UNIVERSITY OF DELHI

University of Delhi

Faculty of Science

Department of Home Science

1-Year M.Sc. Food and Nutrition Coursework 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 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
- Apply theoretical concepts and practical training for research in the field of food science, clinical nutrition and public health nutrition

Program Structure 1: M.Sc. FN : Coursework Track

Semester	Core Courses		Elective Courses		Skill Based Courses		Total Credits
	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	
I	2	8	3	12	1	2	**22**
II	2	8	3	12	1	2	**22**
Total Credits for the Course	**16**		**24**		**4**		**44**

List of Courses to be offered to students opting for Structure-1 (Coursework) 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	Analytical Techniques and Instrumentation	2	0	2	4
Discipline Specific Core Course	DSC 2	I	Nutritional Epidemiology	3	0	1	4
Discipline Specific Elective Course	DSE 1	I	Statistics and Data Management (From the common Home Science pool)	As per the specific course			4
Discipline Specific Elective Course	DSE 2	I	Medical Nutrition Therapy	As per the specific course			4
Discipline Specific Elective Course	DSE 3	I	Institutional Food Service management Social and Cultural Aspects in Public Health Nutrition Improving Maternal, Infant, Young Child and Adolescent Nutrition Animal Products Processing and Preservation Unit Operations in Food Processing Exercise, Nutrition and Metabolism Sport-Specific Nutrition	As per the specific course			4
General Elective Course (*Can be opted for in place 1 DSE course)	GE 1	I	Parenting in Contemporary India Resources and Sustainability Organisational Communication: Tools and Techniques Lifestyle Modifications for Optimal Health Community Nutrition Assessment Dyeing and Printing with Natural Dyes Appreciation of Indian Textiles	As per the specific course			4
Skill Based Course	SBC 1	I	Nutrition Screening and Assessment	0	0	2	2

			Food Business Management Internship-1				
SEMESTER II							
Discipline Specific Core Course	DSC 3	II	Food Product Development and Quality Evaluation	2	0	2	4
Discipline Specific Core Course	DSC 4	II	Nutrition Communication and Health Promotion	3	0	1	4
Discipline Specific Elective Course	DSE 4	II	Precision Nutrition Challenges in Clinical Nutrition	As per the specific course			4
Discipline Specific Elective Course	DSE 5	II	Nutritional Care of the Elderly	As per the specific course			4
Discipline Specific Elective Course	DSE 6	II	Programme Planning in Public Health Nutrition Plant Products Processing and Preservation Food Processing Technologies Clinical Sports Nutrition Doping, Supplements and Ergogenic Aids	As per the specific course			4
General Elective Course (*Can be opted for in place 1 DSE course)	GE 2	II	Parenting in Contemporary India Resources and Sustainability Organisational Communication: Tools and Techniques Lifestyle Modifications for Optimal Health Community Nutrition Assessment Dyeing and Printing with Natural Dyes Appreciation of Indian Textiles	As per the specific course			4
Skill Based Course	SBC 2	II	Nutrition and Health Data Visualisation Scientific Writing Skills	0	0	2	2

			Intellectual Property Rights Bioinformatics for Food and Nutrition Internship-2				

List of PGCF courses of M.Sc. Food and Nutrition (Coursework) (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

Pool of General Elective Courses offered by the Department of Home Science				
	Credits for each Course			
	Theory	Tutorial	Practical	Total
i. Parenting in Contemporary India	3	1	0	4
ii. Resources and Sustainability	3	1	0	4
iii. Organisational Communication: Tools and Techniques	3	1	0	4
iv. Lifestyle Modifications for Optimal Health	3	1	0	4
v. Community Nutrition Assessment	3	1	0	4
vi. Dyeing and Printing with Natural Dyes	3	0	1	4
vii. Appreciation of Indian Textiles	3	1	0	4
Pool of Skill Based Courses offered in Semester I				
	Credits for each Course			
	Theory	Tutorial	Practical	Total
i. Nutrition Screening and Assessment	0	0	2	2
ii. Food Business Management	0	0	2	2
iii. Internship-1	0	0	2	2
Pool of Skill Based Courses offered in Semester II				
	Credits for each Course			
	Theory	Tutorial	Practical	Total
iv. Nutrition and Health Data Visualisation	0	0	2	2
v. Scientific Writing Skills	0	0	2	2
vi. Intellectual Property Rights	0	0	2	2
vii. Bioinformatics for Food and Nutrition	0	0	2	2
viii. Internship-2	0	0	2	2

SEMESTER -I

DISCIPLINE SPECIFIC CORE COURSE
Analytical Techniques and Instrumentation

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		
Analytical Techniques and Instrumentation	**4**	**3**	**0**	**1**		**Nil**

Learning Objectives:

- To understand the fundamental principles, instrumentation, and working mechanisms of major spectroscopic techniques, including UV–Visible spectroscopy, CD spectroscopy, fluorescence spectroscopy, AAS, and flame photometry.
- To develop conceptual and practical knowledge of centrifugation techniques, including sedimentation behavior, types of centrifuges, and their applications in biomolecule separation.
- To understand the principles and operational methods of major chromatographic techniques such as paper chromatography, TLC, ion exchange, molecular sieve, affinity, reverse phase chromatography, HPLC, and FPLC.
- To learn the principles of electrophoretic separation and gain familiarity with techniques such as PAGE (native), SDS-PAGE, agarose gel electrophoresis, isoelectric focusing, and 2-D gel electrophoresis.
- To acquire basic understanding of mass spectrometry, MALDI-TOF, NMR, DSC, and XRD, along with their applications in structural and functional analysis of biomolecules.
- To develop laboratory skills in buffer preparation, spectrophotometric analysis, chromatographic separations, protein estimation, and electrophoretic techniques.

Learning Outcomes:

- Students will understand the principles, instrumentation, and analytical applications of major spectroscopic, electrophoretic, and mass-based techniques.
- Students will be able to apply centrifugation and chromatography methods for separation, purification, and characterization of biomolecules.
- Students will interpret analytical data generated from UV-Vis, fluorescence, CD, AAS, chromatography, electrophoresis, MS, NMR, DSC, and XRD techniques.
- Students will perform key laboratory procedures including buffer preparation, λmax determination, protein estimation, chromatographic separation, and SDS-PAGE.
- Students will develop technical competence and analytical reasoning required for

biochemical and biotechnological laboratory investigations.

THEORY
(Credits 3; Hours 45)

UNIT I: Spectroscopic Techniques 9 Hours

In this unit students will learn about principles and working of key spectroscopic techniques

- Principle and working of UV-visible absorption spectrophotometry, Beer-Lambert law, Applications of UV-visible absorption spectrophotometry,
- Working and Applications of CD-spectroscopy
- Fluorescence spectrophotometry and its applications
- Atomic Absorption Spectroscopy
- Flame Photometry.

UNIT II: Separation Techniques- Centrifugation & Chromatography 11 Hours

In this unit students will learn about principles and application of centrifugation and chromatography

- Principle of centrifugation, Sedimentation coefficient, Factors affecting sedimentation, Various types of centrifuges: Analytical ultracentrifugation, Differential centrifugation, Density gradient centrifugation- Zonal and isopycnic, Application of centrifugation.
- Introduction to chromatography, Principles and applications of Paper Chromatography, Thin Layer Chromatography, Ion Exchange Chromatography, Molecular Sieve Chromatography and Affinity Chromatography, Reverse Phase Chromatography, High Performance Liquid Chromatography (HPLC), Fast Protein Liquid Chromatography (FPLC).

UNIT III: Electrophoresis 4 Hours

In this unit students will learn about principles and application of electrophoresis

- Principle of electrophoresis
- Polyacrylamide gel electrophoresis (Native)
- SDS PAGE
- Agarose gel electrophoresis
- Isoelectric focusing of proteins
- 2-D Gel electrophoresis and its application.

UNIT IV: Mass Spectrometry 6 Hours

In this unit students will learn about principles and application of Mass spectrometry

- Principle and applications of mass spectrometry
- MALDI-TOF
- Nuclear magnetic resonance (NMR)
- Differential scanning calorimetry (DSC)
- X-ray diffraction (XRD).

PRACTICAL
(Credits 1; Hours 30)

1. Preparation of acidic and basic buffer.
2. Determination of absorption maxima (λmax).
3. Estimation of protein concentration by UV and Biuret method.
4. Preparation of cell free extract.
5. Separation of amino acid acids by TLC/paper chromatography.
6. Separation of proteins by Gel filtration chromatography/Ion-exchange chromatography.
7. Demonstration of SDS-PAGE.

Essential Readings:

UNIT I

- Kemp, W. (2022). *Organic spectroscopy*. Bloomsbury Publishing India Pvt. Ltd.; ISBN: 9789394701250.
- Freifelder, D. (1982) *Physical Biochemistry: Applications to Biochemistry and Molecular Biology*, (2 nd ed.), W.H. Freeman and Company (New York); ISBN:0-7167- 1315-2 / ISBN:0-7167-1444-2.
- Mohan, J. (2009). *Organic spectroscopy: principles and applications*. Narosa Publishing House; ISBN: 978-8173195662.

UNIT II

- Katoch, R. (2011). *Analytical techniques in biochemistry and molecular biology*. Springer Science & Business Media.; ISBN: 978-1-4419-9784-5.
- Wilson, K. & Walker J (2010) *Principles and Techniques of Biochemistry and Molecular Biology*, (7 th ed.), Cambridge University Press; ISBN: 978-0-521-51635-8.
- Boyer, R. F. (2012) *Biochemistry Laboratory: Modern Theory and Techniques*, (6 th ed.), Boston, Mass: Prentice Hall; ISBN-13: 978-0136043027.

UNIT III

- Katoch, R. (2011). *Analytical techniques in biochemistry and molecular biology*. Springer Science & Business Media.; ISBN: 978-1-4419-9784-5.
- Wilson, K. & Walker J (2010) *Principles and Techniques of Biochemistry and Molecular Biology*, (7 th ed.), Cambridge University Press; ISBN: 978-0-521-51635-8.
- Boyer, R. F. (2012) *Biochemistry Laboratory: Modern Theory and Techniques*, (6 th ed.), Boston, Mass: Prentice Hall; ISBN-13: 978-0136043027.

UNIT IV

- Shah, V., Patel, T., & Patel K. (2025) *Instrumental Methods of Analysis*, Shaswat Publication; ISBN: 978-93-6087-858-0.
- Kemp, W. (2022). *Organic spectroscopy*. Bloomsbury Publishing India Pvt. Ltd.; ISBN: 9789394701250.
- Mohan, J. (2009). *Organic spectroscopy: principles and applications*. Narosa Publishing House; ISBN: 978-8173195662.

Suggested Readings:

- Cooper, T. G. (2011) *The Tools of Biochemistry* (2nd ed.), Wiley-Interscience Publication (New Delhi); ISBN: 13:9788126530168.
- Plummer D. T., (2015) *An Introduction to Practical Biochemistry*. 3rd ed., Tata McGraw Hill

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

DISCIPLINE SPECIFIC CORE COURSE
NUTRITIONAL EPIDEMIOLOGY

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 Epidemiology	4	3	0	1		Nil

Learning Objectives

- To understand the basic epidemiological concepts and their application in nutritional epidemiology.
- To understand the principles of disease causation with emphasis on modifiable environmental factors including dietary factors.
- To comprehend the effect of measures of dietary exposure and nutrition related health outcomes on determination of diet-disease relationship.
- To understand the application of epidemiology in prevention of disease and promotion of health through nutrition.

Learning Outcomes

The students would be able to:

- Illustrate the epidemiological approach to defining and measuring occurrence of nutrition and health related conditions in population
- Describe major study designs in nutritional epidemiology and select an appropriate design for addressing a study question.
- Explain implication of study design and methods of diet and nutritional status assessment in interpreting studies in nutritional epidemiology
- Develop tool(s) for assessment of any specific dietary exposure in a population group
- Demonstrate the knowledge of epidemiological approach to causation
- Explain the role of epidemiological research in improving health and nutritional status

THEORY
(Credits 3; Hours 45)

UNIT I: Basic Concepts and Methods in Epidemiology **13 Hours**

This unit deals with principles of epidemiology and epidemiological methods. It focuses on various study designs as well as potential errors in epidemiological studies.

- Definition, scope and purpose of epidemiology

- Basic measurements in epidemiology-Measurement of mortality, morbidity and disability - rates, ratios and proportions
- Epidemiologic study methods- design, steps in conducting the studies, data analysis and interpretation
  - Observational epidemiology- descriptive and analytical studies - ecological, cross sectional, case-control and cohort
  - Experimental epidemiology- experimental and quasi experimental trials, randomized control trials, field trials and community trials
- Association and causation in epidemiology
- Potential errors in epidemiologic studies
  - Sampling and non-sampling errors
  - Sources of measurement errors
- Precision and validity of measurements in epidemiology

UNIT II: Epidemiologic Approaches to Diet-Disease Relationships 17 Hours

This unit highlights the epidemiological principles in understanding role of nutrition in human health and/or disease. It also deals with the role of gene-diet interactions in understanding diet-disease relationships.

- Introduction to nutritional epidemiology: Definition, scope and significance of nutritional epidemiology in public health nutrition.
- Nature of dietary variation, measuring diet-disease associations- Type of measurement, time trends, correlation and regression, risk assessment
- Design of nutritional epidemiological studies, strengths and weaknesses of various designs in estimation of diet disease-relationships and their interpretation.
- Genetics in nutritional epidemiology- genetic variation and epigenetics in nutritional epidemiology- Gene diet interactions.
- Ethical aspects of research in nutritional epidemiology.

UNIT III: Exposures in Nutritional Epidemiology 12 Hours

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

- Nutritional exposures- Relevant direct and indirect measures of nutritional assessment
  - Critical review of diet assessment methods- assessment of food consumption at different levels, measurement errors, strengths and limitations, reproducibility and validity of methods measuring food consumption of individuals- 24 dietary recall, diet record and food frequency methods, analysis of dietary patterns.

  Analysis and interpretation of dietary data.
  - 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 for risk assessment.
- Critical review of measures of physical activity: Strengths and weaknesses of subjective and objective assessment methods.

UNIT IV: Role of Epidemiological Research in Development of Nutrition Related Policies and their Evaluation 03 Hours

This unit highlights the role of nutritional epidemiology in generating evidence for nutrition related policies and programs to improve health and wellbeing of populations.

- Use of epidemiological research data for improvement of nutrition and health interventions or national programmes.

PRACTICAL
(Credits 1; Hours 30)

1. 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
2. Determine reliability and validity of an assessment tool
3. Estimate measurement error in anthropometric data
   - Interpret anthropometric data available from national and regional surveys
4. Review and document the changes in nutrition and health problems in vulnerable groups of the population in the last decade using secondary data (Indicators of mortality, morbidity, disability and nutritional status).

Essential Readings

UNIT I

- Bonita, R., Beaglehole, R., Kjellström T. (2006) Basic Epidemiology, 2nd Edition, WHO, 2006 http://whqlibdoc.who.int/publications/2006/9241547073_eng.pdf
- Park, K. (2025). Park's textbook of preventive and social medicine (28th ed.). Banarsidas Bhanot Publishers
- 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 II

- Willett, W. (2013). Nutritional Epidemiology, Third Edition, Oxford University Press.
- Gibson, R. S. (2005). Principles of Nutritional Assessment. 2nd ed. Oxford University Press, Oxford, UK.
- Edelstein, S. (2023). Community and public health nutrition (5th ed.). Jones & Bartlett Learning.

UNIT III

- Willett, W. (2013). Nutritional Epidemiology, Third Edition, Oxford University Press.
- Gibson, R. S. (2005). Principles of Nutritional Assessment. 2nd ed. Oxford University Press, Oxford, UK.

- Buttriss, J. L., Welch, A. A., Kearney, J. M., & Lanham-New, S. A. (Eds.). (2017). Public health nutrition (2nd ed.). Wiley Blackwell.

UNIT IV

- Willett, W. (2013). Nutritional Epidemiology, Third Edition, Oxford University Press.
- Barth, M. M., Bell, R. A., & Grimmer (Somers), K. (Eds.). (2020). Public health nutrition: Rural, urban, and global – Community-based practice. Springer Publishing Company.
- 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.
- NITI Aayog. (2017). National nutrition strategy: Nourishing India. Government of India.

Suggested Readings:

- Moon, G., Gould, M. (2000). Epidemiology: An Introduction. Philadelphia, Open University Press
- Langseth L. (1996). Nutritional Epidemiology: Possibilities and Limitations. Washington DC, ILSI Press.
- Gordis L. Epidemiology. 5th ed. Philadelphia, PA: Saunders Elsevier, 2013
- Aschengrau A., Seage G.R. (2014) Essentials of Epidemiology in Public Health. 3rd ed. Sudbury, MA: Jones & Bartlett.
- Gibney, M.J., Margetts, B.M., Kearney, J.M., Arab, L. (Eds) (2004) Public Health Nutrition. NS Blackwell Publishing
- **Alive & Thrive. (n.d.).** How to: A guide to effective nutrition advocacy. Alive & Thrive. https://www.aliveandthrive.org/en/resources/guidance-on-effective-nutrition-advocacy
- **1,000 Days. (n.d.).** The International Coalition for Advocacy on Nutrition (ICAN). 1,000 Days. https://thousanddays.org/ican/
- 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
- 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
- International Institute for Population Sciences (IIPS), National Programme for Health Care of Elderly (NPHCE), 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.
- Longvah, T., Ananthan, R., Bhaskarachary, K., & Venkaiah, K. (2017). Indian food composition tables. National Institute of Nutrition, Indian Council of Medical Research.

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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 introduces 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.).

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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 UNITs
- 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).

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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.

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

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, communit 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/ Suggested 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.

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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

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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SEMESTER -II

DISCIPLINE SPECIFIC CORE COURSE

Food Product Development and Quality Evaluation

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 Product Development and Quality Evaluation	4	**2**	**0**	**2**		NIL

Learning Objectives

- To impart advanced knowledge of food product innovation and systematic quality evaluation
- To ensure understanding of the New Product Development process, prototype creation, sensory/physicochemical analysis, and lifecycle management

Learning Outcomes

Upon successful completion of this course, the student will be able to

- Explain New Product Development concepts and major development stages
- Critically assess product screening, concept testing, and commercialization strategies
- Apply sensory, physicochemical, and regulatory quality evaluation methods
- Interpret feedback, consumer studies, and post-launch improvements

THEORY
(Credits 2; Hours 30)

UNIT I: Concepts and Fundamentals of New Product Development 8 Hours

This unit explores key definitions, objectives, product types, and foundational drivers of innovation in the food industry

- Definitions, scope, importance of NPD in food industry
- Types of new products: line extensions, "me-too" products, novel, functional, and health-oriented foods
- Product innovation drivers: consumer trends, technology, sustainability, regulatory environment
- Overview of global and Indian practices.

UNIT II: Stages and Strategies in Food Product Development 8 Hours

This unit covers the complete new product development process, from ideation to market launch, including reasons for product failure and lifecycle management

- The steps in NPD process: Idea generation, screening, concept development and testing, business analysis, product development, market testing, commercialization
- Integrated R&D and market approaches
- Causes of product failure, Case studies of success and failure.

UNIT III: Physicochemical and sensory evaluation 7 Hours

This unit explores sensory evaluation techniques and instrumental analyses to ensure food product safety, quality, and consumer acceptance through integrated regulatory and shelf-life assessment.

- Sensory methods: descriptive, discrimination
- Application in product development and market validation

UNIT IV: Safety and Shelf Life evaluation 7 Hours

- Instrumental methods, regulatory standards, shelf-life testing
- Product life cycle strategies and consumer feedback

PRACTICAL
(Credits 2; Hours 60)

- Develop a food prototype by selecting ingredients and employing a staged development approach.
- Standardize the recipe and systematically record all process modifications.
- Conduct sensory evaluation and perform physicochemical quality assessments and shelf-life.

- Compile a comprehensive product detailing market positioning and strategies for consumer acceptance.
- Prepare a project report on food product development and quality evaluation

Essential Reading

UNIT I

- Fuller, G. W. (2005). *New food product development* (2nd ed.). CRC Press.
- Moskowitz, H. R., Saguy, I. S., & Straus, T. (2009). *An integrated approach to new food product development*. CRC Press.

UNIT II

- Fuller, Gordon W. (2005). *New Food Product Development*, 2nd Edition, CRC Press, Boca Raton, Florida.
- Moskowitz, H. R., Saguy, I. S., & Straus, T. (2009). *An integrated approach to new food product development*. CRC Press.
- Moskowitz, H. R., Beckley, J. H., & Resurreccion, A. V. A. (2012). *Sensory and consumer research in food product design and development* (2nd ed.). Wiley-Blackwell.
- Stone, H., Bleibaum, R. N., & Thomas, H. A. (2020). *Sensory evaluation practices* (5th ed.). Academic Press.

UNIT III

- Moskowitz, H. R., Beckley, J. H., & Resurreccion, A. V. A. (2012). *Sensory and consumer research in food product design and development* (2nd ed.). Wiley-Blackwell.
- Stone, H., Bleibaum, R. N., & Thomas, H. A. (2020). *Sensory evaluation practices* (5th ed.). Academic Press.

UNIT IV

- Fuller, Gordon W. (2005). *New Food Product Development*, 2nd Edition, CRC Press, Boca Raton, Florida.
- Moskowitz, H. R., Saguy, I. S., & Straus, T. (2009). *An integrated approach to new food product development*. CRC Press.
- Moskowitz, H. R., Beckley, J. H., & Resurreccion, A. V. A. (2012). *Sensory and consumer research in food product design and development* (2nd ed.). Wiley-Blackwell.

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

DISCIPLINE SPECIFIC CORE COURSE
NUTRITION COMMUNICATION AND HEALTH PROMOTION

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		
Nutrition Communication and Health Promotion	4	3	0	1		Nil

Learning Objectives

- To understand the concept of Dietary Guidelines and their relevance.
- To understand the determinants of food behavior and various models of behaviour change.
- To gain insight about planning, implementing and evaluating behaviour change communication for promotion of nutrition and health among vulnerable groups.
- To get exposure about nutrition advocacy and ethical considerations in nutrition communication.

Learning Outcomes

The students would be able to:

- Learn about the dietary guidelines of various countries and their relevance.
- Describe the inter-relationship between nutrition and health behaviour and apply various models of health behaviour in planning social and behaviour change strategy
- Learn and apply the concept of social and behaviour change communication and explain the principles of ethics in nutrition and health communication.
- Develop an understanding of the concept of nutrition advocacy.

THEORY
(Credits 3; Hours 45)

UNIT I: Dietary guidelines for nutrition and health related concerns 08 Hours

This unit lays thrust on the significance of national and international dietary guidelines in shaping public health strategies, while fostering a critical understanding of their strengths, limitations, and evolving relevance.

- National and international guidelines and their role in nutrition promotion.

- Critical appraisal of the current guidelines.

UNIT II: Nutrition and behaviour inter-relationship 07 Hours

This unit highlights the vital connection between food habits and overall health behaviour, drawing on established models and theories that explain how individuals make nutrition-related decisions. It further emphasizes a range of intervention strategies aimed at promoting healthy eating, incorporating both ecological approaches and individual-level behaviour change techniques.

- Food and health behaviour, models/ theories of health behaviour, strategies for intervention at the ecological and individual level

UNIT III: Social and Behaviour Change Communication for Nutrition and Health Promotion and ethics in SBCC 22 Hours

This unit deals with the fundamental concepts and objectives of communication for behaviour change, various approaches for nutrition and health promotion such as social mobilization and social marketing, and the planning and implementation of communication strategies aimed at promoting positive social and behavioural outcomes. It also focuses on designing effective training strategies for capacity building of trainers and provides an overview of the evaluation of social and behaviour change communication programmes. This unit also covers the crucial role of ethics in nutrition and health communication, emphasizing the responsibility of professionals to share accurate, respectful, and evidence-based information while navigating key ethical principles and contemporary concerns.

- Concept and objectives of nutrition communication for behaviour change.
- Approaches for nutrition and health promotion: Social Mobilization, Social Marketing, process etc.
- Planning of communication strategies for social and behaviour change programme.
- Designing training strategies for trainers and their capacity building.
- Implementing social and behaviour change communication intervention: an overview.
- Evaluation of social and behaviour change communication programmes.
- Significance of ethics in nutrition and health communication.
- Ethical Principles and concerns

UNIT IV: Nutrition Advocacy 08 Hours

This unit provides a comprehensive understanding of advocacy in the field of nutrition, focusing on its meaning, various types, and the tools and techniques used to influence public policies. It further highlights the vital role of advocacy in nutrition policy formulation and guides learners in the preparation of effective policy briefs.

- Meaning, types, tools and techniques and advocacy planning.
- Role of advocacy in nutrition policy formulation, preparation of policy briefs.

PRACTICAL
(Credits 1; Hours 30)

1. Formulate appropriate key messages to create awareness on feeding/diet related practices based on DGI in a vulnerable population group.

2. Design a suitable communication aid to creating awareness on healthy diet and lifestyle related practices among an identified vulnerable population group and pre-test the same.
3. Prepare one infographic on nutrition related health concern among the identified vulnerable group with in the population.
4. Develop a short tool to assess awareness on healthy food choices among the identified vulnerable group with in the population.
5. Review of communication strategies being used in any one public health nutrition programme in the community.
6. Planning of communication strategies for public health nutrition problems among vulnerable groups in the community -field testing of messages and methods.

Essential Readings

UNIT I:

- 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

UNIT II:

- Boyle, M. A. (2022). Community Nutrition in Action (8th ed.). Cengage Learning.

UNIT III:

- Vir, S.C. (2021). Public Health Nutrition in Developing Countries. Volume-II (2nd ed.) Woodhead Publishing India Pvt Ltd.
- Barth, M. M., Bell, R. A., & Grimmer (Somers), K. (Eds.). (2020). *Public health nutrition: Rural, urban, and global – Community-based practice*. Springer Publishing Company.
- Park, K. (2023). Park's Textbook of Preventive and Social Medicine (27th ed.), Jabalpur, India: Banarasidas Bhanot Publishers.

UNIT IV: Nutrition Advocacy

- How to: A guide to effective nutrition advocacy (aliveandthrive.org)
- The International Coalition for Advocacy on Nutrition (ICAN) - 1,000 Days (thousanddays.org)

Suggested Readings

- Maibach E. and Parrott R.L. (1995) Designing health messages: Approaches from Communication Theory and Public Health Practice. Sage Publications, Inc.
- USAID. Effective At-Scale Nutrition Social and Behavior Change Communication. Multi-Sectoral Nutrition Strategy 2014-2025 Technical Guidance Brief.
- McNulty J. (2013) Challenges and issues in nutrition education. Rome: Nutrition Education and Consumer Awareness Group, Food and Agriculture Organization of the UNITed Nations. Available at: www.fao.org/ag/humannutrition/nutritioneducation/en/
- USAID (2010) Behavior Change Communication (BCC). Learning Resource Package. Facilitator's Guide.

- O'Sullivan, G.A., Yonkler, J.A., Morgan, W., and Merritt, A.P. (2003) A Field Guide to Designing a Health Communication Strategy, Baltimore, MD: Johns Hopkins Bloomberg School of Public Health/Center for Communication Programs, March 2003.
- Nutrients Requirements for Indians, (2020). A report of the expert group. National Institute of Nutrition, Indian Council for Medical Research, Government of India. https://www.nin.res.in/RDA_Full_Report_2024.html
- 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
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 **SDS-PAGE, 2D gel electrophoresis,** and **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 SDS-PAGE, 2D- gel electrophoresis and 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.

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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 design

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)

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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 sports
- 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 and ergogenic aids 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.
- Protein Supplements: Proteins, amino acid mixtures and specific amino acids

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. Survey of supplements available in India for performance enhancement in sports
2. Development and standardisation of a sports bar 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.
- 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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SKILL BASED COURSE
NUTRITION SCREENING AND ASSESSMENT

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		
SBC FN-01 Nutrition Screening and Assessment	2	0	0	2		NIL

Learning Objectives

- To gain an insight into the importance/relevance of nutrition screening and assessment in the community and hospital settings.
- To study quality control and standardization techniques in nutritional screening and assessment.
- To get an exposure to various nutritional screening and assessment methods .
- To develop or adapt/modify existing nutrition screening tools/programs for diverse cultural and socioeconomic settings.
- To understand the role of emerging methods/technologies in nutrition assessment.
- To interpret results from nutritional screening and assessment tools and communicate the findings.

Learning Outcomes

The students would be able to:

- Assess nutritional status based on clinical signs and symptoms, anthropometric measurements and dietary intake at the individual and community level.
- Maintain accuracy and consistency in nutrition screening and assessment methods through quality control measures.
- Use of specialized nutrition screening and assessment tools in community and hospital settings.
- Analyse, document and present nutrition assessment data.

PRACTICAL
(Credits 2; Hours 60)

1. **Relevance, significance and methods of Nutrition Screening and Assessment**
    - Importance of nutrition screening and assessment.
    - Relevance and application of different nutrition screening tools.
    - Methods of nutritional assessment in the community and hospital settings.
2. **Standardization, Quality Control & Assurance in Nutrition Screening and Assessment**
    - Standardization, calibration and validation of assessment tools.
    - Inter-observer and intra-observer variability in measurements.
    - Guidelines for maintaining accuracy and consistency in screening/assessment methods
    - Methods to minimize errors in nutrition screening and assessment
3. **Ecological variables in nutritional assessment**
    -
4. **Clinical examination for nutritional assessment.**
    - Identification of key clinical signs and symptoms of nutritional disorders.
5. **Anthropometric measurements for nutritional assessment.**
    - Measurement of Weight, Height/Length, Mid Upper Arm Circumference and Waist Circumference.
    - Interpretation of anthropometric data using various Indices and indicators in different age groups.
6. **Dietary assessment**
    - Assessment of dietary intake pattern, dietary diversity and estimation of food and nutrient intake - Food Frequency Questionnaire and 24-Hours Diet Recall
    - Use of mobile applications and digital tools for dietary assessment.
7. **Assessment of body composition**
    - Estimation of fat mass and lean body mass using Bioelectric Impedance method.
8. **Screening for risk of development of Non-Communicable Diseases**
    - Screening for risk of developing non-communicable diseases (Diabetes, Hypertension, Cardiovascular Diseases).
9. **Interpretation, documentation and presentation of data on nutritional status assessment.**
    - Nutrition data presentation, interpretation and report writing.

Essential Readings

- Gibson, R. S. (2005). *Principles of Nutritional Assessment.* Oxford University Press.
- Lee, R. D., & Nieman, D. C. (2018). *Nutritional Assessment.* McGraw-Hill Education.
- ahan, L. K., & Raymond, J. L. (2020). *Krause's Food & the Nutrition Care Process.*
  Elsevier.
- WHO & FAO Reports on Nutrition Assessment and Screening Guidelines.

Suggested Readings

- Gropper, S. S., Smith, J. L., & Carr, T. P. (2019). *Advanced Nutrition and Human Metabolism.* Cengage Learning.
- Willett, W. C. (2013). *Nutritional Epidemiology.* Oxford University Press.
- Recent research articles and journals on AI and digital tools in nutrition assessment.
- Reports on cultural and socioeconomic adaptations in nutrition screening.

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SKILL BASED COURSE

FOOD BUSINESS 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		
Food Business Management	2	0	0	2		Nil

Learning Objectives

- To equip students with hands-on skills for establishing and managing a food business.
- To provide practical exposure to idea generation, costing, and marketing strategies.
- To develop entrepreneurial skills amongst students
- To develop practical, skill-based knowledge required to manage food businesses effectively.

Learning Outcomes

The student would be able to:

- Develop a food business idea from concept to execution.
- Design appropriate packaging, labelling, and branding for food products.
- Calculate cost, pricing, and profitability of food products.
- Implement marketing and sales strategies for a successful food business.
- FSSAI rules and regulations and licensing

PRACTICAL
(Credits 2; Hours 60)

1. **Market Research and Analysis of Consumer Behaviour**
    - Conducting a consumer survey and preparing a report on the food business observed, with an analysis of strengths, weaknesses, opportUNITies, and threats (SWOT)/ market trends.
2. **Concept Development and Business Planning**
    - Brainstorming food business ideas based on available resources and idea generation
3. **Product or Process Planning, Costing and Pricing**

- Creating a balanced and cost effective menu for a new restaurant or café. The menu should reflect nutritional balance, target customer preferences, and seasonal variations.
- Estimating raw material costs with simple cost sheets and determining product pricing
- Developing an SOP for a commercially viable food product considering market trends, nutrition, and consumer preferences

4. **Human Resource Management**
5. Training the employees working in a college canteen on principles of GMPs
6. **Cost effective Branding and Promotion**
   - Designing a marketing plan for a food product or service (e.g., a new menu item, food delivery service, or health food product).
7. **Basic Packaging and Labelling**
   - Applying FSSAI-compliant packaging and labelling regulations for a given product.
8. **Food Safety and Quality Assurance**
   - Performing a mock food safety audit in a local food establishment. Planning for effective implementation of HACCP (Hazard Analysis Critical Control Point) system or relevant certifications.
9. **Sales Strategies and Customer Engagement**
   - Practicing effective sales of a product and handling customer inquiries and feedback (Grievance redressal mechanism – GoI)
10. **Exploring Funding and Government Schemes**
    - Identifying government support programs, CSR and other funding options for food start-ups.

11. Development of a business plan

- Creating a business plan for a new food-related business; identifying resources, developing project plan, determining investments, creating a financial budget, marketing strategies, understanding regulations to set up businesses.Understanding FSSAI rules and regulations and licensing for food products.

Essential Readings

- Garry, A. and Ken, A. (Eds.) (2007) *The Business of Food*, Sixth edition, India: Bloomsbury publishing.
- Chimhundu, R. (2018) *Marketing Food Brands*, Springer Nature-Palgrave MacmillanWest Yorkshire: Society of Dyers and Colorists, England.
- FSSAI (2025). *Basic Food Safety Handbook/ Manual for Food Manufacturers, Processors and Packers*, Government of India. https://fostac.fssai.gov.in/doc/Basic%20Manufacturing%20English.pdf (accessed 24.2.2025

- Wazir, R. (2024). *Beyond the Menu: A Restaurant Start-up Guide*, India: Jaico Publishing House.
- FSSAI Regulations. https://www.fssai.gov.in/cms/food-safety-and-standards-regulations.php (accessed 24.2.2025).

Suggested Readings

- Jones, G. and Morgan, NJ. (1994) *Adding Value: Brands and Marketing in Food Business*, Boston, Harvard Business School.
- Philip E T. (2008) *Modern Cookery for teaching and Trade Part I & II*, Orient Longmam
- Desai, V. (2011) *The Dynamics of Entrepreneurial Development and Management*. Mumbai: Himalaya *Publishing House Pvt. Ltd.*
- Kottler, P. (1994) *Marketing* Management. New Delhi: Prentice Hall of India Private Limited
- Sethi, M. (2005) *Institution Food Management.* India: New Age International Publishers
- Suri S and Malhotra A (2014). Food Science, Nutrition and Food Safety. Delhi: Pearson India Ltd., New Delhi.
- Mathur P. (2018). Food Safety and Quality Control. Orient Blackswan Pvt. Ltd., Hyderabad.

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SKILL BASED COURSE

INTERNSHIP-1

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		
Internship -1	2	0	0	2		Nil

Learning Objectives

- To gain hands on experience of working in various institutions related to the area of Food and Nutrition.

Learning Outcomes

The student would be able to gain hands on experience of working in various institutions related to the area of Food and Nutrition.

PRACTICAL
(Credits 2; Hours 60)

The students could work with NGOs / Government agencies / International agencies/ Hospitals / Food Industries etc. They would be required to present a report of their Internship in their Department.

SKILL-BASED COURSE

NUTRITION AND HEALTH DATA VISUALIZATION

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		
Nutrition and Health Data Visualization	**2**	**0**	**0**	**2**		NIL

Learning Objectives

- To understand the significance and core principles of effective data visualization in the context of nutrition and health.
- To learn how to extract, prepare, and transform data for effective visualization.
- To build proficiency in creating impactful visualizations, ranging from basic charts to advanced interactive visuals, using tools like Excel, Google Sheets, and specialized data visualization software.
- To apply data visualization techniques to nutrition-related data and create meaningful visuals and dashboards.

Learning Outcomes

The students would be able to:

- Demonstrate an understanding of the significance and core principles of data visualization, specifically within the context of nutrition and health.
- Develop the ability to extract, prepare, and transform raw data into a format suitable for visualization, ensuring accuracy and clarity.
- Gain proficiency in using tools like Excel, Google Sheets, and specialized software to create a variety of visualizations, from basic charts to advanced interactive visuals.
- Apply data visualization techniques effectively to nutrition-related datasets,

creating compelling visuals and dashboards that communicate key insights and trends.

PRACTICAL
(Credits: 2; Hours: 60)

1. **Introduction to Data Visualization and Exploring Nutrition and Health Data**
    a. Critical evaluation of the key principles of data visualization using the existing visualizations
    b. Exploring nutrition-related datasets for understanding different types of data, measurement scales and indicators (NFHS data, NSSO data etc)

2. **Data Preparation and Summarization**
    a. Entering and cleaning of data: Data entry, cleaning and formatting; sorting and filtering data
    b. Transforming data using conditional formatting for removing duplicates, identifying outliers, finding the missing value, data imputation

3. **Data visualization of univariate and bivariate data using excel, Google Sheets, and data visualization software like Tableau/ QGIS/ Power BI etc.**
    a. Creating basic charts such as bar charts, pie charts, line charts, histograms, and box plots.
    b. Creating scatter plots, line graphs and bubble charts.
    c. Understanding when and why to use each specific chart type
    d. Visualizing and interpreting correlation and causality
4. **Creating Interactive Dashboards**
    - Critical evaluation of a nutrition dashboard
    - Developing of nutrition dashboard
    - Case study: reviewing real-world application of data visualization in nutrition and health

Essential Readings

- Cairo, A. (2019). *How Charts Lie: Getting Smarter about Visual Information*. W.W. Norton & Company.
- Tufte, E.R. (2001). *The Visual Display of Quantitative Information*. Graphics Press.
- Wilke, C.O. (2019). *Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures*. O'Reilly Media.
- Few, S. (2012). *Show Me the Numbers: Designing Tables and Graphs to Enlighten*. Analytics Press.
- Manorat, R., Becker, L., & Flory, A. (2019). *Global data visualization tools to empower decision-making in nutrition*. Sight and Life, 33(1), 108-114.
- Stephen R. Midway. (2020) *Principles of Effective Data Visualization, Patterns*. Volume 1, Issue 9, ISSN 2666-3899, https://doi.org/10.1016/j.patter.2020.100141.

- National Family Health Surveys, URL- https://www.nfhsiips.in/nfhsuser/index.php

Suggested Readings

- Healy, K. (2018). *Data Visualization: A Practical Introduction*. Princeton University Press.
- Murray, D. (2016). *Tableau Your Data: Fast and Easy Visual Analysis with Tableau Software*. Wiley.
- Wickham, H. (2016). *ggplot2: Elegant Graphics for Data Analysis*. Springer.
- Jones, B. (2023). *Python Data Visualization Cookbook*. Packt Publishing.
- Monmonier, M. (1996). *How to Lie with Maps.* University of Chicago Press.

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SKILL BASED COURSE
SCIENTIFIC WRITING SKILLS

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		
Scientific Writing Skills	2	0	0	2		Nil

Learning Objectives

- Introduce students to diverse forms of scientific writing, including research articles, theses, and reviews.
- Equip students with skills to write publishable scientific research articles.
- Train students in managing references using tools like Mendeley, Zotero etc.
- Develop skills for effective communication of scientific findings.

Learning Outcomes

The students would be able to:

- Write clear and structured scientific documents adhering to standard formats and ethical guidelines.
- Effectively use reference management and data visualization tools for scientific writing.
- Communicate scientific information to both academic and general audiences through various formats.
- Critically evaluate and improve scientific manuscripts using proofreading and peer-review techniques.

PRACTICAL
(Credits 2; Hours 60)

1. **Introduction to Scientific Writing:** **1 week**

   Forms of scientific writing: Theses, technical papers, reviews, manuals; Key elements of scientific articles; Basics of technical writing

Assignment : Select a published scientific article and condense it into a concise abstract (1/10th of the original length)

2. **Language and Structure in Scientific Writing: 1 week**

Importance of clarity, choosing the right words, sentence structure, tenses, active vs. passive voice; Paragraph structuring, punctuation, and logic flow; Précis writing **Assignment :** Rewrite a complex scientific paragraph to make it clearer and more concise without losing essential details.

3. **Using Tools and Resources for Scientific Writing: 2 weeks**

Web-based search engines, using authentic sources; Reference management tools (e.g., Mendeley, Zotero)
Assignment : Create a detailed review of an instrument, technique, or technology used in Food and Nutrition research.

4. **Visual Communication in Science: 2 weeks**

Creating tables, graphs, and figures; Using MS Office, Excel for data, and creating graphs/tables; Developing explanatory artwork and PowerPoint presentations; Designing scientific posters.
Assignment : Create tables and graphs using a given set of data

Assignment : Design a scientific poster on a current issue in food science and nutrition using assignment 4

5. **Writing for General Audience 2 weeks**

- Science writing for the general public.
- Differences between technical writing and science communication.
- Writing science news and popular articles

Assignment : Convert the review (Assignment 3) into an article targeted at a general audience.

6. **Academic Writing – Structure and Ethics 2 weeks**

- Components of scientific papers: Title, abstract, introduction, methods, results, discussion, conclusion
- Ethics in writing, plagiarism, and using plagiarism checkers
- Selecting journals, understanding impact factors, and submission processes

Assignment : Write a short communication based on a recent lab experiment or field study.

7. Reviewing and Proofreading **1 week**

- Peer-review process and proofreading techniques
- Using proofreading symbols and online review tools
- Addressing reviewers' comments

Assignment : Peer review a classmate's short communication using proofing symbols and suggest improvements.

8. Advanced Scientific Writing **1 week**

- Writing systematic review papers and meta-analyses.
- Understanding citation styles (APA, Vancouver) and managing bibliographies
- Software for referencing

Assignment : Rewrite the bibliography of the review paper done in Assignment 3 in APA, and Vancouver styles.

9. Presenting Research **3 weeks**

- Preparing and presenting research at conferences.
- Designing posters and oral presentations.

Assignment: Prepare a PowerPoint presentation on a food or nutrition-related topic

Assignment : Deliver the prepared PowerPoint presentation

Essential Readings

1. Mohapatra, P.K.J and Moulick, S. (2025). Principles of Scientific and Technical Writing. McGraw Hill
2. Hofmann, A.H. (2016). Scientific Writing and Communication. Oxford Univ Pr; 3rd edition
3. Day, R.A ; Gastel, B. (2006). How to Write and Publish a Scientific Paper. Greenwood Publishers
4. Kalpana, S. and Kanimozh, K. (2024). Scientific Writing Handbook. CBS Publishers and Distributors Pvt. Ltd.

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SKILL BASED COURSE

INTELLECTUAL PROPERTY RIGHTS

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		
Intellectual Property Rights	2	1	0	1		Nil

Learning Objectives

- To provide an understanding of Intellectual Property Rights (IPR) and their relevance in food and nutrition.
- To familiarize students with various types of IPR, including patents, trademarks, geographical indications, and copyrights.
- To understand the role of IPR in food innovation, research, and public health.
- To equip students with knowledge of national and international frameworks governing IPR in the food sector.
- To develop practical skills in patent searching, trademark registration, and case studies on IPR application.

Learning Outcomes

The students would be able to:

- Understand the significance and scope of IPR in food and nutrition.
- Describe different forms of IPR and their application in the food industry.
- Explain legal frameworks, policies, and ethical considerations related to IPR.
- Gain practical knowledge of patent filing, licensing, and commercialization of food products.

THEORY
(Credits 1; Hours 15)

UNIT I: Fundamentals of Intellectual Property Rights **7 Hours**

- Definition, history, and importance of IPR in food and nutrition.
- Types of intellectual property: patents, trademarks, copyrights, geographical

indications, and trade secrets.
- International agreements related to IPR (WTO, TRIPS, WIPO, etc.).
- Legal and regulatory frameworks for IPR in India.
- Patentability criteria for food and nutrition-related innovations.
- Trademark registration and protection for food products and brands.

UNIT II: Application and Ethical Considerations of IPR in Food Industry 8 Hours

- Importance of geographical indications (GI) for traditional and indigenous food products.
- GI registration process in India and case studies.
- Role of copyrights in food product labeling, marketing, and recipe documentation.
- Ethical issues and consumer protection related to IPR in food.
- IPR's role in food safety regulations (FSSAI, Codex Alimentarius, etc.).
- Protection of functional foods, nutraceuticals, and novel food products under IPR.

PRACTICAL
(Credits 1; Hours 30)

1. **Patent Search and Analysis**
   - Conducting a patent search on a food-related product.
   - Analyzing existing patents and their applications in the food sector.
2. **Trademark Registration Process**
   - Understanding trademark application and filing procedures.
   - Case study on a well-known food brand's trademark protection.
3. **Geographical Indication Case Study**
   - Researching and preparing a report on a registered GI product in India.
4. **Copyright and Ethical Considerations**
   - Preparing a food label with copyright compliance.
   - Ethical considerations in recipe documentation and marketing.
5. **IPR in Food Commercialization**
   - Understanding licensing and technology transfer.
   - Group discussion on the future trends of IPR in food and nutrition.
6. **Case Study on Patent Filing**
   - Drafting a mock patent application for a food innovation.
7. **Technology Transfer & Licensing Simulation**
   - Understanding the steps in commercializing food innovations through licensing agreements.
8. **Consumer Protection and IPR**
   - Identifying misleading claims and IPR violations in food advertisements.
   - Exploring legal measures for consumer rights in the food industry.

Essential Readings

- Ganguli, P. (2001). *Intellectual Property Rights: Unleashing the Knowledge Economy*. Tata McGraw-Hill.
- Dutfield, G., & Suthersanen, U. (2008). *Global Intellectual Property Law*. Edward Elgar Publishing.
- Das, K. (2009). *Protection of Geographical Indications: An Overview of Select Issues with Special Reference to India*. Centre for Trade and Development.
- Watal, J. (2001). *Intellectual Property Rights in the WTO and Developing Countries*. Oxford University Press.
- Subbaram, N. R. (2002). *Patent Law: Practices and Procedures*. S. Chand & Company.

Suggested Readings

- Correa, C. M. (2007). *Trade Related Aspects of Intellectual Property Rights: A Commentary on the TRIPS Agreement*. Oxford University Press.
- Chandra, R. (2010). *Intellectual Property Rights: Law and Practice*. Cengage Learning.
- FSSAI Guidelines and Codex Alimentarius on Food Safety and IPR Regulations.

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SKILL BASED COURSE

Bioinformatics in Food and 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		
Bioinformatics in Food and Nutrition	**2**	**0**	**0**	**2**		**Nil**

Learning Objectives

The aim of the course:

- This course intends to give students practical experience with common bioinformatics tools and databases, with a focus on their immediate application in Food and Nutrition.
- Students will be trained in the basic theory and applications of programs and bioinformatics tools used for database searching, protein and DNA sequence analysis, and prediction of protein structures.
- The students will be able to apply their knowledge to do in-silico analysis in the field of Food and Nutrition.

Learning Outcomes

The students will be able to:

- Learn the basics of bioinformatics and computational biology and develop awareness of the interdisciplinary nature of this field.
- Analyse protein structure (food proteins) using visualization software.
- Perform and interpret protein/DNA sequence alignments.
- Conceptualise fundamental aspects of *in-silico* molecular structure prediction.
- Gain the ability to use bioinformatics to gain a deeper understanding of how certain nutrients affect cellular function at molecular level.
- Implement the bioinformatics skills in different aspects of food and nutrition.

PRACTICAL
(Credits 2; Hours 60)

1. To retrieve sequence (protein and gene related to human nutrition) from NCBI and Molecular file formats – FASTA, Genbank.
2. To perform pairwise sequence alignment using BLAST.
3. To find a gene/ORF from the given DNA sequence (promoter region identification, repeat in genome, ORF prediction) using Genscan or other software.
4. To translate the given DNA sequence using bioinformatic tools and predict its protein structure.
5. To retrieve structure (protein and DNA) from PDB and Molecular visualization by software (Pymol/Yasara view).
6. To predict food protein as allergen by using bioinformatics.
7. To perform homology modelling for prediction of food proteins structure.
8. To perform of molecular docking of protein-ligand (nutrient) using software.
9. To design an innovative project using bioinformatic tools in the area of food and nutrition.
10. Visit to Bioinformatics Lab Facility.

Essential Readings:

- Rastogi, S. C., Mendiratta, N., & Rastogi, P. (2022). *Bioinformatics: methods and applications:(Genomics, proteomics and drug discovery)*. 5th Ed. PHI Learning Pvt. Ltd; ISBN: 9789354438219
- Mukhopadhyay C.S., Choudhary, R.K. and Iquebal M.A. (2017) *Basic Applied Bioinformatics* John Wiley & Sons; ISBN: 978-1-119-24433-2.
- Ghosh, Z. and Mallick, B., (2008) *Bioinformatics – Principles and Applications*; 1st Ed. Oxford University Press (India), ISBN: 9780195692303.
- Gromiha, M.M. (2010). *Protein Bioinformatics: From Sequence to Function*; 1st Ed. Academic Press; ISBN: 9780123884244 Paperback ISBN: 9788131222973

Suggested Readings:

- Harisha, S. (2007). *Fundamentals of Bioinformatics*. IK International Pvt Ltd. ISBN: 9788189866419.
- Mount, D. W., & Mount, D. W. (2001). *Bioinformatics: sequence and genome analysis* (Vol. 564). Cold Spring Harbor, NY: Cold spring harbor laboratory press. ISBN: 0879696877.

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

SKILL BASED COURSE

INTERNSHIP-2

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		
Internship -2	2	0	0	2		Nil

Learning Objectives

- To gain hands on experience of working in various institutions related to the area of Food and Nutrition.

Learning Outcomes

The student would be able to gain hands on experience of working in various institutions related to the area of Food and Nutrition.

PRACTICAL
(Credits 2; Hours 60)

The students could work with NGOs / Government agencies / International agencies/ Hospitals / Food Industries etc. They would be required to present a report of their Internship in their Department.

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