SNDT Women's University, Mumbai

M.Sc. (Food Science & Nutrition)

2023

Structure for Four Semesters

M.Sc. (Food Science and Nutrition)

Semester I						
SN	**Courses**	**Type of Course**	**Credits**	**Marks**	**Int**	**Ext**
114311	Physiological Biochemistry (Th.)	Major (Core)	4	100	50	50
114312	Food Chemistry (Th.)	Major (Core)	4	100	50	50
114313	Human Nutrition I (Macro nutrients & water) (Th.)	Major (Core)	4	100	50	50
114324	Methods of Investigations in Foods & Nutrition (Pr.)	Major (Core)	2	50	50	0
124321 124312	Food Science & Chemistry (Pr.) OR Public Nutrition & Health (Th.)	Major (Elective)	4	100	50	50
134311	Research Methodology (Th.)	Minor Stream (RM)	4	100	50	50
End of Semester I			**22**	**550**	**300**	**250**
Semester II						
214311	Food Microbiology I (Th. & Pr.)	Major (Core)	4 (2 + 2)	100	50	50
214312	Human Nutrition II (Micro nutrients) (Th.)	Major (Core)	4	100	50	50
214313	Food Safety & Quality Control (Th. & Pr.)	Major (Core)	4 (1 + 3)	100	50	50
214324	Food Product Development, Modification & Sensory Evaluation (Pr.)	Major (Core)	2	50	0	50

224321 224312 224313 224314	Food Processing & Technology (Pr.) OR Food Quality Standards & Regulations (Th.) OR Functional Foods, Biodynamic Principles, Nutraceuticals OR Food Entrepreneurship	Major (Elective)	4	100	50	50
244341	Internship *	OJT	4	100	50	50
Exit with PG Diploma in Food Science Nutrition (FSN)			**22**	**550**	**250**	**300**

(* Internship at Research & Development Laboratory/Food Analysis Laboratory/ Nutrition Research)

SECOND YEAR

M.Sc. (Food Science & Nutrition)

Semester III						
Code	***Courses***	***Type of Course***	***Credits***	***Marks***	***Int***	***Ext***
314311	Statistical Application in Research	Major (Core)	4	100	50	50
314312	Maternal & Child Nutrition (Th.)	Major (Core)	4	100	50	50
314313	Food Microbiology II (Th. & Pr.)	Major (Core)	4 (2 +2)	100	50	50
314324	Assessment of Nutritional Status (Pr.)	Major (Core)	2	50	0	50
324321 324312 324313 324314 324315 324316	Food Product Development (Pr.) OR Genetics OR Research from Molecular Level to Human OR Recent Methods in Food Processing, Preservation and Packaging OR Understanding Metabolic and Cardiovascular Health OR Advances in Food Microbiology and Safety	Major (Elective)	4	100	50	50
354331	Research Project	RP	4	100	50	50
End of Semester III			**22**	**550**	**250**	**300**
Semester IV						
414311	Nutrigenetics & Nutrigenomics (Th.)	Major (Core)	4	100	50	50
414312	Nutrition Human Microbiome & Health (Th.)	Major (Core)	4	100	50	50
414323	Nutrition in Society (Pr.)	Major (Core)	4	100	50	50
424311 424312 424313	Environment Sustainability, Food and Nutrition Security for Health OR Integrated Lifestyle Health Management OR Integrated Diet and	Major (Elective)	4	100	50	50

424314 424315 424316 424317	Musculoskeletal Health OR Food Product Development for Special population OR Indian Knowledge Systems in Diet, Food & Health OR Nutritional Epidemiology					
454331	Dissertation	RP	6	150	100	50
End of Semester IV			**22**	**550**	**300**	**250**

Course Syllabus

Semester III

3.1 Major (Core)

Course Title **Subject Code**	**Statistical Application in Research** **314411**
Course Credits	**4**
Course Outcomes	After going through the course, learners will be able to
	1. Identify parametric and non-parametric tests
	2. Apply statistical tests for data analysis for both large and small samples
	3. Interpret the results of statistical analysis of data
	4. Summarize data and present it using tables and graphs
Module 1 (Credit 1) - Basics of statistics, data management, and statistical tests.	
Learning Outcomes	After learning the module, learners will be able to
	1. Analyse parametric and non-parametric test
	2. Apply the statistical programs for data management
Content Outline	**Introduction to Statistics** Definition, conceptual understanding of statistical measures, popular concepts and misuse of statistics **Normal Distribution and its Properties** a. Normal distribution b. Binomial distribution c. Probability, use of normal probability tables, area under normal distribution curve d. Parametric and non-parametric tests **Data Management** Planning for data analysis – coding of responses, preparation of code book Coding of data Use of statistical programs - MS Excel – SPSS
Module 2(Credit 1) - Understanding and applying data analysis methods.	
Learning Outcomes	After learning the module, learners will be able to

	1. Describe quantitative analysis, descriptive & inferential statistics.
	2. Apply large and small sample tests and interpret the results.
Content Outline	**Data Analysis** a. Quantitative analysis, descriptive statistics, inferential statistics: Uses and limitations, Summation sign and its properties b. Proportions, percentages, ratios c. Measures of central tendency-mean, median, mode-arithmetic mean and its uses, mid – range, geometric mean, weighted mean d. Measures of dispersion /variability- range, variance, standard deviation, standard error, coefficient of variation, Kurtosis, skewness Grouped data-frequency distribution, histogram, frequency polygons, percentiles, quartiles, tertiles, ogive e. Large and Small Sample tests and interpretation -. Z-test for single proportions and difference between proportions -. Large sample test for single mean and difference between means -. Small sample tests- 't'-test, paired 't'-test, 'F' Test
Module 3(Credit 1) - Using chi-square, correlation, and experiment designs	
Learning Outcomes	After learning the module, learners will be able to
	1. Interpret chi square test, correlation & regression
	2. Distinguish between experiment designs
Content Outline	**Chi square test and its interpretation** a. General features, goodness of fit b. Independence of Attributes **Correlation and Regression and its interpretation** a. Basic concepts b Linear regression and correlation coefficient Regression and prediction c. Rank correlation, Product-moment method **Analysis of Variance and its interpretation** a. One-factor analysis of variance b. Two-factor analysis of variance **Design of Experiments** a. Completely randomized design b. Randomized block design c. Latin square design d. Factorial design
Module 4(Credit 1)- Presenting data and creating research proposals	
Learning Outcomes	After learning the module, learners will be able to

	1. Discuss the presentation of Data
	2. Prepare research proposal
Content Outline	**Presentation of Data** a. Tabulation and Organization of data- frequency distributions, cumulative frequency distribution, contingency tables b. Graphical presentation of data- histogram, frequency polygon, ogive, stem and leaf plot, box and whiskers plot, Graphs for nominal and ordinal data- pie diagram, bar graphs of different types, graphs for relation between two variables, line diagram. Use of illustrations Cautions in visual display of data **The Research Report** Basic components of a research report- prefatory material, introduction and Review of Related Literature, Methodology, Results, Discussion, Conclusion, Summary, Abstract, Bibliography and Appendices Students to design a research study on a topic- - specify type of research - sample selection - protocol/operationalization - tools - tests for statistical analysis **Preparation of a Research Proposal**

Assignments / Activities towards Comprehensive Continuous Evaluation (CCE):

- Assignment on a standard normal curve
- Assignment on calculation of descriptive statistics
- Assignment to test the hypothesis
- Assignment on sample size calculation

Bibliography:

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- Kothari, C.R. and Gang, G. (2019): Research Methodology: Methods & Techniques, 4th edition, New Age International Publishers
- Nelson, M. (2020): Statistics in Nutrition & Dietetics, 1st edition, Wiley-Blackwell
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3.2 Major (Core)

Course Title **Subject Code**	**Maternal & Child Nutrition** **314312**
Course Credits	**4**
Course Outcomes	After going through the course, learners will be able to
	1. Discuss the physiological changes in pregnancy and lactation
	2. Describe the growth and developmental changes from conception till adolescence.
	3. Identify the inter-relationship between nutrition and growth and development during life cycle
	4. Apply their knowledge in community and public nutrition/health programmes
Module 1(Credit 1) - Nutrition and pregnancy care.	
Learning Outcomes	After learning the module, learners will be able to
	1.Determine the physiological changes during pregnancy and discuss the stages of embryonic development
	2. Discuss the nutritional requirements during pregnancy
	3. Determine the various complications that occur during pregnancy and their management
Content Outline	**Changing concepts and controversies in Maternal and Child Nutrition** **Importance of Maternal Nutrition during Pregnancy:** Unit 1. Importance of nutrition prior to and during pregnancy Unit 2. Pre-requisites for successful outcome. Effect of undernutrition on mother-child dyad including pregnancy outcome and Maternal and Child Health – Short term and long term Unit 3. Physiology and endocrinology of pregnancy and embryonic and fetal growth and development Unit 4. Nutritional requirements during pregnancy Unit 5. Adolescent Pregnancy Unit 6. Pregnancy and AIDS, Pregnancy and TB Unit 7. Intra-uterine growth retardation critical windows of development and programming concepts

	Unit 8. Complications of pregnancy and management and importance of antenatal care Unit 9. Congenital malformations, fetal alcohol syndrome and gestational diabetes mellitus
Module 2(Credit 1) - Breastfeeding and infant nutrition	
Learning Outcomes	After learning the module, learners will be able to
	1. Describe the physiology and endocrinology of lactation
	2. Discuss the nutritional composition of breastmilk
	3. Describe key nutritional strategies for infant feeding and importance of exclusive breastfeeding
	4. Identify problems faced by lactating mothers and their management
Content Outline	**Lactation and Infant feeding** Unit 1. Development of mammary tissue and role of hormones Unit 2. Physiology and endocrinology of lactation – Synthesis of milk components, let down reflex, role of hormones, lactational amenorrhea, effect of breast feeding on maternal health Unit 3. Human milk composition and factors affecting breastfeeding and fertility, maternal nutritional status and milk composition Unit 4. Management of lactation – Prenatal breastfeeding skills Education. Rooming in, problems – sore ripples, engorged breast, inverted nipples Unit 5. Exclusive breastfeeding Baby friendly Hospitals Initiative Unit 6. Breast feeding in the age of AIDS **Feeding of infants and children and dietary management, key issues in infant Feeding**
Module 3(Credit 1) - Child growth and preterm infant care	
Learning Outcomes	After learning the module, learners will be able to
	1. Discuss nutritional management strategies adopted for preterm and LBW infants
	2. Describe the growth and development patterns in various stages of childhood
	3. Apply the knowledge of using growth charts into practise by conducting growth monitoring of infants, children and adolescents

Content Outline	**Infant physiology and the preterm and LBW infants: Implications for feeding and management** **Growth and development during infancy, childhood and adolescence** a.Normal pattern of growth and development b. Norms/standards for growth c. Growth monitoring and promotion, growth faltering, Failure to thrive
Module 4(Credit 1) - Malnutrition and health programs	
Learning Outcomes	After learning the module, learners will be able to
	1. Determine the intergenerational impact of maternal and child malnutrition
	2. Discuss public health policies and programmes in realm of maternal and child care in India
Content Outline	Malnutrition in mothers and children: etiology and management (in brief) Consequences of malnutrition on physical development, mental development, cognitive development. Effect of deficiencies of specific nutrients Current Nutrition and Health Status of Women and Children in India. Policies and programmes for promoting maternal and child nutrition & health. International, national and state level Concept of small family, methods of family planning, merits and demerits.

Assignments / Activities towards Comprehensive Continuous Evaluation (CCE):

- Assignment on clinical assessment of malnutrition amongst children.
- Case study of low-birth-weight babies.
- Nutritional assessment of mothers.
- Workshop on SAM and MAM children.
- Visit to ICDS Centres.

Bibliography:

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- Alderman,H.; Behrman,J.; Lavy,V.; Menon,R. (1997) Child Nutrition, Child Health and School Enrollment. Policy Research Working Paper 1700. Washington DC. World Bank
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- WHO/ University of California, Davis (1998) Complementary Feeding of Young Children in Developing Countries. Review of Current Scientific Knowledge. Geneva, WHO

3.3 Major (Core)

Course Title **Subject Code**	**Food Microbiology II** **314313**
Course Credits	**4 (2 Th+2 Pr)**
Course Outcomes	After going through the course, learners will be able to
	1. Discuss the hazards of food- borne disorders and identify the recent procedures adopted in various food operations to prevent them
	2. Conduct bacteriological examination of food samples
	3. Apply the concepts of food safety and microbiological testing into practice
Theory - Module 1(Credit 1) - Food-borne diseases and harmful microbes.	
Learning Outcomes	After learning the module, learners will be able to
	1. Describe the common pathogens implicated in food-borne disorders
	2. Discuss the risk factors and impact of food-borne disorders
Content Outline	**Food borne infections and diseases:** Significance to public health Food hazards and risk factors Bacterial, and viral food-borne disorders, Food-borne important animal parasites, Mycotoxins. *Bacillus, Campylobacter, Brucella, Staphylococcus, Clostridium, E.coli, Aeromonas, Vibrio cholerae, Listeria, Mycobacterium,Salmonella, Shigella*
Module 2(Credit 1) - Food safety rules and HACCP	
Learning Outcomes	After learning the module, learners will be able to
	1. Determine the legal rules and regulations concerning food safety
	2. Apply the principles of HACCP in conducting food safety analysis

Content Outline	**Quality Control/Quality Assurance** Legislation for food safety – national and international Criteria, sampling schemes, records, risk analysis QC- microbial source, code Indicators of food safety and quality: Microbiological criteria of foods and their significance The HACCP system and food safety used in controlling microbiological hazards
Practical - Module 1(Credit 1) - Testing food for bacteria	
Learning Outcomes	After learning the module, learners will be able to
	1. Conduct tests for identification of bacterial contamination of food samples
Content Outline	**Various biochemical tests used in identification of commonly found bacteria in foods:** IMVIC urease, H2S, Catalase, coagulase, gelatin andfermentation (Acid/gas) Demonstration of available rapid methods and diagnostic kits used In identification of microorganisms or their products. HACCP
Module 2 (Credit 1) - Visiting food labs and projects	
Learning Outcomes	After learning the module, learners will be able to -
	1. Summarize latest techniques in food microbiology
Content Outline	Visits (at least two) to food processing unit or any other organizationdealing with advanced methods in food microbiology Project

Assignments / Activities towards Comprehensive Continuous Evaluation (CCE):

1. Discuss the latest approaches in detection of pathogens in food.
2. What is NABL accreditation in food testing laboratories
3. Discuss the importance of having a HACc-P system in a food manufacturing unit.

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- Willey J., Sandman K., and Wood D. (2022) Prescott's Microbiology McGraw Hill Book Company, New York, 12th Edition.

Journals:

- Food Technology published by the Institute of Food Technologists, Chicago, U.S.A.
- Journal of Food Science and Technology published by Association of Food Scientists and Technologists (India) CFTRI – MYSORE.
- Journal of Food Science Published by the Institute of Food Technologists, Chicago, U.S.A.

3.4. Major (Core)

Course Title **Subject Code**	**Assessment of Nutritional Status** **314324**
Course Credits	**2**
Course Outcomes	After going through the course, learners will be able to
	1. Analyze and various methods for assessment of nutritional status, body composition analysis.
	2. Carry out and interpret the assessment of dietary/nutrient intakes
	3. Conduct assessment of physical activity and energy expenditure
Practical - Module 1(Credit 1) - Body Composition & Anthropometry	
Learning Outcomes	After learning the module, learners will be able to
	1. Evaluate the different body composition analysis techniques for nutritional assessment
	2. Apply the correct methods for anthropometric measurements
Content Outline	**Assessment of Nutritional Status** a) Reliability b) Validity c) Accuracy d) Precision **Measurement of weight and height** a) Assessment of nutritional status for adults, young and older children b) Calculation of BMI c)Interpretation Use of WHO reference standards Wasting, stunting, underweight, severe and moderate malnutrition d) Calculation of z-scores and use of software Circumference Measurements – chest, head, mid arm. Waist, hip and ratios wherever applicable to children and adults **Body Composition**

	a) Use of skinfold b) Bioelectric impedance c) Dual X-ray Absorptiometry (DEXA) d) Calculation of body fat WHO Software for Z Scores, IAP Growth charts.
Module 2(Credit 1) - Dietary Intake & Energy Expenditure	
Learning Outcomes	After learning the module, learners will be able to
	2. Determine the legal rules and regulations concerning food safety
	2. Apply the principles of HACCP in conducting food safety analysis
Content Outline	**Dietary intake assessment** a) Food frequency questionnaire b) A 24-hour diet recall and record - Weighment method **Assessment of energy expenditure** a) Indirect calorimetry - use of ergometer, treadmill, heart rate monitoring b) Recording physical activities c) Factorial estimation of energy expenditure: MET, PAL Study of food labels- calculation of DV d) Study of food labels- calculation of DV e) In vitro starch digestibility

Assignments / Activities towards Comprehensive Continuous Evaluation (CCE):

- Executing WHO Software for Z Scores.
- Plotting IAP Growth charts.
- Using BIA machine to analyze body composition of adults.
- Project on dietary assessment using dietary recall techniques.

Bibliography:

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3.5 Major (Elective)

Course Title **Subject Code**	**Food Product Development (Practical)** **324321**
Course Credits	**4**
Course Outcomes	After going through the course, learners will be able to
	1. Apply various aspects of food product development including Food Science and Technology, Marketing and Consumer research, finance and communication
	2. Develop products which meet consumer needs, and are nutritionally and commercially viable
	3. Acquire skills in the various aspects including shelf life assessment, testing of quality parametersand acceptability, packaging and labelling of a product
Module 1(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Prepare food product and conduct its nutritional evaluation
Content Outline	**Nutritional evaluation (estimation of relevant parameters)** **Packaging and Labelling of the product - Packaging design, graphics and labeling**
Module 2(Credit 2)	
Learning Outcomes	After learning the module, learners will be able to
	1. Undertake bulk preparation of the proposed food product and conduct its shelf-life testing
Content Outline	**Bulk preparation of product** **Shelf-life testing of the product** (testing for appropriate quality parameters- chemical, microbiological and nutrient content, acceptability studies) Product integrity and conformance to standard
Module 3(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Undertake costing, marketing, advertising and sales of the developed product

Content Outline	Costing the product and determining the sales price Advertising and test marketing the product
Module 4: **Report preparation**	
Learning Outcomes	After learning the module, learners will be able to, 1. Compile and present findings of the food product development process.
Content Outline	• Structure of the research report, including methodology, results, and conclusions. • Guidelines for effective presentation and communication of findings, including visual aids.

Assignments / Activities towards Comprehensive Continuous Evaluation (CCE):

- Market survey of recent/ innovative food products.
- Assignment on packaging material.
- Test marketing, costing and sensory evaluation.
- Development of food product and quantity food production.

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Journals:

- Critical Reviews in Food Science and Nutrition
- Food Technology
- International Journal of Food Science and Technology
- Journal of Food Technology
- Trends in Food Science and Technology

3.6 Research Project

Course Title **Subject Code**	**Research Project** **354331**
Course Credits	**4**
Course Outcomes	After going through the course, learners will be able to
	1. Experience the research process and prior to undertaking primary research plan and examine existing literature.
	2. Undertake the process of reviewing existing literature, form hypothesis, and define plans for gathering data and analysing data for their research problem.
	3. Recognise process of knowledge production in their subject discipline.
Module 1(Credit 1) - Problem Formulation	
Learning Outcomes	After learning the module, learners will be able to
	1. Recognize and undertake research problem.
Content Outline	Formulation of problem
Module 2(Credit 2) - Literature Review	
Learning Outcomes	After learning the module, learners will be able to
	1. Review the existing literature
Content Outline	Review of Literature
Module 3(Credit 1) - Research Proposal Design	
Learning Outcomes	After learning the module, learners will be able to
	1. Apply critical thinking to the problem selected for research
Content Outline	Designing Research proposal
Module 4 (Credit 1) - Data Collection Planning	
Learning Outcomes	After learning the module, learners will be able to
	1. Able to design the research work and plan the execution.
Content Outline	Planning tools & techniques for data collection

Assignments / Activities towards Comprehensive Continuous Evaluation (CCE):

- Designing a research proposal.
- Presenting review of literature.
- Constructing tools and techniques for data collection.

Semester IV

Syllabus Contents

4.1 Major (Core)

Course Title **Subject Code**	**Nutrigenetics And Nutrigenomics** **414311**
Course Credits	**4**
Course Outcomes	After going through the course, learners will be able to
	1. Apply Nutrigenetics through the course of life. 2. Correlate the relationship between genetics of obesity and metabolic syndrome. 3. Counsel patients based on the principles of nutrigenomics.
Module 1 (Credit 1) - Human Genetics Basics	
Learning Outcomes	After learning the module, learners will be able to
	1. Describe the basics of genetics and the normal physiology of DNA 2. Identify diseases with genetic inheritance patterns
Content Outline	**Introduction to Human Genetics** • Definition of gene, genome, DNA, allele, chromosome. Mitosis and Meiosis. • Mendelian Principles- Chromosome Theory of Heredity (Sutton-Boveri), Inheritance patterns, the phenomenon of Dominance, Recessive, and Codominance. • Inheritance patterns in Humans (Sex-linked, Autosomal, Mitochondrial, Unifactorial, Multi-factorial). • Molecular effects of genetic variation- polymorphism, genetic linkage- linkage disequilibrium, haplotype, copy number variants, and mutations. Hardy-Weinberg equilibrium. Gene nomenclature
Module 2 (Credit 1) - Nutrigenetics & Nutrigenomics Overview	
Learning Outcomes	After learning the module, learners will be able to
	1. Examine history of genetics in nutrition 2. Evaluate the relationship between nutrition, environment and genomics. 3. Recognise interactions of epigenetic changes and nutrient components.
Content Outline	**Introduction to Nutrigenetic and Nutrigenomics** • Introduction to Epigenomics, Molecular mechanisms of Epigenomics, Epigenomics and Nutrition (Molecular bases of gene-gene and gen-environment interaction), Epigenomics and disease, • What is Nutrigenetics and Nutrigenomics? How are they different from each other? Nutrigenomic interactions [direct and indirect method]. • History of Nutrigenetics- Phenylketonuria, MTHFR genes, Where Nutrigenetics differences comes from- Nutritional Relativism, Nutrigenetics and the early life origins of health and diseases.
Module 3 (Credit 1) - Genetics of Metabolic Health	

Learning Outcomes	After learning the module, learners will be able to 1. Examine relationship of genetics of obesity and metabolic health. 2. Recognise the influence of genes on response to dietary interventions.
Content Outline	**Nutrigenetics and Nutrigenomics of Metabolic Health** • Brief Overview of lipid metabolism • Genetic disorders of lipid metabolism • SNPs associated with Lipid profile – ABCG8, CELSR, LDLR, ABCA1, CETP, APOA1, APOA5, GCKR gene. • Genomics of eating behaviour and appetite regulation (HPA, serotonin) • Genetics of body composition; from obesity to extreme leanness, Genetic implication of energy homeostasis, Genetic variation with influence on the individualized response to weight loss diet: FTO Gene as evident, Genetics variation with influence on the individualized body fat percentage: ADRB3, BDNF, FTO, MC4R, SH1B2, TMEM18. • Nutrient-gene interaction studies, lifestyle intervention studies
Module 4 (Credit 1) - Health Coaching & Nutrigenetic Counselling	
Learning Outcomes	After learning the module, learners will be able to 1. Gain skills in undertaking health history using varied tools. 2. Recognise role of counselling and coaching in nutrigenetic counselling.
Content Outline	**Effective Health Coaching and Nutrigenetic Counselling** • Conducting health history questionnaires, health goals, identifying physiological parameters that are essential for the ideal diet planning • Purpose of Effective Counselling, explain Nutrigenetic recommendations and diet plan, Planning the grocery list.

Assignments / Activities towards Comprehensive Continuous Evaluation (CCE):

1. Review current ICMR/NIN guidelines for diet in adults
2.Report on factors affecting genetic changes and epigenetics
3.Formation of a health assessment questionnaire focusing on nutrigenetics.
4.Role play of effective nutrigenetic counselling

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4.2 Major (Core)

Course Title **Subject Code**	**Nutrition Human Microbiome & Health** **414312**
Course Credits	**4**
Course Outcomes	After going through the course, learners will be able to
	1.Illustrate the role of microbiota across the lifespan 2.Explain the application of microbiome in nutritional interventions
Module 1(Credit 1) - Importance of the Microbiome	
Learning Outcomes	After learning the module, learners will be able to
	1. Explain the importance of microbiome in health 2. Discuss the development of microbiota in the body
Content Outline	**Introduction to Human Microbiome** • Various microbes in human body • Importance of microbiome in human health • Microbiota development in all organ systems (microbiota in different niches like respiratory tract, gut microbiota, vaginal and reproductive tract etc.) • Life changing events and personal microbiota development.
Module 2 (Credit 1) - Microbiome Across the Lifespan	
Learning Outcomes	After learning the module, learners will be able to
	1. Explain the mechanism of microbiome in immunity 2. Describe the role of microbiome in longevity and ageing
Content Outline	**Human Microbiome Across the Lifespan** • Microbiota development in all epochs of life • Role of microbiota in aging including healthy aging and role in longevity and ageing related diseases • Role of microbiota in infancy and childhood immunity
Module 3(Credit 1) - Microbial Therapies in Disease	
Learning Outcomes	After learning the module, learners will be able to
	1. Elucidate microbial therapies in gastrointestinal diseases
Content Outline	**Microbiota In Diet And Disease** • Obesity • Malabsorption syndrome • SIBO • GI Cancers • IBD/IBS • GI Surgery **Microbial therapies and diagnostics and personalized therapies**
Module 4 (Credit 1) - Microbiome in Pharmacology and Nutrition	
Learning Outcomes	After learning the module, learners will be able to
	1. Explain the application of healthy microbiome in pharmacology and nutritional therapy
Content Outline	**Applicability And Societal Impact** • Role and applicability of microbiome in pharmacy and medical therapy

	• Approaches to study the Microbiome in healthy and diseased states using data sets like metagenome transcriptome genome and other omics approaches.

Assignments / Activities towards Comprehensive Continuous Evaluation (CCE):

1. Enlist the significant microbes in heath and disease
2. Conduct a market survey of nutraceuticals containing microbes
3. Design audio visual aids to illustrate microbiome development.

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- Nutrition, Microbiota and Noncommunicable Diseases. Editor: Julio Plaza-Díaz (2020)
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4.3 Major (Core)

Course Title **Subject Code**	**Nutrition In Society (Pr.)** **414323**
Course Credits	**4**
Course Outcomes	**After going through the course, learners will be able to**
	1. Familiarize with the problems related to food and nutrition security among various communities / socio-economic groups / rural, tribal, urban slums.
	2. Enable to assess nutritional status of individuals/group.
	3. Enable to plan, implement, monitor and evaluate intervention programmes
	4. Familiarize with the various strategies / approaches used to combat malnutrition.
Module 1(Credit 1) - Food and Nutrition Security in India	
Learning Outcomes	After learning the module, learners will be able to
	1.Illustrate the impact of food and nutrition security in India
Content Outline	Food and nutrition security of different segments of the society vis-à-vis food production and consumption patterns in different states of India Epidemiologic and socio-demographic indicators – current situation
Module 2 (Credit 1) - Strategies to Combat Malnutrition	
Learning Outcomes	After learning the module, learners will be able to
	1. Discuss the strategies of supplementation in vulnerable population for malnutrition 2. Elucidate the economics for such strategies
Content Outline	**Strategies and approaches to combat malnutrition – short term and long term** *For each unit field visits should be undertaken by students. Case studies are to be done and report prepared* a. Food supplementation b. Nutrient supplementation c. Fortification and enrichment d. Food-based approaches, dietary diversification, IEC Cost Analysis: Cost benefits, cost effectiveness and cost efficiency
Module 3 (Credit 1) - Product Development for Vulnerable Groups	
Learning Outcomes	After learning the module, learners will be able to
	1. Develop food products for vulnerable groups and specific target population
Content Outline	Development and preparation of food supplements for various target groups and programmes e.g. pre-schoolers, pregnant/lactating women, mid-day meal programme, emergency situations, Nutritional rehabilitation centres.
Module 4 (Credit 1) - Evaluating Nutrition Policies and Programs	
Learning Outcomes	After learning the module, learners will be able to
	1. Identify the strengths and weakness of national and state policies and programmes for nutrition intervention
Content Outline	**Appraisal of existing programmes: Planning and implementation of an intervention programme**

	1. Situation analysis and needs identification 2. Intervention planning and intervention 3. Plan for monitoring and evaluation

Assignments / Activities towards Comprehensive Continuous Evaluation (CCE):

1. Visit to an NGO
2. Recipe development and demonstration for nutrition awareness through interactive aids targeting people of different age groups

Bibliography:

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4.4.1 Major (Elective)

Course Title **Subject Code**	**Nutritional Epidemiology** **424317**
Course Credits	**4**
Course Outcomes	After going through the course, learners will be able to
	1. Examine epidemiologic methodology in relation to nutritional measures
	2. Conduct nutritional epidemiologic research
	3. Identify and interpret scientific literature about the relationship between nutrition and disease
Module 1 (Credit 1) - Principles of Epidemiological Study Design	
Learning Outcomes	After learning the module, learners will be able to
	1. Describe the principles of epidemiological study design
Content Outline	**Introduction to Epidemiology** • Definition, nutritional epidemiology, history • Purpose of undertaking nutritional epidemiological studies • Components – levels of data outputs • The epidemiology triad • Methodological considerations in study designs in nutritional epidemiology • Life-span developmental approach in nutritional epidemiology
Module 2 (Credit 1) - Dietary Assessment Methods	
Learning Outcomes	After learning the module, learners will be able to
	1. Describe the range of dietary assessment methods and discuss their application 2. Discuss the strengths and limitations of nutritional epidemiological methods
Content Outline	**Types of nutritional epidemiological studies** • KAP survey • Consumer survey • Incidence reports • Prevalence studies • RCTs • Nutrition Database **Methods of dietary assessments – key features, strengths, limitations** • 24-hour recall • Food Diary • Food Frequency Questionnaires • Weighment Method
Module 3 (Credit 1) - Interpreting Nutrition and Disease Associations	
Learning Outcomes	After learning the module, learners will be able to
	1.Interpret nutritional epidemiological research 2.Describe the associations between diet and disease
Content Outline	**Linking exposures and outcomes - Evaluation of diet/disease relationships** • association and causation, • role of chance, errors, bias, and confounding variables.

	• adjustment for total energy, selection of co-founders, continuous versus categorical analyses **Interpretation of nutritional epidemiological findings** • correlations, linear and logistic regressions, factor analyses, analysis of variance • Issues in analysis and presentation of dietary data and biostatistics • A single dietary factor and whole diet approaches in epidemiological analysis
Module 4 (Credit 1) - Applications of Nutritional Epidemiology	
Learning Outcomes	After learning the module, learners will be able to
	1.Provide examples of food policy in practice in vulnerable population groups 2.Describe the socio-ecological influences on food choice
Content Outline	**Applications of nutritional epidemiology** • Policy making in healthy and vulnerable populations • Food product development • Clinical recommendations • Food economics and social impact of food choices, etc. **Recent advances in technological methods of nutritional epidemiology** – AI, digital dietary assessment, etc. **Key study designs and ethical considerations in NE**

Assignments / Activities towards Comprehensive Continuous Evaluation (CCE):

1. Design and conduct an end-in-sight KAP survey in a small group
2. Design a dietary assessment tool that can be used with modern technologies like AI and video conferencing

Bibliography:

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Journals:

- Journal of Nutrition
- Nutrients
- American Journal of Clinical Nutrition
- American Journal of Epidemiology
- Public Health Nutrition
- Indian Journal of Public Health
- Frontiers in Nutrition

4.4.2 Major (Elective)

Course Title **Subject Code**	**Food Product Development for Special Population** **424314**
Course Credits	4
Course Outcomes	After going through the course, learners will be able to -
	1. Apply various aspects of food science for dietary management and product development.
	2. Develop products which meet nutritional needs of consumers.
	3. Explore theoretical concepts and apply during product development/ modification.
	4. Use different sensory methods to evaluate a variety of developed foods.
Module 1 (Credit 1) - Enhancing Food Attributes	
Learning Outcomes	After learning the module, learners will be able to -
	1. Plan specific ingredients to enhance the appearance, texture, and taste of any particular food.
Content Outline	• Use of different food ingredients for development of health foods – artificial sweeteners, modified starches, fat replacers, increasing fiber content, functional ingredients, low sodium food adjuncts, protein concentrates, whey
Module 2 (Credit 1) - Nutritional Needs in Extreme Conditions	
Learning Outcomes	After learning the module, learners will be able to -
	1. Evaluate nutritional needs based on specific conditions and develop wholesome, nutrient-dense foods.
Content Outline	• Developing foods for people under specified conditions: High altitude, Extreme temperatures (high and low), Under water (Scuba divers), Space foods (Astronauts).
Module 3 (Credit 1) - Food Development for Crisis Situations	
Learning Outcomes	After learning the module, learners will be able to -
	1. Develop wholesome and nutrient dense foods based on foods available to meet the nutrient requirements
Content Outline	• Developing foods for people under certain unforeseen situations and natural calamities: War situation (Army, Navy, Air Force), Political unrest, Drought, Famine, Floods, Earthquakes
Module 4 (Credit 1) - Alternatives for Allergies and Intolerances	
Learning Outcomes	After learning the module, learners will be able to -
	1. Develop food alternatives for people with allergies and intolerance
Content Outline	• Foods for people with allergies and intolerances: Lactose free, gluten free • Vegan foods, mock meats

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

1.Develop innovative recipes using artificial sweetener & fat replacer

2.Develop product for any specific condition (High Altitude, extreme temperatures, space food, etc.
3.Plan a food care kit for any unforeseen situations.

Bibliography:

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Journals:

- International Journal of Food Science and Technology.
- Food Technology
- Journal of Food Technology
- Trends in Food Science and Technology
- Critical Reviews in Food Science and Nutrition

4.5 Research Project

454331	**Dissertation**		6
Sr. No.	**Modules and Outcomes**	**Course Contents**	**Cr**
Course Outcomes:	At the end of this course Learners will be able to – - Demonstrate mastery of parametric and non-parametric statistical tests through application in data analysis. - Evaluate and critique quantitative analysis methods, demonstrating proficiency in interpreting large and small sample tests for inferential statistics. - Synthesize advanced statistical techniques such as chi-square tests, correlation, and regression to analyze complex datasets and draw meaningful conclusions. - Construct an argument based on their prior research proposal, integrating data analysis and presentation techniques and drawing summary and conclusion with clarity and precision.		
Following Steps to be completed during the semester:			
	Data collection / finalization/ analysis • Gather and finalize any remaining data required for the dissertation. • Ensure all data is complete, validated, and ready for analysis. • Conduct final data analysis using appropriate statistical methods. • Validate findings and ensure they align with research objectives and hypotheses.		
	Finalization of chapters of Introduction & Methodology • Review and finalize the introduction chapter, providing a clear rationale and background for the study. • Refine the methodology chapter, detailing the research design, sampling methods, and data collection procedures. • Ensure all methodological aspects are well-documented and align with the research questions. • Incorporate any feedback or suggestions to enhance the clarity and coherence of these chapters.		
	Finalization of Results and Discussion • Analyse and interpret the final results obtained from the data analysis. • Present findings in a clear and structured manner, using tables, graphs, and figures as needed. • Discuss the implications of the results in relation to the research questions and existing literature. • Address any unexpected findings or limitations and provide possible explanations.		
	Finalization of Summary and Conclusion • Summarize the key findings of the dissertation in the summary chapter. • Discuss the significance of the findings and their contributions to the field of study. • Revisit the research objectives and evaluate whether they have been met. • Craft a well-rounded conclusion that reflects on the overall research journey and its implications.		
	Approval of final draft of the dissertation and research article		

	• Submit the final draft of the dissertation to the academic advisor or committee for review and approval. • Address any feedback or revisions requested by the advisor or committee to ensure the dissertation meets academic standards. • Simultaneously, students will prepare a research article based on their dissertation findings for submission to an international journal of high repute. • The article should be structured according to the journal's guidelines, emphasizing the novelty, significance, and implications of the research	
	Submission of dissertation and Viva voce • Submit the approved dissertation to the academic institution by the specified deadline. • Ensure the dissertation adheres to all formatting and documentation requirements for final submission. • Concurrently, students will finalize the research article based on their dissertation findings for submission to the international journal. • Prepare for the viva voce (oral defense) examination, which includes defending both the dissertation and the research article before a panel of examiners. • Demonstrate in-depth knowledge, critical thinking, and the ability to articulate and defend research findings during the viva voce.	

Dissertation Assessment Template:

	INTERNAL ASSESSMENT **(25)**			***TOTAL Marks Obtained***
		Proposal (15)		
		Understanding of concept & Execution (10)		
	TOTAL Marks		**out of 25**	
	INTERNAL ASSESSMENT **(25)**	**(A) General**		
		Punctuality, Sincerity, Perseverance, Commitment, Attitude		
		TOTAL	**Out of 15**	
		(B) Skills		
		Use of Resources, Literature, Use of Technology, Communication, Any other		
		TOTAL	**Out of 10**	
	TOTAL Marks (by the internal supervisor) out of 50			
			INTERNAL EXAMINER	EXTERNAL EXAMINER
JOINT ASSESSMENT (100)		Dissertation (50)		
		Viva Voce (50)		
		TOTAL		
		TOTAL (Average of the two)		
OVERALL TOTAL (OUT OF 150)				