Protein estimation using UV-/Biuret method.
3. Demonstration of HPLC.
4. Demonstration of Gel filtration/Ion-exchange chromatography.
5. Demonstration of SDS-PAGE.
6. Critically review original research on studies in the field of nutritional epidemiology and do the following:
    - Identify research designs used, sampling, analyses and interpretation.
    - Identify applications of research evidence in the field of public health nutrition
7. Determine reliability and validity of an assessment tool
8. Estimate measurement error in anthropometric data
9. Interpret anthropometric data available from national and regional surveys

Essential Readings:

UNIT I

- Gropper, S. S., Smith, J. L., & Carr, T. P. (2021). *Advanced nutrition and human metabolism* (8th ed.). Cengage Learning.
- Heber, D., Shiao, Y.-H., & Asset, E. (Eds.). (2023). *Precision nutrition*. Elsevier. https://doi.org/10.1016/B978-0-443-15315-0.00001-8
- Shils, M. E., Shike, M., & Ross, A. C. (Eds.). (2020). *Modern nutrition in health and disease* (12th ed.). Wolters Kluwer.

UNIT II

- Boyer, R. F. (2012). Biochemistry laboratory: Modern theory and techniques (6th ed.). Prentice Hall.
- Freifelder, D. (1982). Physical biochemistry: Applications to biochemistry and molecular biology (2nd ed.). W. H. Freeman.
- Katoch, R. (2011). Analytical techniques in biochemistry and molecular biology. Springer.
- Kemp, W. (2022). Organic spectroscopy. Bloomsbury Publishing India.
- Mohan, J. (2009). Organic spectroscopy: Principles and applications. Narosa Publishing House.
- Wilson, K., & Walker, J. (2010). Principles and techniques of biochemistry and molecular biology (7th ed.). Cambridge University Press.

UNIT III

- Bonita, R., Beaglehole, R., & Kjellström, T. (2006). Basic epidemiology (2nd ed.). World Health Organization. http://whqlibdoc.who.int/publications/2006/9241547073_eng.pdf
- Boyle, M. A. (2022). Community nutrition in action (8th ed.). Cengage Learning.
- Edelstein, S. (2023). Community and public health nutrition (5th ed.). Jones & Bartlett Learning.
- Park, K. (2025). Park's textbook of preventive and social medicine (28th ed.). Banarsidas Bhanot.
- Vir, S. C. (2021). Public health nutrition in developing countries (Vol. 2, 2nd ed.). Woodhead Publishing India.
- Willett, W. C. (2013). Nutritional epidemiology (3rd ed.). Oxford University Press.

UNIT IV

- Buttriss, J. L., Welch, A. A., Kearney, J. M., & Lanham-New, S. A. (Eds.). (2017). Public health nutrition (2nd ed.). Wiley-Blackwell.
- Gibson, R. S. (2005). Principles of nutritional assessment (2nd ed.). Oxford University Press.

Suggested Readings:

- 1,000 Days. (n.d.). The International Coalition for Advocacy on Nutrition (ICAN). https://thousanddays.org/ican/
- Alive & Thrive. (n.d.). How to: A guide to effective nutrition advocacy. https://www.aliveandthrive.org/en/resources/guidance-on-effective-nutrition-advocacy
- Aschengrau, A., & Seage, G. R. (2014). Essentials of epidemiology in public health (3rd ed.). Jones & Bartlett.
- Cooper, T. G. (2011). The tools of biochemistry (2nd ed.). Wiley-Interscience.
- Dietary Guidelines for Indians. (2024). Dietary guidelines for Indians. National Institute of Nutrition, Indian Council of Medical Research, Government of India. https://www.nin.res.in/dietaryguidelines/pdfjs/locale/DGI07052024P.pdf
- Gibney, M. J., Margetts, B. M., Kearney, J. M., & Arab, L. (Eds.). (2004). Public health nutrition. Blackwell Publishing.
- Gibson, R. S. (2005). Principles of nutritional assessment (2nd ed.). Oxford University Press.
- Gordis, L. (2013). Epidemiology (5th ed.). Saunders Elsevier.
- Harvard T. H. Chan School of Public Health. (n.d.). Precision nutrition. The Nutrition Source. https://nutritionsource.hsph.harvard.edu/precision-nutrition/
- International Institute for Population Sciences, National Programme for Health Care of Elderly, Ministry of Health and Family Welfare, Harvard T. H. Chan School of Public Health, & University of Southern California. (2020). Longitudinal Ageing Study in India (LASI) Wave 1, 2017–18: India report. International Institute for Population Sciences.
- Langseth, L. (1996). Nutritional epidemiology: Possibilities and limitations. ILSI Press.
- Longvah, T., Ananthan, R., Bhaskarachary, K., & Venkaiah, K. (2017). Indian food composition tables. National Institute of Nutrition, Indian Council of Medical Research.
- Ministry of Women and Child Development. (2018). Transforming nutrition in India: POSHAN Abhiyaan—A progress report (December 2018). Government of India. https://www.niti.gov.in/sites/default/files/2020-02/POSHAN_Abhiyaan_first_progress_report_6_Feb_2019.pdf
- Moon, G., & Gould, M. (2000). Epidemiology: An introduction. Open University Press.
- Nutrients. (n.d.). Nutrients. MDPI. https://www.mdpi.com/journal/nutrients
- Plummer, D. T. (2015). An introduction to practical biochemistry (3rd ed.). Tata McGraw-Hill.
- World Health Organization. (n.d.). Nutrition Landscape Information System (NLiS). https://www.who.int/teams/nutrition-and-food-safety/databases/nutrition-landscape-information-system

- Zeigler, C., & Piwoz, E. (2022). Prospects and pitfalls of machine learning in nutritional epidemiology. Nutrients, 14(9), 1795. https://doi.org/10.3390/nu14091795

Note: Examination scheme and mode shall be as prescribed by the Examination branch, University of Delhi, from time to time

DISCIPLINE SPECIFIC ELECTIVE COURSE
STATISTICS AND DATA MANAGEMENT

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical		
Statistics and Data Management	4	3	0	1		Nil

Learning Objectives

- To develop understanding of fundamental and advanced statistical concepts used in research and data analysis.
- To enable students to apply descriptive and inferential statistics for real-world decision-making.
- To strengthen ability to formulate hypotheses, select appropriate statistical tests, and interpret outputs.
- To prepare students for quantitative research, industry analytics, and academic data projects.
- To train students in using Excel and SPSS for data handling, visualization, and interpretation.

Learning Outcomes

The students would be able to:

- Explain key concepts in descriptive and inferential statistics.
- Organize, clean, and summarize datasets using appropriate statistical tools.
- Apply probability distributions, correlation, regression, and hypothesis testing.
- Use Excel and SPSS for data visualization, statistical testing, and reporting.
- Interpret statistical outputs and draw valid conclusions for research decisions.
- Design and execute quantitative data analysis workflows independently.

THEORY

(Credits 3; Hours 45)

UNIT I: Introduction and descriptive Statistics **12 Hours**

This unit will introduce the foundations of statistics and techniques for summarizing and describing data.

- Definition, scope, and applications of statistics
- Types of data: qualitative and quantitative
- Scales of measurement
- Classification & tabulation of data
- Graphical and visual representations
- Measures of central tendency: mean, median, mode
- Measures of dispersion: range, variance, standard deviation, coefficient of variation
- Skewness and kurtosis: meaning and interpretation

UNIT II: Probability and Probability Distributions **10 Hours**

This unit explores probability concepts and major statistical distributions.

- Basic probability concepts: Addition & multiplication theorems
- Random variables: discrete and continuous variable
- Binomial, Poisson and Normal distributions
- Sampling theory & sampling distributions
- Central Limit Theorem

UNIT III: Correlation and regression **8 Hours**

This unit focuses on analysing relationships between variables.

- Correlation: Pearson and Spearman correlation
- Simple linear regression: model, estimation, interpretation
- Multiple linear regression: assumptions, multicollinearity, model building

UNIT IV: Hypothesis Testing and Non-Parametric Methods **15 Hours**

This unit introduces hypothesis testing frameworks and non-parametric alternatives for non-normal data.

- Concept of hypothesis: null & alternative
- Types of errors, significance levels, p-value
- Parametric tests:
    - z-test
    - t-test (one sample, independent, paired)
    - ANOVA- One way
    - Chi-square test
- Non-parametric tests:
    - Mann–Whitney U test
    - Wilcoxon signed-rank test
    - Kruskal–Wallis test

- Interpretation and reporting of statistical results
- Research Conclusion and recommendation

Practical

(Credits 1; 30 hours)

1. Data Entry, Coding & Cleaning: Importing data, handling missing values, variable labels, Excel formulas.
2. Descriptive Statistics & Visualization: Mean, Standard Deviation, frequency tables, histograms, boxplots (Excel + SPSS).
3. Cross-Tabulation & Chi-Square Test: PivotTables in Excel; Crosstabs in SPSS.
4. Correlation Analysis: Pearson & Spearman correlations; scatterplots.
5. Simple Linear Regression: Trendline in Excel; Regression output in SPSS.
6. Multiple Regression: Model summary, coefficients, interpretation using SPSS.
7. t-Tests: Independent, paired, and one-sample t-tests in SPSS.
8. ANOVA (One-way & Two-way): Running ANOVA and post-hoc analysis.
9. Non-Parametric Tests: Mann-Whitney, Wilcoxon, Kruskal–Wallis in SPSS.
10. Report Generation & Interpretation
11. Preparing APA-style tables, graphs, and interpretations in Excel/SPSS.

Essential Readings:

UNIT I

This unit describes the foundations of statistics and techniques for summarizing and describing data.

- Agresti, A., & Franklin, C. A. (2009). *Statistics: The art and science of learning from data* (2nd ed.). Pearson Prentice Hall.
- Bernard, H. R. (2000). *Social research methods: Qualitative and quantitative approaches*. Sage.
- Diez, D. M., Barr, C. D., & Cetinkaya-Rundel, M. (2015). *OpenIntro statistics* (3rd ed.). CreateSpace Independent Publishing Platform.
- Minium, E. W., King, B. M., & Bear, G. (2004). *Statistical reasoning for psychology and education*. Wiley.

UNIT II

This unit deals with the probability concepts, rules of probability, discrete and continuous distributions (Binomial, Poisson, Normal).

- Agresti, A., & Franklin, C. A. (2009). *Statistics: The art and science of learning from data* (2nd ed.).
- Diez, D. M., Barr, C. D., & Cetinkaya-Rundel, M. (2015). *OpenIntro statistics* (3rd ed.).

- Minium, E. W., King, B. M., & Bear, G. (2004). *Statistical reasoning for psychology and education*.

UNIT III

This unit focuses on relationship between variables, correlation coefficients, simple and multiple regression, regression assumptions.

- Agresti, A., & Franklin, C. A. (2009). *Statistics: The art and science of learning from data* (2nd ed.).
- Diez, D. M., Barr, C. D., & Cetinkaya-Rundel, M. (2015). *OpenIntro statistics* (3rd ed.).
- Muijs, D. (2004). *Doing quantitative research in education with SPSS*. Sage.

UNIT IV

The UNIT deals with statistical inference such as t-tests, ANOVA, Chi-square, non-parametric tests (Mann-Whitney, Wilcoxon, Kruskal-Wallis), decision making.

- Agresti, A., & Franklin, C. A. (2009). *Statistics: The art and science of learning from data* (2nd ed.).
- Diez, D. M., Barr, C. D., & Cetinkaya-Rundel, M. (2015). *OpenIntro statistics* (3rd ed.).
- Minium, E. W., King, B. M., & Bear, G. (2004). *Statistical reasoning for psychology and education*.
- Muijs, D. (2004). *Doing quantitative research in education with SPSS*.

Suggested Readings

- Field, A. (2025). *Discovering Statistics Using IBM SPSS Statistics* (6th ed.). Sage.
- Kalyanaraman, K., Ramanathan, H. N., & Harikumar, P. N. (2025). *Statistical Methods for Research: A Step-by-Step Approach Using IBM SPSS*. Atlantic Publishers.
- Healey, J. F., & Donoghue, C. (2021). *Statistics: A Tool for Social Research and Data Analysis* (11th ed.).

Note: Examination scheme and mode shall be as prescribed by the Examination branch, University of Delhi, from time to time

DISCIPLINE SPECIFIC ELECTIVE COURSE
MEDICAL NUTRITION THERAPY

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical		
Medical Nutrition Therapy	4	3	0	1		Nil

Learning Objectives

- To understand the nutrition support for hospitalized patients.
- To examine the etiology, pathophysiology and metabolic alterations associated with various disorders/diseases and to provide appropriate nutrition care and medical nutrition therapy (MNT).
- To develop essential skills in dietary counseling for the effective management of diverse disease conditions.

Learning Outcomes

The students would be able to:

- Develop an understanding about the basic principles of providing nutrition support to hospitalized patients
- Attain comprehensive knowledge of the etiolgy, pathophysiology, metabolic anomalies, and corresponding medical nutrition therapy for a wide range of disorders/diseases.
- Apply fundamental principles of dietary counseling to support nutrition management across various disease conditions.

THEORY
(Credits 3; Hours 45)

UNIT I: Nutrition support system **7 Hours**

This unit will highlight the basic principles, indications, contraindications, access routes, nutrient

composition, complications and guidelines on enteral and parenteral nutrition.

- Enteral and Parenteral Nutrition
- International and National Guidelines on Enteral and Parenteral Nutrition

UNIT II: MNT for Hepatic Disorders 7 Hours

Students will understand the etiopathophysiology, metabolic & clinical aberrations, diagnosis, complications, treatment, MNT and recent advances in disorders and also be trained on disease specific dietary counseling.

- End stage liver disease (ESLD)
- Hepatic Encephalopathy
- Liver resection and transplant

UNIT III: MNT for Cardiovascular Disorders 11 Hours

This unit explains the etiopathophysiology, metabolic & clinical aberrations, diagnosis, complications, treatment, MNT and recent advances in different diseases/disorders. Students will also be trained on disease specific dietary counseling.

- Ischemic Heart Disease (compensated and decompensated)
- Rheumatic Heart Disease
- Coronary artery bypass graft (CABG), angioplasty
- Cerebrovascular and peripheral vascular disease
- Heart transplant

UNIT IV: MNT for Renal Disorders 20 Hours

This unit will provide an understanding of etiopathophysiology, metabolic & clinical aberrations, diagnosis, complications and recent advances in prevention, treatment, MNT and dietary Counselling in kidney disorders.

- Nephrotic Syndrome
- Glomerulonephritis
- Acute Renal Failure
- Chronic Kidney Disease
- End Stage Renal Disease (ESRD)
- Dialysis, Transplant, Renal Stones

PRACTICAL
(Credits 1; Hours 30)

1. Market Survey for commercial nutritional therapeutic products
2. Planning & preparation of diets for the following conditions:
   - Hepatic Encephalopathy
   - Liver Transpalant

- Ischemic Heart Disease
- Nephritis
- Acute Renal Failure
- Chronic renal failure
- Patients on dialysis

Essential Readings

UNIT 1

Students will be introduced to the access routes, indications, contraindications, nutrient composition, complications and guidelines on enteral and parenteral nutrition.

- Indian Dietetics Association, (2018). Clinical Dietetics Manual, 2nd ed. Elite Publishing House Pvt. Ltd. (ISBN: 9788193599648)
- Joshi Y K. (2008). Basics of Clinical Nutrition 2nd ed. Jaypee Brothers Medical Publishers. (ISBN: 978-9350251768)
- Mahan, L.K. and Escott-Stump, S. (2021). Krause's Food Nutrition and Nutrition Care Process, 16th Edition, Elsevier Pvt. Ltd. (ISBN: 032381025X)

- ESPEN guidelines: https://www.espen.org/guidelines/espen-practical-guidelines-pdf-versions
- ASPEN guidelines: https://nutritioncare.org/clinical-resources/guidelines-standards/

UNIT II

Students will learn about etiology, metabolic and clinical abnormalities, diagnosis, complications, treatment, MNT, new advancements and counseling in liver disease.

- Indian Dietetics Association, (2018). Clinical Dietetics Manual, 2nd ed. Elite Publishing House Pvt. Ltd. (ISBN: 9788193599648)
- Joshi Y K. (2008). Basics of Clinical Nutrition 2nd ed. Jaypee Brothers Medical Publishers. (ISBN: 978-9350251768)
- Khanna K, Gupta S, Seth R, Passi SJ, Seth R, Mahna R, Puri S (2013). Textbook of Nutrition and Dietetics.2nd Edn. Phoenix Publishing House Pvt. Ltd.
- Mahan, L.K. and Escott-Stump, S. (2021). Krause's Food Nutrition and Nutrition Care Process, 16th Edition, Elsevier Pvt. Ltd. (ISBN: 032381025X)
- Seth, V. and Singh K. (eds.) (2024). Principles of Medical Nutrition Therapy for Positive Clinical Outcomes, 2nd Edition. Elite Publishing House Pvt. Ltd.
- Role of Nutrition in the Management of Hepatic Encephalopathy in End-Stage Liver Failure: https://pmc.ncbi.nlm.nih.gov/articles/PMC3017957/
- ESPEN Guidelines on clinical nutrition in liver disease: https://www.espen.org/files/ESPEN-Guidelines/ESPEN_practical_guideline_Clinical_nutrition_in_liver_disease.pdf

- Indian standard treatment guidelines organ transplant: Liver: https://clinicalestablishments.mohfw.gov.in/sites/default/files/standard-treatment-guidelines/1511.pdf

UNIT III

This unit covers the etiopathophysiology, metabolic and clinical abnormalities, diagnosis, consequences, treatment, MNT, and current developments and counseling in cardiovascular disease.

- British Nutrition Foundation (Ed.), Stanner, S. (Ed.), Coe, S. (Ed.), & Frayn, K. N. (Managing Ed.). (2019). Cardiovascular disease: Diet, nutrition and emerging risk factors (2nd ed.). Wiley-Blackwell. (ISBN: 978-1-118-82991-2)
- Indian Dietetics Association, (2018). Clinical Dietetics Manual, 2nd ed. Elite Publishing House Pvt. Ltd. (ISBN: 9788193599648)
- Joshi Y K. (2008). Basics of Clinical Nutrition 2nd ed. Jaypee Brothers Medical Publishers. (ISBN: 978-9350251768)
- Khanna K, Gupta S, Seth R, Passi SJ, Seth R, Mahna R, Puri S (2013). Textbook of Nutrition and Dietetics.2nd Edn. Phoenix Publishing House Pvt. Ltd.
- Mahan, L.K. and Escott-Stump, S. (2021): Krause‘s Food Nutrition and Nutrition Care Process, 16th Edition, Elsevier Pvt. Ltd. (ISBN: 032381025X)
- Seth, V. and Singh K. (eds.) (2024) Principles of Medical Nutrition Therapy for Positive Clinical Outcomes, 2nd Edition. Elite Publishing House Pvt. Ltd.
- Diet and Cardiovascular Disease: Advances and Challenges in Population-based Studies: https://pmc.ncbi.nlm.nih.gov/articles/PMC5844273/

UNIT IV

Students will learn about etiology, metabolic and clinical abnormalities, diagnosis, complications, treatment, MNT, new advancements and counseling in kidney disease.

- Gonyea, J. E., & Phillips, S. C. (Eds.). (2023). Clinical guide to nutrition care in kidney disease (3rd ed.). Academy of Nutrition and Dietetics. (ISBN-13: 978-0-88091-201-3)
- Indian Dietetics Association, (2018) Clinical Dietetics Manual, 2nd Edition. Elite Publishing House Pvt. Ltd. (ISBN: 9788193599648)
- Joshi Y K. (2008). Basics of Clinical Nutrition 2nd ed. Jaypee Brothers Medical Publishers. (ISBN: 978-9350251768)
- Khanna K, Gupta S, Seth R, Passi SJ, Seth R, Mahna R, Puri S (2013). Textbook of Nutrition and Dietetics.2nd Edn. Phoenix Publishing House Pvt. Ltd.
- Mahan, L.K. and Escott-Stump, S. (2021): Krause‘s Food Nutrition and Nutrition Care Process, 16th Edition, Elsevier Pvt. Ltd. (ISBN 032381025X)
- Seth, V. and Singh K. (eds.) (2024) Principles of Medical Nutrition Therapy for Positive Clinical Outcomes, 2nd Edition. Elite Publishing House Pvt. Ltd.

- KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease: https://kdigo.org/wp-content/uploads/2024/03/KDIGO-2024-CKD-Guideline.pdf

Suggested Readings

- Chowdhary S.R and Aeri B.T. (2023) Textbook of Food Science and Nutrition. Aarahan Publishers. ISBN:978-93-87270-08-4
- Gibney MJ, Elia M, Ljungqvist &Dowsett J. (2005) Clinical Nutrition. The Nutrition Society Textbook Series. Blackwell Publishing Company
- ICMR (2020) Estimated Average Requirements and Recommended Dietary Allowances for Indians. Published by National Institute of Nutrition, Hyderabad.
- Longvah T, Ananthan R, Bhaskarachary K and Venkaiah K (2017). Indian Food Composition Tables. National Institute of Nutrition, ICMR, Hyderabad.
- Puri S, Bhagat A, Aeri, BT, Sharma A (2019). Food Exchange List: A Tool for meal Planning. Elite Publishing House. New Delhi.
- Shils, M.E., Shike, M, Ross, A.C., Caballero B and Cousins RJ (2005) Modern Nutrition in Health and Disease. 10th ed. Lipincott, William and Wilkins.
- Siddhu A, Bhatia N, Singh K, Gupta S (2017). Compilation of food exchange list, technical series 6, Lady Irwin College, University of Delhi. Publ. Global Books Organisation, Delhi
- Williams, S.R. (2001) Basic Nutrition and Diet Therapy. 11th ed. Times Mirror Mosby College Publishing

Note: Examination scheme and mode shall be as prescribed by the Examination branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC ELECTIVE COURSE

INSTITUTIONAL FOOD SERVICE MANAGEMENT

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical		
Institutional Food Service Management	4	2	0	2		Nil

Learning Objectives

- To develop a knowledge base about the facilities required for different types of food service unit
- To equip individuals in understanding and managing resources in a food service institution
- To provide practical skills necessary to manage food service operations in institutional settings

Learning Outcomes

- Gain expertise to function as a food service manager.
- Understand and manage resources in a food service institution.
- Acquire practical experience in managing food service operations for food service UNITs ensuring quality, safety, efficiency and customer satisfaction

THEORY
(Credits 2; Hours 30)

UNIT I: Managing Catering Processes **5 Hours**

In this unit, the students will learn about the management approaches and tools used by managers in food service operations.

- Approaches to management: Classical, Systems approach, Management by Objective, Just-in Time, Total Quality Management
- Tools of Management:
  Tangible Tools: Organization chart, Job description, Job specification, Job analysis, Work schedule, Production schedule, Staff and service analysis statements

Intangible Tools: Communication, Leadership, Decision making

UNIT II: Food Production and Service **12 Hours**

In this unit, the students will learn the components of food production cycle and quality compliance in food service UNITs.

- Food production process
- Meal Ordering Systems (Manual, EMO's)
- Food service in hospitals
- Quality Assurance and accreditation in Food service and health care systems- FSSAI, HACCP, GMP, GHP, NABH, JCI

UNIT III: Management of Resources **10 Hours**

In this unit, students will understand the management of space, equipment, personnel and finances in food service institutions.

- Space and Equipment: Steps in layout planning and architectural features, Feasibility assessment in terms of layout planning
- Personnel: Components of an integrated staffing system, Dealing with employee behaviour, Techniques of motivating employees, Labour Laws
- Managing Finances: Records, Reports, Components of costs and factors affecting costs, Financial accounting, Pricing methods, concept of BEP

UNIT IV: Marketing and Sales Management **3 Hours**

In this unit, the students will understand the marketing principles and strategies relevant to institutional food service.

- Product Differentiation, SWOT Analysis
- Marketing techniques and strategies, Marketing mix
- Sales Management

PRACTICAL
(Credit 2; Hours 60)

1. Market survey of food service organizations **4 Hours**

Market survey of food service organizations to understand the food production and service areas, equipment, labour requirements, marketing and records

2. Planning menus for the following: 20 Hours

- Conference/ Buffet
- Two-day menu for a super specialty hospital
- Three-day menu for a college canteen

3. Quantity cooking: Food stall 28 Hours

- Menu planning
- Standardizing recipes and scaling up to 50/100 portions
- Development of sales promotion tool
- Conduct of project

4. Promoting good hygiene and sanitation practices in a food service UNIT 8 Hours

- Development of tool/aid to promote good hygiene practices
- Training of food service UNIT personnel in development of healthy menus and good hygiene practices
- Conduct of FSSAI checklist in the food service UNIT for good hygiene practices

Essential Readings

UNIT I

- Sethi, M. (2005) Institutional Food Management, New Age International Publishers.
- West, B. and Wood, L. (1988) Food Service in Institutions 6th Edition, John Wiley and Sons.

UNIT II

- Payne- Palacio, J. and Theis, M. (2015) Food service Management: Principles and Practices. 13th ed. Pearson Education.
- Prgomet, M., Li, J., Li, L., Georgiou, A., & Westbrook, J. I. (2019). The impact of electronic meal ordering systems on hospital and patient outcomes: A systematic review. International Journal of Medical Informatics, 129, 275–284.
- Sethi, M. (2005) Institutional Food Management, New Age International Publishers.
- West, B. and Wood, L. (1988) Food Service in Institutions 6th Edition, John Wiley and Sons

UNIT III

- Payne- Palacio, J. and Theis, M. (2015) Food service Management: Principles and Practices. 13th ed. Pearson Education.
- Sethi, M. (2005) Institutional Food Management, New Age International Publishers.
- West, B. and Wood, L. (1988) Food Service in Institutions 6th Edition, John Wiley and Sons
- Desai, V. (2011) The Dynamics of Entrepreneurial Development and Management, Himalya Publishing House Pvt. Ltd., Mumbai.

UNIT IV

- Payne- Palacio, J. and Theis, M. (2015) Food service Management: Principles and Practices. 13th ed. Pearson Education.
- Sethi, M. (2005) Institutional Food Management, New Age International Publishers.
- Desai, V. (2011) The Dynamics of Entrepreneurial Development and Management, Himalya Publishing House Pvt. Ltd., Mumbai.

Suggested Readings

- Knight, J. B. and Kotschevar, L.H. (2000) Quantity Food Production Planning & Management 3rd edition, John Wiley & Sons.
- Kotas, R. and Jayawardardene, C. (1994) Profitable Food and Beverage Management, Hodder & Stoughton Publications.
- Roday, S. (2003) Food Hygiene and Sanitation, Tata McGraw Hill Publication Ltd.
- Taneja, S. and Gupta, S.L. (2001) Entrepreneurship Development. Galgotia Publishing.
- Dessler, G. (2007) Human Resource Management 11th edition Prentice Hall New Jersey.
- Basic Food Safety Training Manual Catering (http://www.fssai.gov.in/home/capacity building/e-library/training-manual.html).
- Street Food Vendor Training on Food Safety and Hygiene (http://www.fssai.gov.in/home/capacity building/e-library/training-manual.html).

Note: Examination scheme and mode shall be as prescribed by the Examination branch, University of Delhi, from time to time

DISCIPLINE SPECIFIC ELECTIVE COURSE
SOCIAL AND CULTURAL ASPECTS IN PUBLIC HEALTH NUTRITION

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical		
Social and Cultural Aspects in Public Health Nutrition	**4**	**3**	**0**	**1**		**Nil**

Learning Objectives

- To explore how socio-cultural factors influence food and nutrition, both historically and in contemporary contexts.
- To examine the social and cultural determinants of food choices and diet-related behaviours.
- To understand the value of cultural knowledge in guiding nutrition practices.

Learning Outcomes

The students would be able to:

- Explain the social and cultural importance of food and its connection to biological aspects of nutrition.
- Analyze historical and current dietary practices and food consumption patterns across cultures.
- Evaluate the impact of social and cultural factors on food choices and dietary behaviours.
- To comprehend the significance of culturally appropriate nutrition interventions.

THEORY
(Credits 3; Hours 45)

UNIT I: Food, Nutrition, and Culture aspects in public health **10 Hours**

This unit deals with the social and cultural significance of food, its integration with biological

aspects of nutrition, It also explores cross-cultural differences and acculturation in food behaviours.

- Ethnological perspectives: social and cultural roles of food
- Integration of biological and socio-cultural aspects of food and nutrition
- Overview of Indian food anthropology

UNIT II: Historical and current Perspectives of culture and food consumption 10 Hours

This unit explores the and historical versus current dietary practices and cultural differences in eating patterns

- Dietary practices and consumption patterns: historical and current perspectives, including health concerns
- Cross-cultural differences in eating behaviour
- Cultural integrity and acculturation in food choices

UNIT III: Food Choices and Diet-Related Behaviour: Social and Cultural Influences 18 Hours

This unit focuses on the influence of the food environment, socio-cultural practices, demographics, and other factors on dietary behaviours. It also includes culture-specific taboos and their role in promoting sustainable, healthy diets.

- Relationship between food environment and dietary practices
- Influence of social structures, demographic factors, cultural values, religious beliefs, and policy on food behaviour
- Culture-specific foods and taboos affecting children, adolescents, pregnant, and lactating women
- Socio-cultural influences on sustainable, healthy diets

UNIT IV: Cultural Knowledge in Nutrition 7 Hours

This unit highlights the role of cultural understanding in shaping food behaviour and delivering culture-specific dietary guidance.

- Influencing changes in food choices and dietary patterns
- Cultural interpretations of malnutrition
- Significance of cultural competence in the practice of public health nutrition - Providing culturally sensitive dietary advice and guidance

PRACTICAL
(Credits 1; Hours 30)

1. Studying staple foods and ethnic cuisines from different regions of India and the world
2. Exploring traditional foods for special occasions across cultures
3. Observing and reporting dietary patterns among individuals of different religions

4. Comparing food habits of migrants with their traditional diets
5. Investigating food waste behaviours across cultures
6. Examining regional diets during pregnancy and infant/child feeding practices
7. Assessing the impact of globalization on food environments and dietary practices

Essential Readings

UNIT I

- Antani, V., Mahapatra, S. (2022). Evolution of Indian cuisine: a socio-historical review. *J. Ethn. Food,* 9, 15. https://doi.org/10.1186/s42779-022-00129-4
- Dufour, D.L., Goodman, A.H. and Pelto, Gretel H. (2012). Nutritional Anthropology: Biocultural Perspectives on Food and Nutrition. 2nd Edition. Oxford University Press.
- Nambiar, V. (2021). Indian Food Anthropology and the Eat Right Movement. Volume I & II. Selective & Scientific Books, New Delhi.

UNIT II

- Dufour, D.L., Goodman, A.H. and Pelto, Gretel H. (2012). Nutritional Anthropology: Biocultural Perspectives on Food and Nutrition. 2nd Edition. Oxford University Press.
- Sanjur, D. (1982). Social and Cultural Perspectives in Nutrition. Prentice Hall.

UNIT III

- Buttriss, J.L., Welch, A. A., Kearney, J.M., Lanham-New, S.A. (Eds.). (2017). Public Health Nutrition (2nd Ed.). Wiley Blackwell.
- Dufour, D.L., Goodman, A.H. and Pelto, Gretel H. (2012). Nutritional Anthropology: Biocultural Perspectives on Food and Nutrition. 2nd Edition. Oxford University Press.
- Edelstein, S. (2023). Community and public health nutrition (5th ed.). Jones & Bartlett Learning.
- McWilliams, M. (2010). Food Around the World: A Cultural Perspective. Second Edition. Pearson Education.

UNIT IV

- Boyle, M. A. (2022). Community Nutrition in Action (8th ed.). Cengage Learning.
- Edelstein, S. (2023). Community and public health nutrition (5th ed.). Jones & Bartlett Learning.
- Sanjur, D. (1982). Social and Cultural Perspectives in Nutrition. Prentice Hall.

Suggested Readings

- Achaya, K.T. (1998). Indian Food. Oxford.
- Farb, P. and G. Armelagos. (1980). Consuming Passions: The Anthropology of Eating. Houghton Mifflin Harcourt.
- Germov, J. & Williams, L. (Eds.). (2009). A Sociology of Food and Nutrition: The Social

Appetite. 3rd Edition. Oxford University Press.
- Gibney, M.J., Margetts, B.M., Kearney, J.K., & Arab, L. (Eds.) (2004). Public Health Nutrition. Wiley-Blackwell.
- Harris, M. (1987). Foodways: historical overview and theoretical prolegomenon. In: Harris, M. and E. B. Ross (eds.) Food and Evolution: Toward a Theory of Human Food Habits. Philadelphia: Temple University Press.
- Higman, B.W. (2011). How Food Made History. 1st Edition. Wiley-Blackwell.
- Le, S. (2018). 100 Million Years of Food: What Our Ancestors Ate and Why It Matters Today. Reprint Edition. Picador.
- McIntosh, Wm. A. (1996). Sociologies of Food and Nutrition. Springer New York.
- Seal, PP. (2023). Food Anthropology in India. Routledge India.
- Sidney, C.H.C. & Tan, C. (2007). Food and Foodways in Asia: Resource, Tradition and Cooking. 1st Edition. Routledge.

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DISCIPLINE SPECIFIC ELECTIVE COURSE

IMPROVING MATERNAL, INFANT, YOUNG CHILD AND ADOLESCENT NUTRITION

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical		
Improving Maternal, Infant, Young Child and Adolescent Nutrition	**4**	**2**	**0**	**2**		**Nil**

Learning Objectives

- To understand the nutritional concerns during pregnancy, lactation, infant, young children and adolescence.
- To gain insight into key nutrition challenges and major maternal, child, and adolescent nutrition policies and programs
- To learn the principles of optimal infant and young child feeding practices.
- To develop skills for effective counselling to promote optimal nutrition for mothers, young children, and adolescents.

Learning Outcomes

The students would be able to:

- Explain the nutritional concerns of mothers during pregnancy and lactation, as well as those of infants, young children, and adolescents.
- Describe the principles of optimal infant and young child feeding practices.
- Demonstrate effective counselling skills to support and promote appropriate nutrition practices among mothers, young children, and adolescents.
- Analyse major nutrition concerns affecting maternal, child, and adolescent health.
- Interpret and evaluate key national flagship policies and programs related to maternal, child, and adolescent nutrition.

THEORY
(Credits 2; Hours 30)

UNIT I: Overview and importance of MIYCAN- linkages of MIYCAN with SDGs 4 Hours

This unit lays thrust on importance of the MIYCAN period and its links to national goals and the SDGs.

- Overview and Importance of MIYCAN period
- Linkages between MIYCAN period and National goals and Sustainable Development Goals (SDGs)

UNIT II: Improving Nutrition During Pregnancy and Lactation 10 Hours

This unit deals with maternal nutrition, key concerns, cultural influences, health risks, and management of nutrition-related pregnancy conditions, as well as the impact of diet on fetal growth. It was deals with lactation support, guidelines and programs, community interventions, and essential counselling practices related to maternal nutrition.

- Nutritional needs during pregnancy and lactation- changes in macronutrient and micronutrient needs
- Nutritional concerns in prenatal and postnatal maternal nutrition, Cultural practices influencing maternal nutrition
- Major causes of maternal mortality and morbidity
- Management of common pregnancy-related disorders such as underweight, overweight, nutritional anaemias, pregnancy-induced hypertension, and gestational diabetes
- Relationship between maternal diet and birth outcomes; Impact of nutrient deficiencies on fetal growth and development, Low birth weight, preterm birth, and intrauterine growth restriction (IUGR); Role of maternal nutrition in brain development
- Lactation counselling and support, human milk banking, and strategies to promote effective breastfeeding.
- Guidelines for maternal nutrition- DGI, Nutrition Supplements, etc.; Maternal nutrition services under government programs; Community-based interventions for improving maternal nutrition
- Key nutrition counselling points for maternal nutrition

UNIT III: Infant and Young Child Nutrition 10 Hours

This unit highlights the nutritional needs of infants and young children, patterns of mortality and common illnesses, preventive health measures, optimal feeding practices, and care of small and sick infants including growth monitoring and SAM management. It also covers key policies and programmes supporting child nutrition and essential counselling practices for caregivers.

- Nutritional needs during infancy and young child years- changes in macronutrient and micronutrient needs, significance of 1000 days
- Neonatal, infant, and child mortality patterns; Common childhood illnesses and nutrition-related morbidities; Preventive and promotive health measures (immunization, hygiene, deworming, early stimulation)
- Nurturing Care Framework, Guidelines for optimal infant and young child feeding; Exclusive breastfeeding - benefits, techniques, challenges; Appropriate complementary feeding practices (timing, consistency, frequency, diversity); Responsive feeding and hygiene practices,
- Care of small and sick infants – Kangroo Mother Care, management of diarrhoea and upper respiratory tract infections (ARI). Growth monitoring and identification of malnourished

children including SAM Children. Management of SAM children
- Policies and programmes addressing infant and young child nutrition (e.g., ICDS, HBNC, HBYC, MAA, IMNCI, IDCT etc.)
- Key nutrition counselling points for infant and young child nutrition

UNIT IV: Adolescent Nutrition **6 Hours**

This unit deals with adolescent nutrient needs, major nutrition concerns, their impact on future health, relevant policies and programmes, and key counselling points for healthy development.

- Nutritional needs during adolescent years- changes in macronutrient and micronutrient needs
- Impact of adolescent nutrition on future maternal and adult health; Key concerns like anemia, undernutrition, overweight/obesity, eating behaviours
- Policies and programmes addressing adolescent nutrition (e.g., ICDS, Supplementary nutrition programmes, School meal programmes, RBSK, RKSK)
- Key nutrition counselling points for adolescent nutrition

PRACTICAL
(Credits 2 ; Hours 60)

1. Gathering and analysing nutrition related indicators for pregnant and lactating women/ infants/ young children/ adolescents
2. Preparation of educational aid on adequate care and nutrition during pregnancy/ nursing mothers/ optimal infant and young child feeding practices/ adolescent girls on importance of adequate nutrition
3. Preparation of educational aid on prevention and management of diarrhoea/ importance and schedule of immunization/ importance of hygiene and sanitation.
4. Planning counselling sessions for nursing mothers for different techniques of breast feeding/ breastfeeding related problems/ expression of breastmilk/ kangaroo mother care etc.
5. Conduct activity to demonstrate age specific complementary food preparation for infants and young children (7 months/ 10 months/1.5 years).
6. Preparation and presentation of information card about various schemes related to maternal, child and adolescent nutrition.
7. Field visit to any ongoing national level programs related to maternal, child, and adolescent nutrition
8. Preparation of case study from field observations related to any one nutrition problem among maternal and child nutrition and health in India.
9. Preparation and presentation of information card about various the national/international organizations working in the field of maternal and child health and nutrition.

Essential Readings
UNIT I

- Park, K. (2025). Park's textbook of preventive and social medicine (28th ed.). Banarsidas

Bhanot Publishers
- Vir, Sheila C (2021). Public Health Nutrition in developing Countries Part 1and 2. Woodhead Publishing India Limited

UNIT II

- Dietary Guidelines for Indians, (2024). National Institute of Nutrition, Indian Council for Medical Research, Government of India. https://www.nin.res.in/dietaryguidelines/pdfjs/locale/DGI07052024P.pdf
- Vir, Sheila C (2024). Child, Adolescent and Women Nutrition in India: Public Policies, Programmes and Progress. New Delhi: Routledge.
- Vir, Sheila C (2021). Public Health Nutrition in developing Countries Part1 and 2. Woodhead Publishing India Limited
- Bamji MS, Krishnaswamy K and Brahmam GNV (Eds) (2016). Textbook of Human Nutrition, 4th edition. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
- World Health Organization (2016). WHO recommendations on antenatal care for a positive pregnancy experience, Geneva, Switzerland.
- Wadhwa A and Sharma S (2003). Nutrition in the Community-A Textbook. Elite PublishingHouse Pvt. Ltd. New Delhi.

UNIT III

- Dietary Guidelines for Indians, (2024). National Institute of Nutrition, Indian Council for Medical Research, Government of India. https://www.nin.res.in/dietaryguidelines/pdfjs/locale/DGI07052024P.pdf
- Vir, Sheila C (2024). Child, Adolescent and Women Nutrition in India: Public Policies, Programmes and Progress. New Delhi: Routledge.
- Vir, Sheila C (2021). Public Health Nutrition in developing Countries Part 1and 2. Woodhead Publishing India Limited
- Guidelines for Enhancing Infant and Young Child Feeding Practices (2013). Ministry of Health and Family Welfare, Government of India.
- Bamji MS, Krishnaswamy K and Brahmam GNV (Eds) (2016). Textbook of Human Nutrition, 4th edition. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
- Wadhwa A and Sharma S (2003). Nutrition in the Community-A Textbook. Elite PublishingHouse Pvt. Ltd. New Delhi.

UNIT IV

- Dietary Guidelines for Indians, (2024). National Institute of Nutrition, Indian Council for Medical Research, Government of India. https://www.nin.res.in/dietaryguidelines/pdfjs/locale/DGI07052024P.pdf
- Vir, Sheila C (2024). Child, Adolescent and Women Nutrition in India: Public Policies, Programmes and Progress. New Delhi: Routledge.
- Vir, Sheila C (2021). Public Health Nutrition in developing Countries Part 1and 2. Woodhead Publishing India Limited
- Bamji MS, Krishnaswamy K and Brahmam GNV (Eds) (2016). Textbook of Human Nutrition, 4th edition. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
- Wadhwa A and Sharma S (2003). Nutrition in the Community-A Textbook. Elite PublishingHouse Pvt. Ltd. New Delhi.

Suggested Readings

- Relevant IEC material from Government of India (including Ministry of Health and Family Welfare, Ministry of Women and Child Development, and other ministries working in nutrition) and Non-Governmental Organizations working in the area of health and nutrition.
- Ministry of Health and Family Welfare (2016). Infant and Young Child Feeding, Training Module for ANMs, Mothers Absolute Affection, National Health Mission, New Delhi.
- Shane A Norris, Edward A Frongillo, Maureen M Black, Yanhui Dong, Caroline Fall, Michelle Lamplet al (2022). Nutrition in adolescent growth and development. The Lancet Vol. 399No. 10320P172-184.
- Dougal Hargreaves, Emily Mates, Purnima Menon, Harold Alderman, Delan Devakumar, Wafai Fawziet al (2022). Strategies and interventions for healthy adolescent growth, nutrition, and development. The Lancet, Vol. 399No. 10320P198-210.
- Victora, Cesar G et al (2021). Revisiting maternal and child undernutrition in low-income and middle-income countries: variable progress towards an unfinished agenda. The Lancet, Volume 397, Issue 10282, 1388 – 1399.
- Heidkamp, Rebecca A et al (2021). Mobilising evidence, data, and resources to achieve global maternal and child undernutrition targets and the Sustainable Development Goals: an agenda for action. The Lancet, Volume 397, Issue 10282, 1400 – 1418.
- Zohra S. Lassi, Rehana A. Salam (2025). Nutrition Across Reproductive, Maternal, Neonatal, Child, and Adolescent Health Care: Focus on Low- and Middle-Income Countries, Springer Nature.

Note: Examination scheme and mode shall be as prescribed by the Examination branch, University of Delhi, from time to time

DISCIPLINE SPECIFIC ELECTIVE COURSE
ANIMAL PRODUCTS PROCESSING AND PRESERVATION

CREDIT DISTRIBUTION, ELIGIBILITY, AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Prerequisites of the Course (if any)
		Lecture	Tutorial	Practical		
Animal Products Processing and Preservation	**4**	**3**	**0**	**1**		**Nil**

Learning Objectives

- To gain in-depth knowledge of processing aspects involved in milk and milk products, meat, fish, poultry, and eggs.
- The course aims to provide knowledge of the principles and preservation of milk and milk products, meat, fish, poultry, eggs, fruits, and vegetables.

Learning Outcomes

The students would be able to:

- Understand the composition and quality standards of milk, plant produce, and animal-based foods.
- Learn essential processing and preservation methods for dairy, fruits–vegetables, and animal products.
- Develop skills in quality testing of milk, eggs, meat, poultry, fish, and processed items.
- Gain knowledge of manufacturing steps and quality aspects of major dairy and animal products.
- Apply hygiene, sanitation, and basic HACCP principles in food processing operations.

THEORY
(Credits 3; Hours 45)

UNIT I: Milk and Milk Products processing
(18 Hours)

This unit deals with the introduction, composition, nutritive value, properties, processing, manufacturing and quality aspects of milk and milk products

- **Introduction to market milk:** Indian standards, Composition, factors affecting composition of milk, physicochemical properties of milk and its constituents, Clean milk practices, buying and collection, platform tests.
- **Milk processing:** Pre-heating, filtration, clarification, standardization, bactofugation, homogenization, pasteurization, cooling, packaging and storage.
- **Milk products (Cream, butter, ice cream, curd, cheese, khoa and ghee)-**Introduction, definition, classification, methods of manufacture, quality aspects.

UNIT II: Technology of Meat and Poultry
(12 Hours)

This unit deals with the composition, nutritive value, classification, pre-slaughter handling, post-mortem changes and preservation of meat and poultry.

- Chemical composition and nutritive value, Types and classification of meat and poultry
- Pre-slaughter handling; ante-mortem and post-mortem inspection; methods of stunning, slaughter, and dressing.
- Post-mortem muscle changes—rigor mortis, factors affecting rigor, thaw rigor, and cold shortening, ageing, curing, smoking, tenderizing, and colour changes in meat.
- Hygiene and sanitation practices in slaughterhouses
- Major preservation methods: chilling, freezing, curing, smoking, dehydration, canning, and irradiation, antibiotic residue concerns, concept of value addition and by-product utilization

UNIT III: Fish processing and products (6 Hours)

This unit deals with the composition, nutritive value, post-harvest changes, spoilage, processing, preservation and utilisation of fish and its products.

- Composition, nutritive value and on-board handling of fish, Post-harvest physiology and spoilage of fish.
- Preservation techniques: Chilling, freezing (IQF, block freezing), curing, drying, smoking, canning, irradiation, Modified Atmosphere Packaging and quality factors.
- Fish processing and value-added products: Surimi, fish mince, fish protein concentrates. Utilization of fish processing by-products.

UNIT IV: Egg processing and products (9 Hours)

This unit deals with the composition, nutritive value, functional properties, quality aspects, processing of fish and its products.

- Nutritive value and functional properties of eggs
- Egg grading and quality standards, quality factors, and storage
- Bacterial infection, pasteurization, freezing, drying, and egg substitutes.

- Processing of egg products: Egg powders, frozen eggs, liquid eggs. Technology of egg foams and factors influencing foaming characteristics.

PRACTICAL
(Credits 1; Hours 30)

List of Experiments

- Determination of Acidity in milk and milk products.
- Platform tests for milk quality: (COB, MBRT, Specific gravity, SNF)
- Estimation of milk fat by the Gerber method.
- Assessment of common adulterants in milk and milk products.
- Preparation and Quality Evaluation of Chicken Sausage.
- Planning of generic HACCP model for poultry.
- Quality evaluation of fish (Fresh vs Stale).
- Detection of meat in Vegan foods
- Cut out analysis of canned fish (Sardine/Mackerel/Tuna) and analysis of external and internal parameters.
- Evaluation of eggs for quality parameters (market eggs, branded eggs)

Essential Readings

UNIT I

- De, S. (2007).Outlines of Dairy Technology.Oxford: Oxford University Press.
- Webb B.H.and Alford (2005). Fundamentals of dairy chemistry. CBS Publisher.
- Potter, N. N., & Hotchkiss, J. H. (2012). Food science. Springer Science & Business Media.
- Srilakshmi, B.(2002). Food science. New Age Publishers
- https://www.scribd.com/document/659871719/Manual-Dairy-03-10-2022

UNIT II

- Hui, Y.H. 2001. Meat Science and Applications. Marcel Dekker.
- Pearson, A.M. & Gillett, T.A. 1996. Processed Meats. 3rd Ed. Chapman & Hall.
- Lawrie, R.A. 2006. Lawrie's Meat Science. 7th Ed. Woodhead Publishing.
- Potter, N. N., & Hotchkiss, J. H. (2012). Food science. Springer Science & Business Media.
- Srilakshmi, B.(2002). Food science. New Age Publishers
- Van Loesecke HW (1998) *Food Technology Series Drying and Dehydration of foods*. Allie Scientific Publishers

UNIT III

- Govindan, T.K. 1985. Fish Processing Technology. Oxford & IBH.
- Sen, D.P. (2005). Advances in Fish Processing Technology. Allied Publishers Pvt.Limited.
- Hall, G.M. (1997). Fish Processing Technology. 2nd edition NY: VCH
- ElShehawy, S. M., & Farag, Z. S. (2019). Safety assessment of some imported canned fish using chemical, microbiological and sensory methods. *Egyptian Journal of Aquatic Research, 45*(4), 389–394.

- Pais-Costa, A. J., Marques, J. C., & Prego, R. (2025). New perspectives on canned fish quality and safety. *Foods*, 14(1), 99
- Potter, N. N., & Hotchkiss, J. H. (2012). Food science. Springer Science & Business Media.
- Srilakshmi, B.(2002). Food science. New Age Publishers

UNIT IV

- Stadelman, W.J. and Cotterill, O.J. 2001. Egg Science and Technology. Haworth Press.
- Potter, N. N., & Hotchkiss, J. H. (2012). Food science. Springer Science & Business Media.
- Srilakshmi, B.(2002). Food science. New Age Publishers

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DISCIPLINE SPECIFIC ELECTIVE COURSE
UNIT OPERATIONS IN FOOD PROCESSING

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical		
Unit Operations in Food Processing	**4**	**2**	**0**	**2**		**Nil**

Learning Objectives

- To impart knowledge about various UNIT operations used in food processing
- To understand the efficiency and suitability of equipment for specific UNIT operations
- To understand the concept of hygienic design, sustainability, and Industry 4.0 elements in process planning

Learning Outcomes

The students would be able to:

- analyse and differentiate various UNIT operations used in food processing
- evaluate the efficiency and suitability of equipment for specific UNIT operations
- apply hygienic design, sustainability, and Industry 4.0 elements in process planning

THEORY
(Credits 2; Hours 30)

UNIT I: Introduction to UNIT Operations **2 Hours**

This unit deals with the introduction and classification of UNIT operations in food processing.

- Definition of UNIT operations,
- Classification of UNIT operations:
  - Preliminary operations (cleaning of raw material, sorting, grading)
  - Conversion operations (size reduction, mixing, filtration, centrifugation, etc.)
  - Preservation operations (heat processing, evaporation, freezing, irradiation, etc.)
  - Ancillary operations (plant hygiene, water supplies, material handling, etc.)

UNIT II: Preliminary Operations **4 Hours**

This unit deals with the cleaning, sorting, grading and peeling of food in industry.

- Cleaning: theory, methods of cleaning – wet and dry and applications
- Sorting and grading: theory, methods (shape and size, weight, color and machine vision sorting and grading systems) and applications, recent developments.
- Peeling: theory, methods and applications

UNIT III: Conversion Operations 12 Hours

This unit deals with the operations like size reduction, mixing , centrifugation, expression, extraction, filtration and membrane separation.

- Size reduction: Theory, Principles of size reduction- energy laws; Equipment of size reduction in solid and liquid food- mechanism and working principle, Effect on foods and microorganism, Developments in size reduction technologies.
- Mixing: Theory, Equipment of mixing in – dry powders, low or medium viscosity liquids, high viscosity liquids and pastes, dispersion of powders in liquids, Effect on foods and microorganism, Developments in mixing technologies.
- Centrifugation: Theory, Equipment for- separation of immiscible liquids, clarification of liquids by removal of small amounts of solids, removal of solids.
- Expression and Extraction: Theory and Equipment
- Filtration and Membrane Separation: Theory, types, membrane fouling, Equipment, applications in food processing.

UNIT IV: Automation, Sustainability and Hygienic Design in UNIT Operations 12 Hours

This unit deals with recent advancements in food processing UNIT operations with emphasis on automation, sustainability and hygienic design

- Food plant design
- Automation in processing lines and equipment control; introduction to PLC, sensors and machine vision in selected UNIT operations (sorting, grading, mixing, membrane processing).
- Industry 4.0 applications: data-driven process monitoring, predictive maintenance and traceability.
- Sustainability considerations in equipment and process selection: energy efficiency, water use reduction and waste minimization strategies.
- Hygienic design principles: sanitary materials of construction, equipment cleanability and advances in CIP/SIP systems.

PRACTICAL
(Credits 2; Hours 60)

- Sorting and grading of food material (grains, spices, fruits and vegetables)

- Screen analysis of food sample
- Freezing time calculation
- Mixing index calculation using solid-solid and liquid-liquid systems
- Estimation of filtration rate
- Study of ultra-filtration process.
- Food plant design
- Study on material handling in food processing industry
- Industrial Visit

Essential Readings

UNIT I

- Fellows, P. J. (2017). Food Processing Technology: Principles and Practice (4th ed.). Woodhead Publishing.
- Barbosa-Cánovas, G. V., Balasubramaniam, V. M., Chorng-Li, T., Pothakamury, U. R., & Swanson, B. G. (2001). Non thermal Processing of Foods. IFT Press/Marcel Dekker.
- Singh, R. P., & Heldman, D. R. (2014). Introduction to Food Engineering (5th ed.). Academic Press.
- Ibarz, A., & Barbosa-Cánovas, G. V. (2014). UNIT Operations in Food Engineering. CRC Press.

UNIT II

- Barbosa-Cánovas, G. V., Balasubramaniam, V. M., Chorng-Li, T., Pothakamury, U. R., & Swanson, B. G. (2001). Non thermal Processing of Foods. IFT Press/Marcel Dekker.
- Fellows, P. J. (2017). Food Processing Technology: Principles and Practice (4th ed.). Woodhead Publishing.
- Ibarz, A., & Barbosa-Cánovas, G. V. (2014). UNIT Operations in Food Engineering. CRC Press.

UNIT III

- Heldman, D. R., & Lund, D. B. (2007). Handbook of Food Engineering (2nd ed.). CRC Press.
- Fellows, P. J. (2017). Food Processing Technology: Principles and Practice (4th ed.). Woodhead Publishing.

UNIT IV

- Sun, D. W. (Ed.). (2016). Emerging Technologies for Food Processing (2nd ed.). Academic Press.
- Singh, R. P., & Heldman, D. R. (2014). Introduction to Food Engineering (5th ed.). Academic Press.

Suggested Readings

- R. Paul Singh and Dennis R. Heldman. 2014. Introduction to Food Engineering, 5th Ed. Elsevier, Amsterdam, The Netherlands.
- Christie John Geankoplis. 2003. Transport Processes and Separation Process Principles (Includes UNIT Operations), 4th Ed. Prentice-Hall, NY, USA.
- Warren L. McCabe, Julian Smith, Peter Harriott. 2004. UNIT Operations of Chemical Engineering, 7th Ed. McGraw-Hill, Inc., NY, USA.
- Toledo R T, 2018. Fundamentals Of Food Process Engineering, Springer, Fourth Edition ISBN: 9783319900971
- Fritz, M., & E. Hertel (2020). "Sustainability and Digitalization in the Food Industry." Journal of Food Engineering Trends.

Note: Examination scheme and mode shall be as prescribed by the Examination branch, University of Delhi, from time to time

DISCIPLINE SPECIFIC ELECTIVE COURSE

EXERCISE, NUTRITION AND METABOLISM

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical		
Exercise, Nutrition and Metabolism	4	3	0	1		Nil

Learning Objectives

- To familiarize students with the concepts of metabolism, energy expenditure and periodisation for fitness and sports
- To enable students to imbibe knowledge and methods for planning daily diets; nutrient intake strategies and hydration for fitness and various types of sports

Learning Outcomes

- The students would be able to understand the role of different nutrients in sports performance and health of a competitive or recreational athlete.
- Students will be able to plan daily diets; nutrient intake strategies and hydration regimens for various types of sports

THEORY
(Credits 3; Hours 45)

UNIT I: Energy and Macronutrient intake for physical fitness and periodised sports training **15 Hours**

This unit focusses on Energy metabolism and macronutrients for physical fitness and sports performance

- **Exercise Energy expenditure:** Concept of metabolism; periodisation in sports; energy systems and energy availability for assessment of energy requirement of athletes and consequences of energy imbalance on performance; commonly reported energy intake patterns of athletes.
- **Carbohydrate Intake and performance:** Carbohydrate and its utilisation in the body; intensity of training impacting carbohydrate utilisation; recommendations of type, timing and quantity of carbohydrate intake in resistance training and endurance training
- **Fat Intake and performance:** Intensity of training impacting fat utilization; recommendations of type, timing and quantity of fat intake in resistance training and endurance training.
- **Protein Intake and performance:** Type and quality of protein and its utilisation in the body; protein turnover and recommendations for protein during endurance versus resistance training; specific role of amino acids for performance; dietary protein strategies for performance enhancement

UNIT II: Micronutrients in exercise performance **15 Hours**

This unit focusses on Energy metabolism and macronutrients for physical fitness and sports performance

- **Vitamins:** Intake of vitamins in exercise performance: through mental ability, immunity and recuperation to an injury; performance benefits of key vitamins; requirements for athletes.
- **Minerals:** Mineral intake and exercise performance: mental ability, immunity and recuperation to an injury; performance benefits of key minerals; requirements for athletes.
- **Antioxidants:** Definition of oxidative stress in exercise and sports; antioxidants; enzymatic and non-enzymatic antioxidants; mode of action; antioxidant effects in reducing exercise related oxidative stress; effect on muscle contraction and exercise performance; antioxidant deficiencies and exercise performance; antioxidant requirements for exercise.

UNIT III: Hydration strategies for athletes **5 Hours**

This unit focuses on dehydration and strategies for hydration for athletes

- **Dehydration:** Causes; symptoms and its effects on cardiovascular system and muscle metabolism; tolerable levels of dehydration; synergistic effect of dehydration and hyperthermia; effects of dehydration on endurance performance; methods for determining degree of dehydration among athletes; strategies for lowering hyperthermia.
- **Hydration strategies:** Beverage composition and formulation (isotonic, hypotonic and hypertonic); only fluid versus fuelling with other macronutrients and electrolytes for

exercise benefits; beverage volume for maintaining euhydration with performance benefits; beverage timing (pre-exercise hydration, during exercise hydration protocol, post-exercise rehydration); factors that influence intake; gastric emptying and absorption of fluids; beverage palatability and fluid intake; intravenous rehydration; food versus fluid consumption during exercise.

UNIT IV: Nutrient periodisation and meal timing for sports **10 Hours**

This unit will strengthen concepts and application of nutrient periodisation, meal timing related to the type of training and exercise of all types, with special focus on endurance events

- **Nutrient periodisation and Meal timing:** Concept and importance of periodisation and meal timing related to the type of training and exercise intensity.
- Effect of energy intake and co-ingestion of carbohydrate and protein before, during and after training.
- Importance of timing of carbohydrate intake; type of carbohydrates and proteins beneficial for maximum refuelling post exercise sessions.
- Gender differences in carbohydrate, protein and fat refuelling strategies.
- Effect of high or low carbohydrate, protein and fat on training adaptation and performance; periodisation of macronutrients based on the phase/season of training and strategies to be followed.

PRACTICAL

(Credits 1; Hours 30)

1. To calculate exercise energy expenditure using the factorial method with activity records and energy cost of sports from the compendium for athletes.
2. Menu planning for food and fluid intake (incorporating traditional Indian food ingredients) for training of:
    - Endurance games
    - Power games in different weight categories
    - Team sports
    - Skilled sports
3. Menu planning for athletes for the following:
    - Pre-competition meal
    - Consumption during-competition
    - Post-competition recovery meal
4. Formulation of sports drinks using traditional Indian food ingredients:

- Isotonic beverages
- Hypotonic / hypertonic beverages

Essential Readings

UNIT I:

- Burke, L., Minehan, M., and Deakin, V. (Eds.). (2021). Clinical Sports Nutrition (Vol.6) McGraw-Hill Education , Australia. ISBN-13:978-1760425647
- Campbell, B. (Ed.). (2013). Sports nutrition: enhancing athletic performance. CRC Press.
- Fink, H. H., & Mikesky, A. E. (2017). Practical applications in sports nutrition. Jones &

  Bartlett Learning.
- The Academy of Nutrition and Dietetics. (2021). *Sports Nutrition for Indians* [PDF]. Available at https://higherlogicdownload.s3.amazonaws.com/THEACADEMY/de8f706f-a2d1-4ee8-8d52-404d56f75b77/UploadedImages/IND/Document/Resources/Sports_Nutrition_for_Indians_2021.pdfILSI- India, NIN, SAI. *Nutrition and hydration Guidelines for excellence in sports performance*; 2007: 48-49.
- Lal P.R. Handbook of Sports Nutrition, Friends' Publications, New Delhi, ISBN-13: 978-8172162818.
- Eberle, S. G. (2013). Endurance Sports Nutrition, 3E. Human Kinetics.

UNIT II:

- Wolinsky, I., & Driskell, J. A. (Eds.). (2005). Sports nutrition: vitamins and trace elements.

  CRC Press.
- Maughan, R.J., & Shirreffs, S.M. (Eds.). (2013). Food, Nutrition and Sports Performance III (1st ed.). Routledge. https://doi.org/10.4324
- Fink, H. H., & Mikesky, A. E. (2017). Practical applications in sports nutrition. Jones &

  Bartlett Learning.
- Amawi, A., AlKasasbeh, W., Jaradat, M., Almasri, A., Alobaidi, S., Hammad, A. A., Bishtawi, T., Fataftah, B., Turk, N., Saoud, H. A., Jarrar, A., & Ghazzawi, H. (2024). Athletes' nutritional demands: a narrative review of nutritional requirements. *Frontiers in nutrition*, *10*, 1331854. https://doi.org/10.3389/fnut.2023.1331854

UNIT III:

- ILSI- India, NIN, SAI. *Nutrition and hydration Guidelines for excellence in sports performance*; 2007: 48-49.
- Lal P.R. Handbook of Sports Nutrition, Friends' Publications, New Delhi, ISBN-13: 978-8172162818.
- The Academy of Nutrition and Dietetics. (2021). Sports Nutrition for Indians [PDF]. Available at https://higherlogicdownload.s3.amazonaws.com/THEACADEMY/de8f706f-a2d1-4ee8-8d52-404d56f75b77/UploadedImages/IND/Document/Resources/Sports_Nutrition_for_Indians_2021.pdf

UNIT IV:

- ILSI- India, NIN, SAI. *Nutrition and hydration Guidelines for excellence in sports performance*; 2007: 48-49.
- Campbell, B. (Ed.). (2013). Sports nutrition: enhancing athletic performance. CRC Press.
- Lal P.R. Handbook of Sports Nutrition, Friends' Publications, New Delhi, ISBN-13: 978-8172162818.
- Eberle, S. G. (2013). Endurance Sports Nutrition, 3E. Human Kinetics.

Suggested Readings

- Marie Dunford. (2017) Nutrition for Sport and Exercise.
- Jeukendrup, A. (2010). Sports Nutrition-From lab to Kitchen. Meyer & Meyer Sport.
- Spano, M., Kruskall, L., & Thomas, D. T. (2017). Nutrition for Sport, Exercise, and Health.
  Human Kinetics.
- Lamprecht, M. (Ed.). (2014). Antioxidants in sport nutrition. CRC Press.
- Valenzuela, P. L. (2023). Recent Advances in Nutrition for Disease Prevention and Sports Performance Enhancement. *Nutrients*, *15*(5), 1170.
- Kloby Nielsen, L. L., Tandrup Lambert, M. N., & Jeppesen, P. B. (2020). The Effect of Ingesting Carbohydrate and Proteins on Athletic Performance: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Nutrients*, *12*(5), 1483. https://doi.org/10.3390/nu12051483

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DISCIPLINE SPECIFIC ELECTIVE (DSE)

SPORT-SPECIFIC NUTRITION

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical		
Sport-specific Nutrition	4	2	0	2		NIL

Learning Objectives

- To understand the concept of basing nutritional intake on physiological demands of training for Specific Sports
- To gain expertise in fuel and nutrient support specific to a sporting event during training, pre-competition, during competition and recovery.

Learning Outcomes

- Students will be able to demonstrate comprehension of the principles of basing nutritional intake on physiological demands of training for Specific Sports
- Students will be able to plan fuel and nutrient support during training, pre-competition, during competition and recovery, specific to a sporting event.

THEORY

(Credits 2; Hours 30)

UNIT I: Nutrition for team sports and Ultra-Endurance events 8 Hours

This unit deals with the concept of adaptation of nutrition guidelines for team games (Hockey, Kabaddi and Cricket) and marathon covering the following aspects:

- Playing position and rules of the game; basic physiology of playing team sports; physique mapping for each event (body composition).

- Determining position wise fuel need for training and competition; quantity and timing of nutrient intake; current research on position-specific nutrition needs and fuel utilisation.

- Current literature suggestions on food intake and recovery strategies; supplement usage and dietary periodisation among the athletes; case studies on team sports and marathon

UNIT II: Nutrition for Power and Weight-Category Sports 8 Hours

This unit deals with the concept of adaptation of nutrition guidelines for specific sports requiring adherence to weight categories

- Strength and Combat sports (Sprits, Jumps, Throws, Wrestling, Weightlifting, Judo, Boxing): Game dynamics; fuel utilisation (energy and macronutrients); energy demands of the game; nutrient timing and dietary periodisation

- Weight management issues: Overemphasis on protein requirements; tailored nutrition and hydration guidelines before, during and post-training/competitions; supplement or other ergogenic aids; recovery strategies (dietary and non-dietary components).

UNIT III: Nutrition for Water Sports 6 Hours

This unit deals with the knowledge of various water-sports and the concept of adaptation of nutrition guidelines for water sports (Swimming, Rowing):

- Understanding of Water Sports
- Physiological and biochemical changes in water sports
- Common nutritional problems associated to water sports
- Guidelines specific to nutrition in water sports: Identifying individual energy and other macronutrient requirements; nutrient-timing; dietary periodisation; supplement usage.

UNIT IV: Nutrition for Nutrition for sports requiring Balance and coordination 8 Hours

This unit deals with the concept of adaptation of nutrition guidelines for balance and coordination related sports:

- **Balance related sports (Gymnastics, Golf):** Understanding playing formats and fuel utilisation (energy and macronutrients); different energy demands of balance sport; physique maintenance and weight management issues; nutrient timing and dietary periodisation; tailored nutrition and hydration guidelines before, during and post-training/competitions
- **Coordination sport (Archery, Shooting):** Playing formats and specific demands of the game; eye-hand coordination; current research relating nutrition and coordination sports performance; maintaining proper fuel and hydration in coordination sport; case studies of archers and shooters; identifying the current nutritional problems; dietary guidelines for pre, during and post- training/competitions

PRACTICAL

(Credits 2; Hours 60)

1. Menu planning for food and fluid intake during training and competition including nutrient periodisation for :
    - Hockey players/cricketers.
    - Kabaddi players
    - Sprinters and runners.
    - Tennis/Badminton.
    - Rowing.
    - Shooting/Archery.
    - Marathon
2. Menu planning for food and fluid intake during training and competition including nutrient periodisation and weight-management for:
    - Power sports.
    - Gymnastics.
3. Analysis of food labels of sports products
4. Nutritional evaluation of sports drink

Essential Readings

UNIT I:

- Roberts, J. D., López-Samanes, A., & Trakman, G. (Eds.). (2024). *Nutrition for team and individual sport athletes*. Frontiers Media SA. ISBN 9782832557761.
- Fink, H. H., & Mikesky, A. E. (2017). Practical applications in sports nutrition. Jones & Bartlett Learning.
- Christoph Zinner and Billy Sperlich. (2016). Marathon Running: Physiology, Psychology, Nutrition and Training Aspects

- Ryan, M. (2012). Sports nutrition for endurance athletes. Velo Press.
- Stohs, S. J., & Kitchens, E. K. (Eds.). (2013). *Nutrition and enhanced sports performance: Muscle building, endurance, and strength*. Academic Press. ISBN 9780123964779.

UNIT II:

- Jackson, C. G. R. (Ed.). (2000). *Nutrition and the Strength Athlete*. CRC Press. ISBN: 9780849381980.
- Maughan, R. J. (Ed.). (2008). Nutrition in sport (Vol. 7). John Wiley & Sons.
- Slater, G., & Phillips, S. M. (2011). Nutrition guidelines for strength sports: sprinting, weightlifting, throwing events, and bodybuilding. Journal of sports sciences, 29(sup1), S67-S77.
- Stohs, S. J., & Kitchens, E. K. (Eds.). (2013). *Nutrition and enhanced sports performance: Muscle building, endurance, and strength*. Academic Press. ISBN 9780123964779.

UNIT III:

- González Andrade, C. (2025). *Nutrition and water polo* (PDF eBook). César González Andrade. Publisher date: February 5, 2025. ISBN 9798230233350.
- FINA. (2021). *Nutrition for aquatic athletes* (PDF booklet). Fédération Internationale de Natation (FINA). Available at https://resources.fina.org/fina/document/2021/02/04/5c14b311-7eba-4d2b-9114-acf13d300683/nutrition_for_aquatic_athletes_booklet_v5_final.pdf

UNIT IV:

- Clark, N. (2008). *Sports nutrition guidebook* (4th ed.) [PDF]. Human Kinetics. Available at https://repository.bbg.ac.id/bitstream/1996/1/Sports_Nutrition_Guide.pdf
- Jemni, M. (Ed.). (2018). *The science of gymnastics: Advanced concepts* (2nd ed.). Routledge. ISBN 978-1-138-70192-2.
- Marcolin, G., Matej, S., & Paillard, T. (Eds.). (2022). *Postural balance control in sport and exercise* [PDF]. Frontiers in Physiology. ISBN 978-2-88976-730-4.

Suggested Readings

- Burke, L., Deakin, V., & Minehan, M. (Eds.). (2021). *Clinical sports nutrition* (6th ed.). McGraw-Hill Education.
- Campbell, B. (Ed.). (2013). Sports nutrition: enhancing athletic performance. CRC Press.
- Reaburn, P. R. (Ed.). (2014). Nutrition and Performance in Masters Athletes. CRC Press.
- Powers, S. (2014). Exercise physiology: Theory and application to fitness and performance. McGraw-Hill Higher Education.

- McArdle, W. D., Katch, F. I., & Katch, V. L. (2015). Exercise physiology: nutrition, energy, and human performance. 8th Edition, Lippincott Williams & Wilkins.

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COURSES IN RESEARCH METHODOLOGY

ADVANCED RESEARCH METHODOLOGY

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Pre- requisite of the Course (if any)
		Lecture	Tutorial	Practical		
Advanced Research Methodology	2	2	0	0	As per admission criteria	Should have studied Basic Research Methodology and Statistics

Learning Objectives

- Construct a theoretical framework for diverse research problems.
- Compare and contrast the design elements of experimental, quasi-experimental, and non-experimental studies.
- Formulate appropriate research questions for a mixed-methods design.

Learning Outcomes

After completing the course, students will be able to:

- Design complex research projects, including mixed-methods and longitudinal studies, appropriate for advanced academic inquiry.
- Determine the internal and external validity of research designs.
- Evaluate and justify the selection of advanced sampling techniques.

THEORY
(Credits 2; Hours 30)

UNIT I: Theoretical Foundation of Research Design and Sampling. 12 Hours

This unit covers the theoretical foundation of research designs, issues of internal and external validity, advanced literature review techniques including systematic reviews and meta- analysis, and approaches to theory building through inductive, deductive, and abductive reasoning. The

unit also discusses sophisticated sampling techniques, sample size determination, and sources of sampling error, enabling learners to design rigorous and generalizable research studies.Types of research designs and internal external validity perspectives

- Literature Review Approaches: Systematic Review, Meta Analysis, scoping review and others
- Theory Building and testing in qualitative and quantitative researches
- Sampling Frameworks and strategy, Sample size calculation and error
- Advanced Quantitative Sampling Techniques: Stratified Cluster Sampling, Multi-Stage Sampling, Adaptive Sampling and other techniques.
- Sampling in qualitative research: Techniques and issues of depth, context and data saturation

UNIT II: Quantitative, Qualitative and Mixed Methods Research Design. 18 Hours

This unit focuses on the different types of research designs including, advanced quantitative research designs, key qualitative research methodologies and mixed-methods research designs and strategies for integrating qualitative and quantitative data.

- Quantitative Research Design
    - Advanced Experimental Designs: RCT Designs, Factorial designs, Repeated Measures (within-subjects),
    - Longitudinal Studies: Panel, Cohort, and Trend designs
    - Cross-Sectional: Survey and other quantitative designs.
- Qualitative Methodologies
    - Aspects of robust Qualitative research designs.
    - Iteration, Data Triangulation,Saturation and Reflexivity in qualitative research
    - Ethnographic Research, Case Study Research, Narrative Inquiry
    - Action and Participatory Researches: philosophical and methological perspectives
- Mixed-Methods Design
    - Convergent Parallel, Explanatory Sequential, Exploratory Sequential designs; Notation systems (e.g., QUAL to QUAN)
    - Integration and Mixing: Strategies for data mixing, synthesis, and developing a unified interpretation.

Essential Readings UNIT

I

This unit introduces the perspectives that guide advanced research practices. Students will study different types of research designs, key issues of validity, advanced literature review methods, and approaches to theory development. The unit also covers details of sampling for research. The unit aims to strengthen students' conceptual clarity and ability to link theory, methodology, and research questions in scholarly inquiry.

- Black, J. A., & Champion, D. J. (1976). *Methods and issues in social research*. John Wiley & Sons
- Burns, Robert, B. (2000) *Introduction to Research Methods*(4th ed.,chaps8-10, 20-22, 29,30). Sage Publications
- Kothari, C.R., Garg, Gaurav (2023) *Research Methodology: Methods and Techniques*
- (5th ed.) New Age International Publishers
- Mandlik, D., Kalkar, P., Singh C. (2025) *Advanced Research Methodologies and Practices*. Taylor & Francis.
- Mallik, R., Kurian, M., Prajapati, V., Pithadia, M. (2023) *Advanced Research Methodology*. AG Publishing House
- Neuman, W. Laurence (2008) Social Research Methods: Qualitative and Quantitative Approaches (6th ed., chaps3-5) Pearson Education

UNIT II

This unit focuses on advanced quantitative research designs including experimental, longitudinal, and cross-sectional designs. Emphasis is placed on understanding complex experimental structures and multivariate approaches. Through this unit, students will also develop an understanding of advanced qualitative research approaches such as ethnographic, case study, narrative, and participatory research designs, focusing on their key features and applications. The unit will further discuss mixed-methods research designs that integrate quantitative and qualitative approaches. Students will examine different mixed-methods designs and strategies for integrating data during analysis and interpretation.

- Baumeister, M., Kropf, S., & Pöpper, C. (2022). Quantile-based MANOVA: A new tool for inferring multivariate data in factorial designs. *arXiv preprint arXiv:2211.15484*. https://doi.org/10.48550/arXiv.2211.15484
- Black, J. A., & Champion, D. J. (1976). *Methods and issues in social research*. John Wiley & Sons
- Burns, Robert, B. (2000) *Introduction to Research Methods*(4th ed.,chaps8-10, 20-22, 29,30). Sage Publications
- Caruana, E. J., Roman, M., Hernández-Sánchez, J., & Solli, P. (2015). Longitudinal studies. *Journal of Thoracic Disease*, *7*(11), E537–E540. https://doi.org/10.3978/j.issn.2072-1439.2015.10.63

- Creswell, J. W., & Creswell, J. D. (2023). *Research design: Qualitative, quantitative, and mixed methods approaches* (6th ed.). SAGE Publications, Inc.
- Denzin, N. K., Lincoln, Y. S., Giardina, M. D., & Cannella, G. S. (Eds.). (2024). *The SAGE handbook of qualitative research* (6th ed.). SAGE Publications
- Kerlinger, F. N. (1973). *Foundations of Behavioral research* (2nd ed., chaps 7,8, 17- 26). Holt, Rinehart, and Winston.
- Kothari, C.R., Garg, Gaurav (2023) *Research Methodology: Methods and Techniques* (5th ed.) New Age International Publishers
- Luthfiandana, R., Santioso, L. L., Febrian, W. D., Soehaditama, J. P., & Sani, I. (2024). Qualitative research concepts: Phenomenology, grounded theory, ethnography, case study, narrative. *Scientia Journal of Applied Management*, *2*(1), 26–36. https://doi.org/10.38035/sjam
- Minc, S. D., Chandanabhumma, P. P., Sedney, C. L., Haggerty, T. S., Davidov, D. M., & Pollini, R. A. (2022). Mixed methods research: A primer for the vascular surgeon. *Seminars in Vascular Surgery*, *35*(4), 447–455. https://doi.org/10.1053/j.semvascsurg.2022.09.003
- Neuman, W. Laurence (2008) Social Research Methods: Qualitative and Quantitative Approaches (6th ed., chap 13) Pearson Education
- Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in implementation research. *Administration and Policy in Mental Health and Mental Health Services Research*, *42*(5), 533–544. https://doi.org/10.1007/s10488-013-0528-y

Suggested Readings

- Dagher, D., & Khan, M. (2025). Writing a systematic review and meta-analysis: A step-by-step guide. *Sports Health*, *17*(5), 885–890. https://doi.org/10.1177/19417381251364686
- M. E. R. (2020). Methodological integrity in critical qualitative research. *The Counseling Psychologist*, *48*(6), 848–874. https://doi.org/10.1177/0011000020950348
- Findley, M. G., & Faten, A. (2024). Vulnerability in research ethics: A call for assessing vulnerability and implementing protections. *Proceedings of the National Academy of Sciences*, *121*(11), https://doi.org/10.1073/pnas.2322821121

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TOOLS FOR RESEARCH

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical		
Tools for Research	2	2	0	0	As per admission criteria	Nil

Learning Objectives

- Design and evaluate quantitative and qualitative tools.
- Understand data processing and effectively utilize common statistical packages.
- Apply coding techniques, and utilize digital platforms and AI in research design and analysis.

Learning Outcomes

After completing the course, students will be able to:

- Differentiate between major quantitative and qualitative tools.
- Demonstrate proficiency in data entry, coding and cleaning.
- Utilize digital platforms and AI effectively in the formulation, administration, and data collection.
- Proficiently utilize specialized software for qualitative data analysis and quantitative statistical testing.

THEORY
(Credits 2; Hours 30)

UNIT I: Quantitative Tools, Data Coding and Analysis **15 Hours**

This unit introduces quantitative research tools, including questionnaires and rating scales, and the principles of their development, reliability, and validity. It covers major rating scales and key steps in scale construction, analysis, and standardization, along with the use of digital

platforms and AI for tool development and administration. This unit also focuses on quantitative data coding, entry, and cleaning using statistical software. It introduces variable definition, handling of missing data, basic automation through spreadsheet and open-source tools, and familiarization with commonly used statistical software for data management and analysis.

- Quantitative measurement, Variables and construct definition
- Quantitative tool development: Questionnaire, Semi-Structured Interview Schedules.
- Rating Scales Types and Development Process: Item Generation and Content Validation, Item Analysis, Internal Consistency and Factor Analysis, Scale Refinement and Standardization.
- Coding styles and Approaches.
- Assessment of Reliability and Validity of quantitative Tools.
- Data Coding, Entry and Cleaning (Statistical Software): Handling missing data (listwise/pairwise deletion).
- Automation and Data Scripting: Advance excel, other open-source software for data import/export.
- Statistical Software Usage: Navigating common statistical packages
- Leveraging Digital Tools and AI for enhancing the Research lifecycle: Tool Formulation, Data collection and Analysis

UNIT II: Qualitative Tools, Data Coding and Analysis 15 Hours

This unit introduces major qualitative research tools and their application in research. It covers the development and validation of qualitative tools, descriptive and thematic coding techniques, and the use of digital platforms and AI for qualitative data collection and analysis. This unit further focuses on qualitative data coding and analysis using qualitative data analysis software. It introduces the interface and use of QDAS for importing, coding, cleaning, and managing text, audio, and video data, along with an overview of NVivo, ATLAS.ti, and other open-source tools.

- Qualitative tools: In-Depth Interview, Focus Group Discussion, Case Study, Observation, Diaries, Oral Narratives/Stories and others.
- Participatory tools : Types, characteristics and usage in qualitative and participatory researches.

- Developing Qualitative Tools: Tool selection and development, pilot testing and refinement.
- Validity of Qualitative Tools: Qualitative vs. Quantitative Validity, Methods for establishing validity for qualitative tools.
- Coding Techniques: Descriptive and thematic coding
- Digital Platforms and AI for development of qualitative tools and data analysis.
- Qualitative Data Analysis Software (QDAS) Interface: Importing, coding and cleaning different data types (text, audio, video)
- Overview of NVivo, ATLAS.ti and other open-source QDAS software

Essential Readings

UNIT I

This unit aims to build an understanding of quantitative tools used for the purpose of data collection. The unit introduces various types of quantitative data tools, their development and assessment of their reliability and validity. This unit further introduces various rating scales and their development, validation and standardisation. The unit also includes the learning of coding and analysis of quantitative data, basics of data processing scripts and common statistical packages

- Creswell, J. W., & Creswell, J. D. (2023). *Research design: Qualitative, quantitative, and mixed methods approaches* (6th ed.). SAGE Publications.
- Cheema, J. R. (2014). Using listwise deletion to cope with missing data: A cautionary note. *Journal of Educational and Developmental Psychology, 4*(1), 127–134.
- Ghasemi, A., & Zahediasl, S. (2012). Normality tests for statistical analysis.

  International Journal of Endocrinology and Metabolism, 10(2), 486–489.
- Gotschall, T., & Gotschall, T. (2018). EndNote, Mendeley, RefWorks, Zotero: A comparative review. *Journal of Electronic Resources in Medical Libraries, 15*(1), 1–18.
- Hausner, E. T., & Hirt, S. J. (2020). Improving reproducibility in academic data-intensive research through computational workflows. *Frontiers in Research Metrics and Analytics, 5*(7).
- Johnson, R., & Witsel, M. (2018). ORCID: A necessary piece of infrastructure for global research evaluation. *Frontiers in Research Metrics and Analytics, 3*(28).

UNIT II

This unit introduces various types of qualitative tools used in research, their development, pilot testing and refinement. The unit also introduces techniques of establishing validity and of such qualitative tools of data collection. This section also discusses prominent digital and AI tools for qualitative research and provides an overview of qualitative data coding and analysis software.

- Allsop, D. B., Chelladurai, J. M., Kimball, E. R., Marks, L. D., & Hendricks, J. J. (2022). Qualitative methods with NVivo software: A practical guide for analyzing qualitative data. Psych, 4(2), 142–159.
- Al-Kassimi, M., & Al-Sharqi, A. (2020). Data visualization techniques: Model and taxonomy. International Journal of Research in Engineering and Science, 8(3), 44–53.
- Creswell, J. W., & Creswell, J. D. (2023). *Research design: Qualitative, quantitative, and mixed methods approaches* (6th ed.). SAGE Publications.
- Gotschall, T., & Gotschall, T. (2018). EndNote, Mendeley, RefWorks, Zotero: A comparative review. *Journal of Electronic Resources in Medical Libraries, 15*(1), 1–18.
- Johnson, R., & Witsel, M. (2018). ORCID: A necessary piece of infrastructure for global research evaluation. *Frontiers in Research Metrics and Analytics, 3*(28).
- Provalis Research. (n.d.). QDA Miner: Qualitative Data Analysis Software. Retrieved from https://provalisresearch.com/products/qualitative-data-analysis-software/
- Urban Institute. (2025). Urban Institute Data Visualization Style Guide. Retrieved from http://urbaninstitute.github.io/graphics-styleguide/
- Weninger, M. (2024). Open coding in qualitative research: A systematic review and guide. *ResearchGate* (preprint).

Suggested Readings:

- Kang, H. (2013). The prevention and handling of the missing data. *Korean Journal of Anesthesiology, 64*(5), 402–406.
- Kery, M., & Myers, M. (2020). Improving reproducibility in academic data-intensive research through computational workflows. *Frontiers in Research Metrics and Analytics, 5*(7).
- Saravanakumar, A. P., & Shitharth, S. (2023). A survey on sentiment analysis: Techniques, algorithms, and application areas. *Journal of King Saud University – Computer and Information Sciences, 35*(3).

- Takes, F. W. (2024). Gephi tutorial for graph/network visualization. Retrieved from https://github.com/franktakes/gephi-tutorial

Note: Examination scheme and mode shall be as prescribed by the Examination branch, University of Delhi, from time to time

SEMESTER -II

DISCIPLINE SPECIFIC ELECTIVE
PRECISION NUTRITION

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical/ Practice		
Precision Nutrition	**4**	**3**	**0**	**1**		**Nil**

Learning Objectives:

- To understand the concepts of Precision nutrition, its elements, nutritional indicators and the role of artificial intelligence in Precision nutrition.
- To gain a foundational understanding of DNA structure, how genotypes translate into phenotypes, and how variations such as mutations, SNPs, and CNVs influence individual biological differences
- To understand the key molecular biology techniques used to analyze proteins and nucleic acids
- To understand the composition and diversity of the human gut microbiota and how the gut microbiota communicates with the brain through the gut–brain axis, influencing mood, behavior, and neurological health.

Learning Outcomes:

The students would be able to:

- Understand the principles of Precision Nutrition and identify its key components, nutritional biomarkers, and the ways artificial intelligence contributes to personalized dietary recommendations.
- Describe DNA structure and genetic mechanisms, and analyse how genotypes translate into phenotypes, including the impact of mutations, SNPs, and CNVs on individual variability in nutritional responses.
- Apply core molecular biology techniques such as electrophoresis, PCR-based methods, sequencing, and immunoassays—to investigate proteins, genes, and molecular markers relevant to nutrition and health.

- Evaluate the diversity and functions of the human gut microbiota and explain how microbial communities interact with the brain through the gut–brain axis to influence metabolism, behaviour, and overall health.

THEORY

(Credits 3; Hours 45)

UNIT-I: Introduction to Precision Nutrition and Artificial Intelligence (AI) 8 Hours

Students will be introduced about the Precision nutrition, its elements, nutritional indicators and the role of artificial intelligence in Precision nutrition.

- Introduction to Precision Nutrition
- Elements in developing Precision Nutrition
- Nutritional indicators (Anthropometry, clinical, biochemical, diet), biomarkers, physical activity and Precision Nutrition
- Role of AI in Precision Nutrition

UNIT II: Nutrigenomics and Metabolomics 15 Hours

Students will gain a foundational understanding of **DNA structure**, how **genotypes** translate into **phenotypes,** and how variations such as **mutations, SNPs, and CNVs** influence individual biological differences. They will explore **nutrigenomics, metabolomics**, the **epigenome**, and the **exposome** to understand how diet and environmental factors shape gene activity.

- DNA structure, Genotype & Phenotype, Gene variations, Mutations, SNPs, CNVs.
- Nutrigenomics, Metabolomics, Epigenome, Exposome
- Epigenetics and its mechanisms: DNA methylation, Histone modification and non-coding RNA
- The Effect of Micro Nutrients, Macro Nutrients and Bioactive Components on Gene Expression
- Altered Gene expression in Chronic Conditions- Obesity, Type-II diabetes, cardiovascular diseases and cancer.
- Circadian Rhythm, gene expression and Chronobiology
- Metabolomics in understanding relation between diet, metabolism and health

- Tools and Techniques to analyze metabolites from food and metabolic processes-Mass spectrometry and NMR

UNIT III: Molecular techniques in Nutritional genomics and Metabolomics 15 Hours

Students will gain an understanding of key molecular biology techniques used to analyze proteins and nucleic acids. They will learn the principles and applications of **western blotting** for protein separation and identification. They will also understand how **ELISA** is used to detect and quantify specific proteins or antibodies in biological samples.

- Introduction to western blotting
- Enzyme Linked Immunosorbent Assay (ELISA)
- Polymerase chain reaction (PCR)
- RT-PCR and Real time PCR.
- Introduction to next generation DNA sequencing
- Introduction to Microarray and its applications

UNIT IV: Diet and Gut Microbiota 7 Hours

Students will develop an understanding of the **composition and diversity of the human gut microbiota**, including the major microbial groups that inhabit the digestive system. They will explore how the gut microbiota communicates with the brain through the **gut–brain axis**, influencing mood, behavior, and neurological health.

- Human Gut Microbiota Composition
- Microbiota and Gut-brain Axis
- Influence of Diet on Gut Microbiota
- Microbiota and its relation with Obesity and other disease conditions (Type II Diabetes, CVDs, IBD, Neurodegenerative diseases)

PRACTICALS

(Credit 1; Hours 30)

1. Evaluation of case studies from the published literature to understand precision nutrition.
2. Assessment of Munich Chronotype questionnaire and Pittsburgh Sleep Quality Index
3. Genomic DNA isolation and its purity check
4. Agarose Gel electrophoresis
5. DNA quantification using Diphenylamine/UV-method
6. RNA Quantification using orcinol/ UV-method

7. Lab visit for demonstration of PCR
8. Interpretation of Genetic tests for various disease conditions.

Essential Readings:

UNIT I

- Kirk, D., Catal, C., & Tekinerdogan, B. (2021). Precision nutrition: A systematic literature review. *Computers in Biology and Medicine*, *133*, 104365.
- Liang, Y., Xiao, R., Huang, F., Lin, Q., Guo, J., Zeng, W., & Dong, J. (2024). AI nutritionist: Intelligent software as the next generation pioneer of precision nutrition. *Computers in biology and medicine*, *178*, 108711.

UNIT II

- Simopoulos, A. P., & Ordovás, J. M. (Eds.). (2004). *Nutrigenetics and nutrigenomics* (Vol. 93). Karger Medical and Scientific Publishers.
- Carlberg, C., Ulven, S. M., & Molnár, F. (2016). *Nutrigenomics*. Berlin, Germany: Springer.
- Paro, R., Grossniklaus, U., Santoro, R., & Wutz, A. (2021). *Introduction to Epigenetics*. Springer Nature.
- Singh, V., Mani, I. (2023). *Epigenetics in Health and Disease*. Academic Press.

UNIT III

- Kumar, P. (2016). *Tools and Techniques of Biophysics and Molecular Biology.* Pathfinder Publication.
- Wilson, K., Hofmann, A., Walker, J. M., & Clokie, S. (Eds.). (2018). *Wilson and Walker's principles and techniques of biochemistry and molecular biology*. Cambridge university press.

UNIT IV

- Ramos, S., & Martín, M. Á. (2021). Impact of diet on gut microbiota. *Current Opinion in Food Science*, *37*, 83-90.

Suggested Readings:

1. de Toro-Martín, J., Arsenault, B. J., Després, J. P., & Vohl, M. C. (2017). Precision nutrition: a review of personalized nutritional approaches for the prevention and management of metabolic syndrome. *Nutrients*, *9*(8), 913.
2. Wang, D. D., & Hu, F. B. (2018). Precision nutrition for prevention and management of type 2 diabetes. *The lancet Diabetes & endocrinology*, *6*(5), 416-426.
3. Voruganti, V. S. (2022). Precision nutrition: recent advances in obesity. *Physiology*.
4. Liang, Y., Xiao, R., Huang, F., Lin, Q., Guo, J., Zeng, W., & Dong, J. (2024). AI nutritionist: Intelligent software as the next generation pioneer of precision nutrition. *Computers in biology and medicine*, *178*, 108711.
5. Ferreira, D. D., Ferreira, L. G., Amorim, K. A., Delfino, D. C. T., & Ferreira, A. C. B. H. (2025). Assessing the Links Between Artificial Intelligence and Precision Nutrition. *Current Nutrition Reports*, *14*(1), 1-17.

Note: Examination scheme and mode shall be as prescribed by the Examination branch,University of Delhi, from time to time.

DISCIPLINE SPECIFIC ELECTIVE COURSE

CHALLENGES IN CLINICAL NUTRITION

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical		
Challenges in Clinical Nutrition	**4**	**2**	**0**	**2**		**Nil**

Learning Objectives

- To understand the process of diet counselling in nutrition care process.
- To understand the nutrition related challenges faced by specific groups like elderly and paediatric population.
- To understand the nutritional management of cancer patients
- To understand the latest technologies which can aid in nutrition care

Learning Outcomes

Student will be able to:

- Use the principles of dietary counselling in various diseases.
- Acquire an in depth understanding about clinical nutrition challenges faced by elderly and children
- Plan diets for cancer patients undergoing different types of therapy
- Acquire skills to use latest technologies in the nutrition care process

THEORY

(Credits 2; Hours 30)

UNIT I: Diet Counselling **4 Hours**

Students will be introduced to the concept of nutrition counselling, Behaviour Change Communication models and strategies for counselling

- Concept and importance of counselling in the nutrition care process
- Understanding dietary patterns and food choices and their impact on counselling
- Behaviour Change Communication and Models for behaviour change
- Counselling strategies

UNIT II: Geriatric and Paediatric Nutrition **16 Hours**

Students will be introduced to the concept of geriatric and paediatric nutrition, common clinical nutrition related problems faced by elderly and children, and strategies for nutritional management.

- Definition of ageing, geriatric and paediatric nutrition, physiological and biochemical changes impacting nutrition among elderly and children
- Assessment of nutritional status of older adults and children in clinical/hospital setting
- Major nutritional and health problems during old age including drug nutrient interactions for selected health conditions:
  Musculoskeletal: osteoporosis, sarcopenia, arthritis and frailty.
  Neurological and cognitive: Mild Cognitive Impairment, Alzheimer's disease, Vascular and Lewy Body Dementia, Parkinson's disease, depression
  Metabolic: obesity, malnutrition, constipation, dehydration, diabetes, hypertension and cardiovascular diseases
- Nutritional management of Inborn Errors of Metabolism in infants and children - phenylketonuria, maple syrup urine disease, galactosemia, congenital hypothyroidism, congenital adrenal hyperplasia
- Epilepsy in children – special diets for management (Ketogenic diet, Atkins diet)
- Nutritional challenges in developmental disabilities in children- autism spectrum disorders, cerebral palsy, attention deficit hyperactivity disorder
- Paediatric diabetes: Type 1 DM – management and impact on growth and management
- Nephrotic syndrome and CKD in children - Impact on growth and management

UNIT III: Nutrition and Cancer **6 Hours**

Students will be introduced to the concept of onco-nutrition and nutritional management of cancer patients.

- Carcinogenesis and Mutagenesis- Diet-Cancer relationship
- Nutrition care process for cancer patients– nutrition, screening and assessment, goals of nutrition care and intervention
- Nutritional implications of cancer therapy – chemotherapy, radiation, biotherapy, hormone, immunotherapy.
- Role of food in cancer prevention– fibre, antioxidants, phytochemicals

UNIT IV: New technology in nutrition practice **4 Hours**

Students will be introduced to the newer concepts in nutrition like AI in nutrition, Chrono and nano nutrition, diet and mental health and smart health technologies.

- Applications of Artificial Intelligence in nutrition and dietetics and AI sources related to nutrition
- Microbiome and nutrition, chrono nutrition and nano nutrition
- Diet and mental health
- Application of smart health care digital devices in clinical nutrition service

PRACTICAL
(Credits 2; Hours 60)

Planning and preparation of diets and dietary counselling for following diseases

1. Osteoporosis
2. Sarcopenia
3. Alzheimer's Disease
4. Inborn errors (any one)
5. Tube feed for cancer patient
6. Epilepsy
7. Neurodevelopmental disorder (ADHD/Autism/cerebral palsy)
8. Paediatric Kidney disease
9. Type I diabetes (Paediatric)
10. Depression

Essential Readings

UNIT I

Students will be introduced to the concept of nutrition counselling, Behaviour Change Communication models and strategies for counselling

- Narula Uma. Communication Models (2023); Atlantic Publishers and Distributors (P) Ltd ISBN 8126906766
- Mahan, L.K. and Escott-Stump, S. (2021): Krause's Food Nutrition and Nutrition Care Process, 16th Edition, Elsevier Pvt. Ltd. ISBN 032381025X
- Snetselaar L. (2009). Nutrition Counseling Skills for the Nutrition Care Process. Fourth Ed. Sudbury, Massachusetts: Jones Bartlett Publishers. ISBN-13: 978-0-7637-2960-8
- Holli B Betsy and Beto A Judith. (2014). Nutrition Counseling and Education Skills for Dietetics Professionals. Sixth edition. USA: Lippincot Williams and Wilkins; Wolters Kluwer. ISBN-10: 1451120389

UNIT II

Students will be introduced to the concept of geriatric and paediatric nutrition, common clinical nutrition related problems faced by elderly and children, and strategies for nutritional management.

- Indian Dietetics Association, (2018) Clinical Dietetics Manual, 2nd Edition. Elite Publishing House Pvt. Ltd.

- Khanna K, Gupta S, Seth R, Passi SJ, Seth R, Mahna R, Puri S (2013). Textbook of Nutrition and Dietetics.2nd Edn. Phoenix Publishing House Pvt. Ltd.
- Raymond, J.L. and Morrow, K. (2020) Krause and Mahan's Food & the Nutrition Care Process. 15th ed. Saunders-Elsevier
- Seth, V. and Singh K. (eds.) (2024) Principles of Medical Nutrition Therapy for Positive Clinical Outcomes, 2nd Edition. Elite Publishing House Pvt. Ltd.
- Mehta, P and Chouhan, K (2016) Ageing, Nutrition and Health. Kalpaz Publication
- Goday, P.S and Walia, C (Eds) (2022) Paediatric Nutrition for Dietitians. Taylor & Francis Ltd. CRC Press
- ESPEN guideline on clinical nutrition and hydration in geriatrics. DOI link: https://doi.org/10.1016/j.clnu.2018.05.024
- ESPEN guideline clinical nutrition in neurology. DOI: 10.1016/j.clnu.2017.09.003

UNIT III

Students will be introduced to the concept of onco-nutrition and nutritional management of cancer patients.

- Raymond, J.L. and Morrow, K. (2020) Krause and Mahan's Food & the Nutrition Care Process. 15th ed. Saunders-Elsevier
- Seth, V. and Singh K. (eds.) (2024) Principles of Medical Nutrition Therapy for Positive Clinical Outcomes, 2nd Edition. Elite Publishing House Pvt. Ltd.
- Shivshankar, T. (2025) Onco-nutrition: Bridging Cancer Care and Nutritional Science Publisher: Sundaram Digital Publication House. ISBN: 9788196975562
- Narimatsu, H., & Yaguchi, Y. T. (2022). The Role of Diet and Nutrition in Cancer: Prevention, Treatment, and Survival. *Nutrients*, *14*(16), 3329. https://doi.org/10.3390/nu14163329

UNIT IV

Students will be introduced to the newer concepts in nutrition like AI in nutrition, Chrono and nano nutrition, diet and mental health and smart health technologies.

- de Oliveira Melo, N. C., Cuevas-Sierra, A., Souto, V. F., & Martínez, J. A. (2024). Biological Rhythms, Chrono-Nutrition, and Gut Microbiota: Epigenomics Insights for Precision Nutrition and Metabolic Health. *Biomolecules*, *14*(5), 559. https://doi.org/10.3390/biom14050559
- Grajek, M., Krupa-Kotara, K., Białek-Dratwa, A., Sobczyk, K., Grot, M., Kowalski, O., & Staśkiewicz, W. (2022). Nutrition and mental health: A review of current knowledge about the impact of diet on mental health. *Frontiers in nutrition*, *9*, 943998. https://doi.org/10.3389/fnut.2022.943998

Suggested Readings

- Chowdhary S.R and Aeri B.T. (2023) Textbook of Food Science and Nutrition. Aarahan Publishers. ISBN:978-93-87270-08-4 https://amzn.eu/d/blLz8S8
- Gibney MJ, Elia M, Ljungqvist &Dowsett J. (2005) Clinical Nutrition. The Nutrition Society Textbook Series. Blackwell Publishing Company
- ICMR (2020) Estimated Average Requirements and Recommended Dietary Allowances for Indians. Published by National Institute of Nutrition, Hyderabad.
- Joshi Y K.(2008) Basics of Clinical Nutrition 2nd ed. Jaypee Brothers Medical Publishers

- Longvah T, Ananthan R, Bhaskarachary K and Venkaiah K (2017). Indian Food Composition Tables. National Institute of Nutrition, ICMR, Hyderabad.
- Puri S, Bhagat A, Aeri, BT, Sharma A (2019). Food Exchange List: A Tool for meal Planning. Elite Publishing House. New Delhi.
- Shils, M.E., Shike, M, Ross, A.C., Caballero B and Cousins RJ (2005) Modern Nutrition in Health and Disease. 10th ed. Lipincott, William and Wilkins.
- Siddhu A, Bhatia N, Singh K, Gupta S (2017). Compilation of food exchange list, technical series 6, Lady Irwin College, University of Delhi. Publ. Global Books Organisation, Delhi
- Williams, S.R. (2001) Basic Nutrition and Diet Therapy. 11th ed. Times Mirror Mosby College Publishing
- Racz B., Duskova M., Starka L., Hainer V., Kunesova M. Links between the circadian rhythm, obesity and the microbiome. Physiol. Res. 2018;67:S409–S420.
- https://www.cancer.gov/about-cancer/treatment/side-effects/nutrition

Note: Examination scheme and mode shall be as prescribed by the Examination branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC ELECTIVE COURSE
NUTRITIONAL CARE OF THE ELDERLY

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical		
Nutritional Care of the Elderly	4	3	0	1		Nil

Learning Objectives

- To acquire knowledge about the physiological, metabolic, and psychosocial changes associated with aging and their impact on nutritional status in the elderly population.
- To comprehend the macro- and micronutrient requirements, dietary recommendations, and nutritional guidelines for older adults.
- To identify and assess common nutrition-related health conditions, risks and drug nutrient interactions among elderly.
- To apply standardized nutritional assessment tools, dietary planning methods, and communication strategies for effective nutrition management.

Learning Outcomes

The students would be able to:

- Discuss the biological, sociocultural, and behavioural dimensions influencing elderly nutrition.
- Assess and interpret the nutritional status and risks among aged individuals using appropriate assessment tools.
- Formulate and justify evidence-based dietary plans and nutrition interventions suitable for elderly health conditions.
- Communicate and counsel using appropriate IEC material for families and caregivers.

THEORY
(Credits 3; Hours 45)

UNIT I: Introduction to Aging and Nutrition 12 Hours

This unit highlights the concept of aging process, age related physiological changes, nutrition associated health issues, socio cultural factors and challenges of elderly care.

- Process of aging, physiological changes and functional decline
- Nutrition-related health issues such as undernutrition, obesity, sarcopenia, osteoporosis, and anemia
- Interplay between nutrition and chronic diseases (diabetes, cardiovascular diseases, dementia), association between nutritional deficiencies, functional decline and frailty among elderly
- Socio-cultural factors influencing elderly nutrition
- Demographic trends and challenges of elderly care in India
- National Policy on Older Persons (NPOP) and National Programme for Health Care of Elderly (NPHCE)

UNIT II: Nutritional Requirements and Nutritional Assessment of the Elderly 12 Hours

This unit highlights specific nutrient needs of the elderly, nutritional assessment and life style modification for healthy aging.

- Macro- and micronutrient needs specific to elderly individuals
- Changes in energy metabolism and hydration needs in old age
- Use of standardized nutritional assessment techniques (MNA, GNRI, CGA)
- Utilizing interpretation and assessment outcomes to guide intervention planning
- Nutrition guidance and lifestyle modification for healthy aging

UNIT III: Dietary Recommendations and Nutritional Management for Various Health Conditions 17 Hours

This unit focuses on Indian dietary guidelines for elderly, appropriate diets and drug nutrient interactions

- Indian dietary guidelines for elderly and dietary recommendations
- Balanced, culturally appropriate diets for elderly with varying health conditions
  - Gastrointestinal disorders – Flatulence, Constipation, GERD, Diarrhoea
  - Weight Imbalances – Obesity, Underweight
  - Hypertension, Dyslipidemias, Diabetes Mellitus
  - Osteoporosis, Arthritis
  - Neurological disorders: Dementia, Parkinsons Disease, Alzheimer's Disease
- Nutrient and drug Interactions, role of functional foods in aging, Use of nutraceuticals and supplements

UNIT 1V: Communication strategies for effective Counselling to promote healthy aging 4 Hours

This unit focuses on the communication strategies to address the age related nutrition needs, chronic disease conditions and promotion of healthy life style for healthy aging

- Educational and counseling strategies using appropriate IEC materials addressing multiple chronic disease conditions in elderly
- Addressing barriers and enablers for healthy eating specific to elderly

PRACTICAL
(Credits 1; Hours 30)

1. Dietary intake assessment using 24-hour recall and food frequency questionnaires, adaptations of assessment tools to address short term memory loss among elderly
2. Demonstration of measuring anthropometric parameters relevant to elderly nutrition (BMI, mid-upper arm circumference, proxy measurements for height).
3. Diet planning for elderly with diabetes, hypertension, osteoporosis, and digestive disorders.
4. Planning and preparation of specialized therapeutic recipes (soft diet, high-protein snacks, low sodium meals)
5. Planning of Cyclic Menu for residential institutions for elderly accommodating regional preferences and medical conditions.
6. Designing culturally appropriate nutrition education materials.
7. Field visit or virtual tours to community or government elderly nutrition programs and evaluation of existing nutrition interventions for elderly.

Essential Readings

UNIT I

- Agarwal, E., Miller, M., Yaxley, A., & Isenring, E. (2024). Malnutrition in the elderly: A narrative review. *Maturitas*, 128, 1-12.
- National Policy on Older Persons (NPOP) and National Programme for Health Care of Elderly (NPHCE) Document, Government of India

UNIT II

- Barry M., &Murphy, R. (2025). *Geriatric Nutrition: Comprehensive Guide for Clinical Practice (2nd ed.).* Springer.
- Kaiser, M. J., Bauer, J. M., & Schroll, M. (2025). Assessment tools for nutritional status in older persons: MNA and beyond. *Clinical Nutrition*, 44(1), 19-28
- Keller, H. H., & Goy, R. (2023). *Nutrition and Aging: Assessment and Treatment of Nutrition-Related Health Problems*. CRC Press.
- Raymond, J. L., & Mahan, L. K. (Eds.). (2024). *Krause and Mahan's Food and the Nutrition care process (19th ed.*). Elsevier.

UNIT III

- Brownie, S., & Houweling, T. A. J. (2024). Nutritional interventions for sarcopenia in older adults: A systematic review. *Journal of Nutrition, Health & Aging,* 28(4), 402–412
- Dietary Guidelines for Indians (2024) *Dietary Guidelines for Indians: A manual*., NIN
- McIntosh, S. N. (2021). *Williams' Basic Nutrition and Diet Therapy (16th ed.).* Elsevier.

- Tucker, K. L., Duggan, C. P., Jensen, G. L., & Peterson, K. E. (Eds.). (2024). *Modern Nutrition in Health and Disease (12th ed.*). Jones & Bartlett Learning.

UNIT IV

- Miller A, Steinle N (2020) Barriers to Healthy Eating in the Elderly; A National and Global Perspective. J Hum Nutr Food Sci 8(1): 1130.
- Mohan, S., & Singh, A. (2024). Behavior change communication strategies in elderly nutrition programs: Evidence from India. *Nutrition and Health*, 30(2), 123–134.

Suggested Reading

- Gosh, S., & Reddy, V. (2023). Nutritional challenges and solutions in India's aging population. *Indian Journal of Public Health*, 67(2), 115–121.
- IFCT (2017) *Indian Food Composition Tables*, NIN
- Longvah, T., Ananthan, R., Bhaskarachary, K. and Venkaiah, K. (2017). Indian Food Composition Tables. National Institute of Nutrition, ICMR, Hyderabad.
- World Health Organization. (2024). *Integrated care for older people: Guidelines on community-level interventions to manage declines in intrinsic capacity* (WHO/NMH/NMA/20.4). World Health Organization.
- Yen, C., & Lin, S. (2024). Nutrition and chronic disease prevention in the elderly: Current perspectives. *Frontiers in Nutrition*, 11, Article 785632.
- Zeng, Y., & Xiao, S. (2025). Advances in nutritional pharmacology relevant to aging populations. In S. R. Murphy & J. T. Lee (Eds.), *Pharmacology and Nutrition in Aging* (pp. 115-143). Elsevier.
- The Encyclopedia of Ageing. 4th Edition Vol I and Vol II Editor Chief- Richard Schulz. Assoc Editors- Linda Noelker, Kenneth Rockwood, Richard Sprott. 2006. Springer Publishing Company. New York.

Note: Examination scheme and mode shall be as prescribed by the Examination branch, University of Delhi, from time to time

DISCIPLINE SPECIFIC ELECTIVE COURSE
PROGRAMME PLANNING IN PUBLIC HEALTH NUTRITION

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical		
Programme Planning in Public Health Nutrition	**4**	**2**	**0**	**2**		**Nil**

Learning Objectives

- To understand the planning and management of public health nutrition programmes.
- To gain insight into the process of programme monitoring and evaluation.
- To understand the concept of nutritional surveillance.
- To get exposure to the key components of nutrition in emergency and disaster situations.

Learning Outcomes

The students would be able to:

- Become familiar with the process of planning and management of public health nutrition programmes.
- Apply monitoring and evaluation concepts in public health nutrition programmes and interpret programme indicators.
- Describe nutritional surveillance systems, including their purpose, components, and role in public health decision-making.
- Identify nutrition-related challenges during emergencies/disasters and recommend strategies to tackle them.
- Acquire skills in conducting situational analysis/needs assessment, developing action plans for public health nutrition programmes, and their evaluation.

THEORY
(Credits 2; Hours 30)

UNIT I: Planning Public Health Nutrition Programmes **14 Hours**

This unit deals with the process involved in planning public health nutrition programmes. It

emphasizes the importance of understanding community needs, setting appropriate goals, selecting interventions, and designing effective implementation and evaluation strategies.

- Planning process in public health nutrition – community needs assessment/situational analysis, setting goals and objectives, selecting indicators, selecting interventions, planning for programme implementation and resources, planning for programme monitoring and evaluation, planning for programme termination, stakeholder participation in programme management

UNIT II: Programme Monitoring and Evaluation 8 Hours

This unit focuses on the essential concepts, tools, and processes involved in monitoring and evaluating public health nutrition programmes.

- Programme monitoring: Definition, purpose, indicators, data collection and analysis, monitoring tools (e.g. Health Management Information System, Poshan tracker)
- Programme evaluation: Definition, purpose, types, indicators, steps of evaluation, strategies for data collection, evaluation designs

UNIT III: Nutrition surveillance 4 Hours

This unit deals with the core concepts and components of nutrition surveillance and highlights its significance in programme planning and public health decision-making.

- Definition, objectives, indicators, agencies involved in nutrition surveillance
- Nutrition surveillance for programme planning – Triple A approach

UNIT IV: Nutrition in Emergencies and Disasters 4 Hours

This unit deals with the nutritional challenges that arise during emergencies and disaster situations, focusing on the needs of vulnerable groups and the strategies used for assessment, relief, and rehabilitation.

- Natural and manmade disasters resulting in disaster situations
- Nutritional problems in emergencies in vulnerable groups
- Assessment and surveillance of affected population groups
- Nutritional relief and rehabilitation in disaster situations

PRACTICAL
(Credits 2; Hours 60)

1. Field visit to observe implementation of a national public health programme.
2. Critical appraisal of ongoing national public health nutrition programmes.
3. Prepare a fact sheet to present a situational analysis of an identified public health nutrition problem.
4. Prepare a tool to collect data for the situational analysis of an identified public health nutrition problem.

5. Identify key interventions and present evidence on the effectiveness and efficacy of the chosen intervention for an identified public health nutrition problem.
6. Identification of key indicators for evaluation of national public health nutrition programmes.
7. Plan a suitable action plan for: Conducting situational analysis/community needs assessment of an identified public health nutrition problem, or For effectively managing an identified public health nutrition problem, or Conducting an evaluation for public health nutrition programme.

Essential Readings

UNIT I

- Vir, S.C. (2021). Public Health Nutrition in Developing Countries. Volume-II (2nd ed.) Woodhead Publishing India Pvt Ltd.
- Park, K. (2023). Park's Textbook of Preventive and Social Medicine (27th ed.), Jabalpur, India: Banarasidas Bhanot Publishers.
- Boyle, M. A. (2022). Community Nutrition in Action (8th ed.). Cengage Learning.

UNIT II

- Vir, S.C. (2021). Public Health Nutrition in Developing Countries. Volume-II (2nd ed.) Woodhead Publishing India Pvt Ltd.
- Boyle, M. A. (2022). Community Nutrition in Action (8th ed.). Cengage Learning.

UNIT III

- Al Jawaldeh, A., Osman, D., Tawfik, A., & World Health Organization, Regional Office for the Eastern Mediterranean. (2013). *Food and nutrition surveillance systems: Technical guide for the development of a food and nutrition surveillance system for countries in the Eastern Mediterranean Region* (WHO Regional Publication, Eastern Mediterranean Series No. 33). WHO Regional Office for the Eastern Mediterranean. https://applications.emro.who.int/dsaf/EMROPUB_2013_EN_1576.pdf
- Tuffrey, V. (2016). *Nutrition surveillance systems: Their use and value* (Report). Save the Children UK.

https://resourcecentre.savethechildren.net/pdf/nutrition_surveillance_systems.pdf

UNIT IV

- World Health Organization. (2000). Management of nutrition in major emergencies. WHO. https://www.who.int/publications
- World Health Organization, UNITed Nations High Commissioner for Refugees, UNITed Nations Children's Fund, & World Food Programme. (2004, February 23). Food and nutrition needs in emergencies (Technical document). https://www.who.int/publications/i/item/food-and-nutrition-needs-in-emergencies
- World Health Organization Regional Office for the Eastern Mediterranean. (n.d.). *Nutrition in emergencies*. WHO. https://www.emro.who.int/nutrition/nutrition-in-emergencies/
- Vir, S. C. (Ed.). (2011). *Public health nutrition in developing countries* (2-volume set). Woodhead Publishing India.

Suggested Readings

- Bamji, M.S., Hemalatha, R., and Reddy, G.B. (2025). Textbook of Human Nutrition, 5th edition. CBS Publishers and Distributors.
- Ministry of Health & Family Welfare. (2019). *National Family Health Survey (NFHS-5) India 2019–21: State fact sheets*. Government of India. https://rchiips.org/nfhs/factsheet_NFHS-5.shtml
- Ministry of Health & Family Welfare. (2018). *Comprehensive National Nutrition Survey (CNNS) India 2016–18: National report*. Government of India & UNICEF.
- Ministry of Women & Child Development. (2021). *POSHAN Abhiyaan: Operational guidelines*. Government of India. https://poshanabhiyaan.gov.in
- Ministry of Health & Family Welfare. (2020). *Health Management Information System (HMIS) manual*. Government of India.
- NITI Aayog. (2017). *National nutrition strategy*. Government of India. https://library.niti.gov.in/cgi-bin/koha/opac-retrieve-file.pl?id=a0185815c4868f92466245d161108c36
- WFP India & National Institute of Disaster Management (NIDM), Ministry of Home Affairs, Government of India. (2022, November 11). Ensuring food and nutrition security in climate fragilities and disasters: The 31 inspiring practices. World Food Programme. https://www.wfp.org/publications/ensuring-food-and-nutrition-security-climate-fragilities-and-disasters-31-inspiring
- Vir, S.C. (2023). Child, Adolescent and Woman Nutrition in India: Public Policies, Programmes and Progress. KW Publishers Pvt. Ltd.

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DISCIPLINE SPECIFIC ELECTIVE COURSE
PLANT PRODUCTS PROCESSING AND PRESERVATION

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical		
Plant Products Processing and Preservation	**4**	**3**	**0**	**1**		**Nil**

Learning Objectives

- To understand the composition, structure, and functional properties of major plant foods and relate them to processing behaviour and nutritional quality.
- To gain comprehensive knowledge of traditional and modern processing technologies used for milling, extraction, preservation, minimal processing, and value addition in plant-based foods.
- To develop the ability to evaluate post-harvest physiological changes, quality attributes, and apply scientific principles to reduce post-harvest losses.
- To develop practical skills in assessing plant food quality and preparing value-added, exotic and healthy products from cereals, pulses, oilseeds, and fruits & vegetables.

Learning Outcomes

The students would be able to:

- Explain the structure, composition, and functional properties of major plant food groups and their relevance to processing and nutrition.
- Compare traditional and modern processing methods and their effects on quality, safety, and nutritional value of plant foods.
- Evaluate physicochemical, nutritional, and sensory changes during processing, preservation, and value addition of plant foods.
- Demonstrate practical skills in quality assessment and small-scale processing of cereals, pulses, oilseeds, fruits, and vegetables.

THEORY
(Credits 3; Hours 45)

UNIT I: Cereals, Millets & Coarse Grains Technology
(15 Hours)

This unit deals with the structure, composition, nutritive value, milling and utilisation of products of cereals and millets.

- Structure of wheat grain, nutritive value and composition, physical and chemical properties.
- Milling of wheat: Roller milling process, flour fractions, flour treatments: bleaching, maturing agents, products and by-products of milling process.
- Introduction to other cereals and millets: Rice, maize, oats, rye, corn, pearl millet; their nutritional importance and commercial value (Puffed rice, Rice flakes, parboiling of rice, extruded and fortified rice).

UNIT II: Pulse & Oilseed Processing Technology
(8 Hours)

This unit deals with the composition, nutritive value, processing of pulses and different oilseeds and methods of texturization of plant protein.

- Pulses: Composition, protein quality, antinutritional factors, soaking, germination, fermentation
- Oilseeds: Seed structure & composition, Pre-processing: cleaning, conditioning, cracking, flaking, Mechanical & solvent extraction, oil refining: physical and chemical
- TVP, high-moisture extrusion, plant-based meat applications

UNIT III: Post-harvest management of Fruits & Vegetables
(10 Hours)

This unit deals with the post-harvest changes and management of fruits and vegetables.

- Post-Harvest Physiology & Quality: Maturity indices, ripening physiology, Climacteric vs non-climacteric, sorting, grading, washing, peeling, minimal processing, control of enzymatic browning
- Post-harvest changes and management of fruits and vegetables: Climacteric rise, horticultural maturity, physiological maturity, maturity indices, and process of ripening-physical and chemical changes. Causes of post-harvest losses, measures to reduce post–harvest losses in F & V, CA storage, and MAP.

UNIT IV: Fruits & Vegetables Processing
(12 Hours)

This unit deals with the processing and preservation of fruits and vegetables.

- Canning: Selection of fruits and vegetables, process of canning, factors affecting the process- time and temperature, containers of packing, lacquering, syrups and brines for canning, spoilage in canned foods.
- Jams, jellies and marmalades: Introduction, Jam: Constituents, selection of fruits, processing & technology, Jelly: Essential constituents (Role of pectin, ratio), Theory of jelly formation and defects in jelly.
- Tomato products: Selection of tomatoes, pulping & processing of tomato juice, tomato puree, paste, ketchup, sauce and soup**.**

PRACTICAL
(Credits 1; Hours 30)

List of Experiments

- Determination of physical and chemical properties of wheat
- Determination of gluten quality and quantity
- Sedimentation value of flour/ Fermenting power of yeast
- Evaluation of flour suitability through baking tests
- Preparation of plant protein-based product- soy/pulse protein-based tofu, soymilk, high protein drink, soy yoghurt, almond protein bars
- Determination of maturity indices of fruits & vegetables-TSS, Sugar:acid, TA, size & shape, weight & firmness.
- Processing of tomato products (ketchup and sauce).
- Processing of jams, jellies and marmalades.

Essential Readings

UNIT I

- Kent, N. L. (1994). *Technology of cereals* (4th ed.). Pergamon Press.
- Matz A Samuel, *Bakery Technology and Engineering*.
- Food Safety and Standards Authority of India. (2022). Food safety and testing manuals. Government of India.

UNIT II

- Chakraverty, A. (2001). *Post-harvest technology of cereals, pulses and oilseeds* (3rd ed.). Oxford & IBH Publishing Co. Pvt. Ltd.
- Manay, S. and Sharaswamy, M. (1987). Food Facts and Priniciples. Wiley Eastern Publisher.

UNIT III

- Wills, R., McGlasson, B., Graham, D., Joyce, D., & Geeson, J. (2007). *Postharvest: An introduction to the physiology and handling of fruit and vegetables* (5th ed.). CABI Publishing.
- Salikhe D K and Kadam SS (1995) *Handbook of fruit science and technology. Production Composition, Storage and processing*. Marcel Decker inc, New York

UNIT IV

- Siddapa, GS (1986) *Preservation of Fruits and Vegetables*, ICAR Publication
- Srivastava, R. P., & Kumar, S. (1998). *Fruit and vegetable preservation: Principles and practices* (3rd ed.). CBS Publishers & Distributors.
- Salikhe D K and Kadam SS (1995) *Handbook of fruit science and technology. Production Composition, Storage and processing*. Marcel Decker inc, New York

Suggested Reading

Handbook of Research on Food Processing and Preservation Technologies (5 Vols) - Eds. Birwal, Goyal, et al. (Taylor & Francis/Apple Academic Press, 2021-2022)

Note: Examination scheme and mode shall be as prescribed by the Examination branch,University of Delhi, from time to time

DISCIPLINE SPECIFIC ELECTIVE COURSE
FOOD PROCESSING TECHNOLOGIES

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical		
Food Processing Technologies	4	2	0	2		Nil

Learning Objectives

- Understand the basic scientific principles governing microbial inactivation and quality changes under different thermal, non-thermal, and low-temperature processing conditions.
- Analyze and determine the critical process parameters (e.g.,F, D, z values; pressure, time, electric field strength) required to achieve specific safety and quality targets.
- Identify the operational mechanics, advantages, and limitations of major food processing equipment used for preservation, concentration, and product transformation (e.g., retort, HPP UNIT, extruder).
- Evaluate the impact of various processing technologies on the nutritional, physicochemical, and sensory attributes of different food commodities.
- Apply the principles of smart processing, automation, and modeling to optimize energy efficiency and quality control in modern food production lines.

Learning Outcomes

The students would be able to:

- Critically differentiate between the mechanisms of microbial inactivation achieved by thermal (Pasteurization, Sterilization) and non-thermal (PEF, HPP) technologies.
- Calculate and validate the thermal process determination parameters (F,D, z values) for safe and effective canning/retort operations.
- Select and justify the appropriate processing technology (e.g., Freeze-drying vs. Dehydration vs. HPP) for a given food product to maximize quality retention and shelf-life.
- Design a simple cold chain management plan and explain the role of freezing kinetics in preserving the quality of frozen products.
- Demonstrate knowledge of how AI and Automation are integrated with emerging technologies (Ohmic, Microwave) to create smart and efficient processing environments.

THEORY
(Credits 2; Hours 30)

UNIT I: Thermal Processing Technologies 8 Hours

This unit focuses on the fundamental principles of heat transfer, microbial death kinetics, and engineering of established preservation, concentration, and product-shaping thermal methods.

- Pasteurization and Sterilization: Batch vs. Continuous systems (HTST, UHT).Effectiveness relative to target microorganisms (e.g., *C. botulinum*).
- Evaporation, Concentration, Dehydration: Single-effect vs. Multiple-effect evaporators. Drying kinetics (constant rate, falling rate periods).Air-drying (tray, fluidized bed), spray drying, drum drying.
- Retort Processing and Canning: Canning process flow sheet. Thermal process determination: D-value (Decimal Reduction Time), z-value (Thermal Resistance Constant), and F-value (Sterilizing Value) calculations.
- Baking and Extrusion Technologies: Principles of baking (heat and mass transfer).Extrusion cooking: Components, mechanics

UNIT II: Non-Thermal Technologies 7 Hours

This unit covers advanced preservation techniques utilizing pressure, electric fields, radiation, and separation methods to achieve microbial inactivation and selective component removal with superior quality retention.

- High-Pressure Processing (HPP): Principles of pressure effects on microbial membranes and enzymes. Equipment, process parameters (pressure, hold time), and applications.
- Pulsed Electric Fields (PEF): Mechanism of electroporation. Electric field strength, pulse width, and treatment time.
- Membrane Technologies (RO, UF, MF, Nano-filtration): Principle of operation (pressure gradient).Membrane pore size, flux, and applications in clarification and concentration.
- Ozone, UV Irradiation, Cold Plasma, Ultrasound: Mechanisms of microbial inactivation for each method, Applications in surface treatment and liquid processing.

UNIT III: Low Temperature Processing Technologies 7 Hours

This unit Explores preservation through temperature reduction, focusing on the physics of chilling and freezing, cold chain management, and the quality implications of ice formation and sublimation.

- Chilling Technology and Cold-Chain Management: Refrigeration cycle basics. Chillers (air blast, hydro-cooling). Importance of Time-Temperature Integrators (TTIs) in the cold chain.

- Freezing Kinetics and Freeze-Drying (Lyophilization): Freezing curves and the zone of maximum ice crystal formation. Impact of freezing rate on ice crystal size and texture. Freeze-Drying: Principle of sublimation, stages (freezing, primary, secondary drying).
- Cryogenic Freezing, IQF, and Thawing: Use of Liquid Nitrogen and CO_2, Individual Quick Freezing (IQF): Fluidized bed technology. Controlled thawing techniques and their effect on drip loss and quality.

UNIT IV: Emerging Processing Technologies 8 Hours

This unit describes the latest volumetric and highly controlled energy delivery technologies and their integration with Industry 4.0 concepts to create adaptive, efficient, and quality-driven smart food manufacturing systems.

- Ohmic Heating and Radiofrequency (RF) Heating: Principle of volumetric heating (Joule effect).Factors affecting conductivity and heating uniformity. Applications in particle-containing fluids.
- Microwave and Infrared Heating: Mechanism of heating. Penetration depth, surface heating, and rapid drying applications.
- Smart Processing: Automation, Modelling, and AI Applications: Process Automation and Sensors: In-line monitoring systems. CFD (Computational Fluid Dynamics) and other modeling techniques for process optimization (e.g., heat/mass transfer). Integration of Artificial Intelligence (AI) and Machine Learning for predictive maintenance, quality sorting, and adaptive control.

PRACTICAL
(Credits 2; Hours 60)

List of Experiments

1. Concept of Heat penetration and determination of F, D, z-values using laboratory retort.
2. Microwaving vs. boiling effect on texture and nutrient retention in vegetables.
3. Dehydration of fruits/vegetables using hot-air and infrared drying; rehydration ratio.
4. Freezing efficiency study using air-blast or household deep freezer: determination of freezing time, drip loss upon thawing, and evaluation of textural changes in selected fruits/vegetables.
5. High-pressure processing simulation using available demonstration tools/software.
6. Membrane filtration for juice clarification and performance efficiency evaluation.
7. FTIR/texture/rheological analysis of raw vs. processed samples.
8. Packaging and shelf-life modelling using water activity and microbiological parameters.
9. Industrial visit or virtual processing simulation & report submission

Essential Readings/ Suggested Readings

UNIT I

- Kent, N. L. (1994). *Technology of cereals* (4th ed.). Pergamon Press.

- Matz A Samuel, *Bakery Technology and Engineering*.
- Food Safety and Standards Authority of India. (2022). Food safety and testing manuals. Government of India.

UNIT II

- Chakraverty, A. (2001). *Post-harvest technology of cereals, pulses and oilseeds* (3rd ed.). Oxford & IBH Publishing Co. Pvt. Ltd.
- Manay, S. and Sharaswamy, M. (1987). Food Facts and Priniciples. Wiley Eastern Publisher.

UNIT III

- Wills, R., McGlasson, B., Graham, D., Joyce, D., & Geeson, J. (2007). *Postharvest: An introduction to the physiology and handling of fruit and vegetables* (5th ed.). CABI Publishing.
- Salikhe D K and Kadam SS (1995) *Handbook of fruit science and technology. Production Composition, Storage and processing*. Marcel Decker inc, New York

UNIT IV

- Siddapa, GS (1986) *Preservation of Fruits and Vegetables*, ICAR Publication
- Srivastava, R. P., & Kumar, S. (1998). *Fruit and vegetable preservation: Principles and practices* (3rd ed.). CBS Publishers & Distributors.
- Salikhe D K and Kadam SS (1995) *Handbook of fruit science and technology. Production Composition, Storage and processing*. Marcel Decker inc, New York

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DISCIPLINE SPECIFIC ELECTIVE COURSE

CLINICAL SPORTS NUTRITION

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical		
Clinical Sports Nutrition	4	2	0	2		**NIL**

Learning Objectives

- To understand the nutritional requirements for athletes with clinical conditions, special conditions and special dietary needs.
- To develop skills for fulfilling dietary considerations for athletes with clinical conditions, special conditions and special dietary needs.

Learning Outcomes

- The competency of providing suitable dietary modifications for various clinical conditions of sports persons.
- Competency of providing guidelines and dietary monitoring of sports persons with various clinical conditions to enable enhanced performance.

THEORY

(Credits 2; Hours 30)

UNIT I: Athletes with Nutrition related disorders **7 Hours**

This unit deals with the nutritional intake of athletes with Diabetes Mellitus, Anemias and gastrointestinal disorders.

- **Diabetes Mellitus:** Problems of athletes with Type-1 diabetes and cardiovascular diseases; Medical Nutrition Therapy (MNT) for athletes with Type-1 diabetes and cardiovascular disease; dietary guidelines and nutrient timing; type of carbohydrate and timing; pre and post event carbohydrate loading and fluids; insulin adjustments for athletes with Type-1

diabetes; special problems for athletes with Type-1 diabetes and cardiovascular disease; complications with poorly controlled diabetes.

- **Anaemias in Sports:** Definition and description; causes and consequences; physiological effects of exercise; pathophysiology; Medical Nutrition Therapy.
- **Athletes with gastrointestinal(GI) disorders, food allergies and food intolerance:** GI disturbance occurring in some athletes before, during and after competition and training; excessive flatulence; abdominal distention; intermittent diarrhoea; constipation; Food Related Adverse Reactions (FRAR); physiological and dietary factors affecting gastric emptying and gut comfort; gut trainability; lower GI tract conditions; Irritable Bowel Syndrome(IBS); low Fermentable Oligosaccharides, Disaccharides, Monosaccharides & Polyols (FODMAP) diet for IBS; Composition, food sources of FODMAP and pattern of consumption; Celiac disease (Diagnosis and treatment); Inflammatory Bowel Disease (IBD)-Diagnosis, Nutrition related concerns for athletes with untreated IBD; Medical Nutrition Therapy.

UNIT II Nutrition for Sports injuries 9 Hours

In this unit students learn about the appropriate nutritional intake of athletes for recovery from injuries and management of paralympic athletes.

- **Sport injury and rehabilitation**: Type of injury and rehabilitation required, physiological and metabolic changes during injury and rehabilitation; eating habits commonly followed during an injury; overweight among injured athletes; role of nutrition and dietary guidelines in recovery from an injury; common injuries among athletes-Maxillofacial fractures, knee injury, Anterior Cruciate Ligament (ACL) tear, Patellofemoral syndrome, Tennis elbow, Ankle sprain, Groin pull, Hamstring sprain.
- **The Paralympic Athlete:** Athletes with physical or intellectual impairments (Classification and associated risk for injury or health outcomes); Body composition assessment and management; Eating difficulties and behaviours observed in some athletes with impairments.
- **Paralympic athletes and nutritional demands:** Dietary intakes and potential issues; reported dietary intakes; fibre timing of food intake and bowel control; fluid intake; medicine requiring Therapeutic Use Exemption (TUE) under World Anti-Doping Agency (WADA); Use of vitamin, mineral or sports supplement; travelling with paralympic athletes.

UNIT III Nutrition for athletes with special dietary needs 8 Hours

This unit explores nutritional challenges for children, female, and vegetarian athletes, focusing on growth, energy needs, and dietary guidelines for performance.

- **Children and adolescent athletes:** Nutritional issues commonly faced; eating habits and addiction; nutritional requirements for growth and training.
- **Female athletes:** Vulnerability to nutrition assault and insufficiency; differences in fuel or nutrient utilisation among female athletes; female athletic triad (FAT) including eating disorder, menstrual irregularity and poor bone mineral density and RED-S (Relative Energy Deficiency in Sport); energy availability-definition and its association with FAT and RED-S; assessment for RED-S; dietary guidelines and suggestions for RED-S; dietary guidelines and suggestions for pregnant and lactating female athletes.
- **Vegetarian athletes:** Classification; nutritional status and dietary considerations; nutritional gaps currently identified and suitable dietary modification for fuelling during training, competitions and traveling.

UNIT IV: Medical and Nutritional Issues for the Travelling Athlete 6 Hours

This unit addresses the nutritional challenges of traveling athletes, focusing on environmental monitoring, food safety, hydration, illness prevention, and adherence to dietary guidelines for optimal performance.

- Nutritional problems often faced by the travelling athletes; monitoring and documentation of climate, time zones, altitude, food safety and availability by the support staff or nutritionist;
- Market surveys and research support for the journey (travel, accommodation, catering, training and event schedules); noting vaccination and existing allergies; hydration and supplements for travel within country and overseas;
- Strategies for meeting dietary guidelines while traveling and follow up.

PRACTICAL

(Credits 2; Hours 60)

1. Planning a diet and important points for counselling for an athlete with:
    - Diabetes Mellitus;
    - Anaemia;

- Food-Related Adverse Reactions;
- Sports injury.

2. Planning a diet and enlisting other important aspects of dietary management of a Paralympic athlete.
3. Planning a diet for vegetarian athletes; enlisting aspects of follow up.
4. Preparing a handout for dietary support during traveling, including fluid intake strategies and.
5. Assessing athletes at risk of eating disorders using EAT -26

Essential Readings

UNIT I

- Burke, Louise, and Vicki Deakin. (2015). *Clinical sports nutrition*. McGraw-Hill.
- Jeukendrup, A., & Gleeson, M. (2019). Sport nutrition (3rd ed.). Human Kinetics.
- Jeukendrup, A. (2017). *Training the gut for athletes*. Sports Science Exchange, 28(165), 1–6.
- Bhatia, T. K., Bhatia, J., & Aryadeep. (2022). *An entity called sports anemia: Does it really exist or is a misnomer: A systematic review of existing literature*. *GMC Patiala Journal of Research and Medical Education*, 5(01), 25–33. https://www.jrme.gmcpatiala.edu.in/index.php/j/article/view/94
- Manna, I. (2020). *Study of iron status of Indian female athletes*. *Journal of Cardiovascular Disease Research*, 11(4). https://jcdronline.org/index.php/JCDR/article/view/1204 Retrieved from https://www.gssiweb.org/en/sports-science-exchange/article/training-the-gut-for-athletes
- Cannata, F., Vadalà, G., Ambrosio, L., Papalia, R., & Napoli, N. (2020). *Nutritional therapy for athletes with diabetes*. *Journal of Functional Morphology and Kinesiology*, 5(4), 83. https://doi.org/10.3390/jfmk5040083 PMC

UNIT II

- Burke, Louise, and Vicki Deakin. (2015). *Clinical sports nutrition*. McGraw-Hill.
- Broad, E. (Ed.). (2014). Sports Nutrition for Paralympic Athletes. CRC Press.
- Chowdhery, A., Agarwal, A., & Saini, A. (2025). *Prevalence of sports injuries among athletes in the Lucknow region: A cross-sectional study*. *Cureus*, 17(8), e90266. https://pubmed.ncbi.nlm.nih.gov/40964569/

UNIT III

- Burke, Louise, and Vicki Deakin. (2015). *Clinical sports nutrition*. McGraw-Hill : Chapter 18, Nutritional issues for young athletes: children and adolescents.

- Burke, Louise, and Vicki Deakin. (2015). *Clinical sports nutrition*. McGraw-Hill : Chapter 24, Special Populations: Section: Travelling Athletes

UNIT IV

- Burke, Louise, and Vicki Deakin. (2015). *Clinical sports nutrition*. McGraw-Hill : Chapter 24, Special Populations: Section: Travelling Athletes

Suggested Reading

- Campbell, B. (Ed.). (2013). Sports nutrition: enhancing athletic performance. CRC Press.
- Larson-Meyer, D. E. (2007). Vegetarian sports nutrition. Human Kinetics.
- Marie Dunford. (2017) Nutrition for Sport and Exercise.
- Jeukendrup, Asker. (2017). Training the Gut for Athletes. Sports Medicine. 47. 10.1007/s40279-017-0690-6.

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DISCIPLINE SPECIFIC ELECTIVE

DOPING, SUPPLEMENTS AND ERGOGENIC AIDS

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical		
Doping, Supplements and Ergogenic Aids	**4**	**3**	**0**	**1**		**NIL**

Learning Objectives

- To gain understanding of the various supplements used for performance enhancement in
- To build knowledge on the drugs used in sports and the nodal bodies for controlling doping.

Learning Outcomes

- Student will gain competence towards guiding the athlete on supplements for sports performance.
- Students will be able to understand doping control practices and assist athletes towards preventing use of banned drugs.

THEORY
(Credits 3; Hours 45)

UNIT I: Doping in Sports **12 Hours**

This unit develops a basic understanding of Drugs used for performance enhancement and the Basic Acts for protection

- Doping in sports: Definition of Doping
- Categories of banned drugs in sports
- Anti-doping framework
- Role of WADA and NADA

UNIT II: Ergogenic Aids and Macronutrient Supplements 10 Hours

This unit deals with Usage of Macro-nutrients as supplements for performance enhancement in Sports.

- **Dietary supplements:** Definition and classifications; Ergogenic aids: Definitions and Classifications; Dietary Supplement Health and Education Act of 1994; Government Protections from Dietary Supplement Hazards and Risks;
- **Carbohydrate Supplements:** Carbo-loading, Sports Drinks, Bars and Gels.
- **Fat Supplements:** Omega Fatty acids, Medium Chain Triglycerides, Fish Oils.

UNIT III: Micronutrient Supplements for performance enhancement 11 Hours

In this unit students will gain knowledge on the usage of Micro-nutrients as supplements for performance enhancement in Sports.

- **Vitamin Supplements:** B-Complex Vitamins, Vitamin C, Vitamin D, Vitamin E Supplements, Multi-Vitamin Supplements.
- **Mineral Supplements:** Calcium-Magnesium, Iron Supplements, Chromium, Zinc.
- **Antioxidants Supplements:** Endogenous and Exogenous Antioxidant Supplements.

UNIT IV: Metabolite and Botanical Ergogenic Supplements 12 Hours

In this unit students learn about various botanical supplements used for performance enhancement and the common metabolites in use by athletes to gain performance.

- **Botanical Ergogenic Supplements:** Wheat Germ oil, Beetroot, Green Tea Extract, Tart Cherries, Caffeine, Curcumin, Phytosterols, Bio Flavonoids, Ashwagandha, Trifla, Rhodiola, Shilajit, Ginseng, Grape Seed Extract, Resveratrol, Chyawanprash, Herbal Testosterone-Boosters (Eg. Tribulus Terristris, Nettle Root, Long Jack Root Etc), Bitter Orange (Citrus aurantium), Capsaicin, White Kidney Bean (Phaseolus vulgaris), Garcinia Cambogia (Hydroxycitric Acid), Guar Gum, and Psyllium, Glucomannan.
- **Metabolite Ergogenic Supplements:** Beta-Alanine, L-Carnitine Co Enzyme Q 10, Creatinine, DHEA, NADH, Glycerol, Inosine, Melatonine, Gamma Oryzanol (Ferurates), Glucosania, Alcohol, Adoptogens, Alkalinizers, Androstenedione, HMB.

PRACTICAL

(Credit 1; Hours 30)

1. Market survey of supplements available in Indian market for performance enhancement
2. Development and standardisation of a sports bars or meal replacement bars.

3. Composition and brand names of supplements that improve Muscle mass commonly available in the market and role of nutrients listed in athletic performance.
4. Composition and brand names of Carbohydrate supplements; Protein supplements; Fat supplements; Micronutrient-supplements; metabolite supplements; and botanical supplements commonly available in the market.
5. Planning a diet for strength athletes with supplements for muscle building.
6. Planning a diet for endurance athletes with supplements for energy and micronutrients.
7. Providing diet for clinical conditions with supplement usage (Planning the type, quantity and timing of supplement intake).

Essential Readings

UNIT I:

- Sharma, S. K., et al. (2024). *Examining doping violations among Indian women in sports*. *ShodhKosh: Journal of Visual and Performing Arts*, 5(1). Retrieved from https://www.granthaalayahpublication.org/Arts-Journal/ShodhKosh/article/view/5114 Granthaalayah Publication

- *A critical analysis of the impact of doping in sports domain*. (2021). *International Journal of Law Management & Humanities*. Retrieved from https://ijlmh.com/paper/a-critical-analysis-of-the-impact-of-doping-in-sports-domain/

- World Anti-Doping Agency. (2025). *The Prohibited List*. https://www.wada-ama.org/en/resources/world-anti-doping-code-and-international-standards/prohibited-list
- Pal, Atul. (2025). A review of doping in sports: India and the world. Sports law, policy & diplomacy journal. 3. 71-88. 10.30925/slpdj.3.1.5.
- WADA official website https://www.wada-ama.org/en

UNIT II:

- TrueSport. (n.d.). *Nutrition Guide: Fueling for performance* [PDF]. TrueSport / U.S. Anti-Doping Agency (USADA). https://learn.truesport.org/wp-content/uploads/Nutrition-Guide.pdf
- Antonio, J., Kalman, D., Stout, J. R., Greenwood, M., Willoughby, D. S., & Haff, G. G. (2008). *Essentials of sports nutrition and supplements*. Humana Press

UNIT III:

- Maughan, R. J. (Ed.). (2008). Nutrition in sport (Vol. 7). John Wiley & Sons.

UNIT III:

- Vedula G.S., Dietary Supplements and Nutraceuticals (pdf from ResearchGate) 2025. Publisher: Notion Press; ISBN: 9798897247493

UNIT IV:

- Castell, L. M., Stear, S. J., & Burke, L. M. (Eds.). (2015). *Nutritional supplements in sport, exercise and health: An A-Z guide* [PDF]. Retrieved from https://vdoc.pub/documents/nutritional-supplements-in-sport-exercise-and-health-an-a-z-guide-5np38amoqp70
- Maughan, R. J., et al. (2018). *Herbal medicine for sports: A review*. *Journal of the International Society of Sports Nutrition, 15*, Article 14. https://jissn.biomedcentral.com/articles/10.1186/s12970-018-0218-y
- Slater, G., & Jenkins, D. (2006). *Dietary supplements and sports performance: Metabolites, constituents, and extracts*. *Journal of the International Society of Sports Nutrition, 3*, Article 2. https://jissn.biomedcentral.com/articles/10.1186/1550-2783-3-2-1

Suggested Readings

- Ryan, M. (2012). Sports nutrition for endurance athletes. Velo Press.
- Raven, P., Wasserman, D., Squires, W., & Murray, T. (2012). Exercise Physiology: An Integrated approach. Nelson Education.
- Ehrman, J. K., Kerrigan, D., & Keteyian, S. (2017). Advanced Exercise Physiology: Essential Concepts and Applications. Human Kinetics.
- McArdle, W. D., Katch, F. I., & Katch, V. L. (2015). Exercise physiology: nutrition, energy, and human performance. 8th Edition, Lippincott Williams & Wilkins.

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COURSE IN RESEARCH METHODOLOGY

TECHNIQUES OF RESEARCH WRITING

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Pre-requisite of the Course
		Lecture	Tutorial	Practical		
Techniques of Research Writing	2	2	0	0	As per admission policy	Should have studied Advanced Research Methodology and Tools for Research

Learning Objectives

- Comprehend and apply principles of academic writing for research
- Understand the concept of plagiarism and adopt strategies to avoid plagiarism.
- Learn and use different citation styles and effectively utilize reference management tools.
- Outline the process of writing, publishing, and presenting research.
- Avoid common errors in academic writing.

Learning Outcomes

After completing the course, students will be able to:

- Structure and organize major scholarly works according to disciplinary standards.
- Master the principles of academic writing and non-plagiaristic expression.
- Employ visualization techniques to effectively communicate complex research findings and data patterns.
- Apply citation styles and formatting requirements meticulously to produce publication-ready manuscripts.

THEORY
(Credits 2; Hours 30)

UNIT I: The Foundations and Structure of a Research Manuscript 18 Hours

This unit covers the essentials of clear, concise, and formal academic writing, ethical practices including plagiarism avoidance, effective idea organization, and responsible use of AI tools in research. This unit also guides students through crafting a complete research manuscript, including introduction, methodology, results, discussion, and conclusions, with emphasis on accurate data presentation, visualization, and proper manuscript formatting.

- Academic Writing principles and organization of ideas
- Plagiarism types, use of plagiarism-checking software & interpretation of plagiarism reports.
- Academic writing frameworks: IMRAD (Introduction, Methods, Results, Discussions) Structure and the TEEC (Topic sentence, Evidence, Explanation, Conclusion) Structure
- Ethical use of AI in academic writing
- Data Visualization: Principles, Types and Tools

UNIT II: Citation, Reference Management, Publication and Presentation of Research 12 Hours

The unit focuses on mastering citation styles, managing references using software tools, and conducting efficient literature searches using databases and advanced search strategies. The unit further explores journal selection, ethical publishing practices, research paper writing, and the creation and delivery of effective presentations and posters for diverse academic audiences.

- Citation Management & formatting guidelines: Detailed application of specific styles (e.g., APA 7th, MLA, Chicago, Vancouver), managing in-text citations, citation index.
- Reference Management Software (RMS): Zotero, Mendeley and other citation tools; searching specialized databases (e.g., Scopus, Web of Science, ScienceDirect);
- Databases and Search Strategy- Key search terms, Boolean operators, PRISMA diagram
- Types and Selection of Journals: Predatory journals, Cloned journals; Open access and Paid Journals; Impact Factor and other metrics of Journals
- Research Paper writing and publishing in peer-reviewed journals, understanding journal-specific guidelines.
- Formulating and Presenting a Research Poster

- Presentation Skills: Creating effective slides, summarizing complex findings for different audiences, and managing Q&A sessions.

Essential Readings:

UNIT 1

This unit introduces the essential principles of scholarly writing required for academic research. It focuses on developing clarity, precision, and coherence in written work while maintaining an appropriate academic tone. This unit also familiarizes students with accurate citation practices and systematic reference management in academic writing. Further, the unit covers the correct presentation of tables, figures, and overall manuscript formatting in line with journal and institutional requirements. Students will gain practical skills necessary for producing professionally structured research documents.

- American Psychological Association. (2020). *Plagiarism* (7th ed.). APA Style. https://apastyle.apa.org/style-grammar-guidelines/citations/plagiarism
- American Psychological Association. (2020). *Sample tables* (7th ed.). APA Style. https://apastyle.apa.org/style-grammar-guidelines/tables- figures/sample-tables
- American Psychological Association. (2023). *Citing generative AI in APA Style: Part 1—Reference formats*. APA Style Blog. https://apastyle.apa.org/blog/cite-generative-ai-references
- Thomas, C. George (2021) Research Methodology and Scientific Writing (2nd ed.) Springer Nature

UNIT II

This unit focuses on the organization and presentation of a complete research report/document. Students will learn how to write each section of a research manuscript clearly and logically. The unit focusses on the processes involved in publishing and presenting research work. It covers the selection of appropriate journals, awareness of unethical publishing practices, the basics of writing for peer-reviewed publications, effective research presentation skills, including poster preparation and oral presentations

- American Psychological Association. (2020). *Response to reviewers* (7th ed.). APA Style. https://apastyle.apa.org/style-grammar-guidelines/research-publication/response-reviewers
- American Psychological Association. (2020). *Heading levels* (7th ed.). APA Style. https://apastyle.apa.org/style-grammar-guidelines/paper- format/heading-levels
- Hamilton College. (n.d.). *How to write an APA research paper*. https://www.hamilton.edu/academics/centers/writing/writing-resources/how-to-write-an-apa-research-paper

- Montclair State University. (2021). *How to prepare your dissertation in APA Style*. https://www.montclair.edu/graduate/wp-content/uploads/sites/58/2021/01/DISSERTATION-GUIDELINES-FOR-APA-STYLE-1-2021.pdf
- Tullu, M. S., & Karande, S. (2017). *Writing a model research paper: A roadmap*. *Journal of Postgraduate Medicine*, *63*(3), 143–146. https://doi.org/10.4103/jpgm.JPGM_325_17

Suggested Readings:

- AME Publishing Company. (2022). *Discussion and conclusion*. https://cdn.amegroups.cn/journals/vats/files/journals/27/articles/4955/public/4955-PB1-8866-R1.pdf?filename=amj-04-26.pdf
- McLeod, S. (2023). *How to write a methods section for a psychology paper*. Very well Mind. https://www.verywellmind.com/how-to-write-a-method- section-2795726

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