Annexure 4.1

Avinashilingam Institute for Home Science and Higher Education for Women
(Deemed to be University , Estd. u/s 3 of UGC Act 1956, under Category A by MHRD)
Re-accredited with A^{++} Grade by NAAC. CGPA 3.65/4, Category by I UGC
Coimbatore – 641 043, Tamil Nadu, India

Department of Food Science and Nutrition

M.Sc. Food Science and Nutrition

Programme Outcomes:

1. Design innovative processing techniques and food products with health, nutritionaland environmental concern (H,3).
2. Assess community nutritional problems and impart nutrition education based on theneeds of community (L,1).
3. Apply the principles of nutrition in the planning of diets for normal and therapeuticnutrition ((M,2).
4. Demonstrate professional attitudes, effective communication and behavioural skillsthat support and enhance individuals and team performance (H,3).
5. Analyze the nutritive value and hazardous components towards providing safe foodsto consumers (L,1).
6. Apply interdisciplinary science and technological approaches to enhance research knowledge and competency (M,2).

Programme Specific Outcomes:

1. Acquire professional skills in nutrition intervention at individual and community levels.
2. Apply research and innovation in food product design and development for career prospects.
3. Create sustainable strategies for enhancing food safety and food security.

Scheme of Instruction and Examination
(For students admitted from 2025-2026 onwards)

Part	Subject code	Name of paper / component	Hours of Instruction /week		Scheme of examination				
			T/T	P	Duration of exam	CIA	CE	Total	Credit
First Semester									
I	25MFNC01	Nutrition through Life Span	3	-	3	40	60	100	3
I	25MFNC02	Assessment of Nutritional Status Practical	-	4	3	40	60	100	2
I	25MFNC03	Food Microbiology and Food Safety	3	2	3	40	60	100	4
I	25MFNC04	Community Nutrition and Public Health	3	-	3	40	60	100	3
I	25MFNC05	Research Methods and Statistical Applications	3	2	3	40	60	100	4
I	25MFNC06	Therapeutic Nutrition	4	-	3	40	60	100	4
I	25MFNC07	Therapeutic Nutrition Practical	-	4	3	40	60	100	2
II		CSS/Adult Education/Community Engagement and Social Responsibility	2	-	-	-	-	-	-
Second Semester									
I	25MFNC08	Physiological Basis for Nutrition	3	2	3	40	60	100	4
I	25MFNC09	Food Biotechnology	4	-	3	40	60	100	4
I	25MFNC10	Advances in Nutrition -I	2	2	3	100	-	100	3
I	25MFNC11	Analytical Instrumentation for Foods	2	2	3	40	60	100	3
I	25MFNC12	Techniques for Clinical Nutrition Practical	-	4	3	40	60	100	2
II	25MFNPD1	Professional Development Course - Product Development and Entrepreneurship	3	-	-	100	-	100	Remarks
II		Interdisciplinary Course	4	-	3	100	-	100	4
II		Professional Certificate Course	-	-	-	-	-	100	2
II	25MXCSS1/ 25MXAED1/ 25MXCSR1	CSS/Adult Education/ Community Engagement and Social Responsibility	2	-	2	-	-	100	2

Internship during summer vacation (1 month)									
Third Semester									
I	25MFNC13	Chemistry of Foods	4	2	3	40	60	100	5
I	25MFNC14	Advances in Nutrition – II	3+1	-	3	40	60	100	4
I	25MFNC15	Biomolecules and Intermediary Metabolism	4	-	3	40	60	100	4
I	25MFNC16	Post Production System	3	-	3	40	60	100	3
I	25MFNC17	Techniques for Experimental Nutrition Practical	-	6	3	40	60	100	3
I	25MFNC18	Functional Foods and Nutraceuticals	3	-	3	40	60	100	3
I	25MFNC19	Food Safety and Security (Self Study)	2	-	3	100	-	100	2
I	25MFNC20	Mini Project*	1	-	-	100	-	100	2
I	25MFNC21	Internship	-	-	-	-	-	100	2
II		Multidisciplinary Course	2	-	3	100	-	100	2
Fourth Semester									
I	25MFNC22	Research Thesis/ Project/Patent	-	30	-	100	100	200	20
								Total Credits	**96**

*1 hour after class hours

Other courses to be undergone by the student:

***MOOC Course – 2 to 4 Credits-Credit transfers may be claimed.**

Minimum 96+2 credits to earn the degree

** Students who exit at the end of 1st year shall be awarded a Postgraduate Diploma.

Other Courses offered by the Department

Interdisciplinary Course **25MFNI01 Nutritional Management for Lifestyle Diseases**

Multidisciplinary Course **25MFNM01 Wellness and Fitness**

Nutrition through Life Span

Semester I

25MFNC01 **Hrs of Instruction /Week: 3**

Course Objectives: **No. of Credits: 3**

1. Understand the need for assessing the nutritional status of an individual and community
2. Ascertain the nutritional requirements for each stage of life cycle
3. Recognize and comprehend the nutritional management for special events

Unit 1: **Assessment of Nutritional Status** **9**

Concept and objectives; Direct methods – anthropometric measurements, biochemical estimation, clinical examination and diet surveys; Indirect methods- Vital statistics, Assessment of ecological factors; Techniques of diet and nutritional surveys; *Assessing the food and nutritional problems in the community (SS)*

Unit 2: **Maternal and Infant Nutrition** **9**

Pregnancy–pre-conception, stages of gestation, energy and nutrient needs, physiological cost of pregnancy, maternal weight gain, diet modification, complications

Lactation - physiology of lactation, efficiency of milk production, maternal energy and nutrient needs, breast feeding, nutritional composition of breast milk, galactogogues, diet modification.

Infants–energy and nutrient needs, infant feeding, premature infant and their feeding, nutrition of infant formula, *weaning foods and introduction of other foods (SS)*

Unit 3: **Child and Adolescent Nutrition** **9**

Preschool children–energy and nutrient needs in growth and development, cognitive development, prevalence of malnutrition, *feeding programmes (SS)*

School children – energy and nutrient needs, packed lunch, *school lunch programme (SS)*

Adolescence– changes in growth and development, hormonal influences, energy and nutrient needs, psychological problems, eating behaviors, *nutritional problems (SS)*

Unit 4: **Adult and Geriatric Nutrition** **9**

Adults–energy and nutrient needs

Elderly - Physiological changes in aging, *hormonal changes in menopausal and post-menopausal women (SS),* energy and nutrient needs, nutrient – drug interactions, degenerative diseases,

Unit 5: **Nutrition for Special Events** **9**

Sports – energy and nutrient needs for athletes, women athletes, diabetic athletes, gymnastics, swimming, sports supplements, DOPA

High altitudes – energy and nutrient needs, altitude sickness, related health problems, nutrition for mountaineers

Space travel and Sea voyage *– physiological changes, energy and nutrient needs, psychological preparedness, health problems (SS)*

Total Hours 45

Text Books:

1. Sri Lakshmi, B. Nutrition Science. New Age International (P) Ltd. Pub. New Delhi, 2024
2. Shills, M.E., Olson, J., Shike, M. and Roos, C.Modern Nutrition in Health and Disease. 10th Edition .Williams and Williams. A. Beverly Co. London, 2005
3. A Cathrine Ross, Benjamin Caballero, Robert J Cousins, Katherine L Tucker, Thomas R Ziegler, Modern Nutrition in Health and Disease, 11th edition, Lippincott Williams & Wilkins Publishers, 2012
4. Shubhangini A Johsi, Nutrition and Dietetics, 5th edition, Mc Graw Hill Publications, 2021
5. Wadhwa, Nutrition in the Community, Elite Publishing House, 2013
6. Prabha Bisht, Community Nutrition in India, 1st edition, Star Publications, 2020

Reference Books:

1. Dietary Guidelines for Indians, ICMR, National Institute of Nutrition, Hyderabad, 2024
2. Bamji M.S, Textbook of Human Nutrition, 3rd edition, Oxford and IBH Publishing, New Delhi, 2009
3. Mark Lawrence and Tony Worsley, Public Health Nutrition, 1st edition, Allen & Unwin Publishers, 2007

Course Outcomes:

1. Predict the nutritional status of the community
2. Comprehend the need for macro and micro nutrients in human life cycle
3. Plan diets for all age groups including special conditions
4. Relate the lifestyle changes across different age and nutrition transition
5. Explain the purpose and use of dietary guidelines in planning diet

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO2	PSO3
CO 1	H	H	M	H	-	M	H	-	H
CO 2	L	L	H	H	L	H	H	L	H
CO 3	H	-	H	H	L	M	H	L	H
CO 4	H	-	H	H	L	M	H	L	H
CO 5	H	-	H	H	L	M	H	L	H

Assessment of Nutritional Status Practical

Semester I
25MFNC02

Hrs of Instruction /Week: 4
No. of Credits: 2

Course Objectives:

1. Familiarize on the techniques and methods of assessing nutritional status
2. Assess the nutritional status of different age groups in the community
3. Planning a day's diet for different age groups

1	**Direct methods - for different age groups and comparing with standards** **Anthropometric Measurements** Height, weight, BMI calculation, waist circumference, hip circumference, WHR, head circumference, chest circumference, head/chest ratio, wrist circumference, mid arm circumference, skinfold thickness, sitting height, knee height, body composition	**8**
2	**Biochemical Methods** Blood hemoglobin, urine dipstick method for albumin and sugar	**4**
3	**Clinical assessment and interpretation** Clinical examinations for physical signs – hair, angles of mouth, gums, teeth, nails, skin, eyes, tongue, muscles, bones, thyroid gland, lower extremities-oedema	**4**
4	**Dietary assessment** 24 hours dietary recall, food frequency questionnaire, dietary history, food dairy technique, observed food consumption (food weight)	**12**
5	**Indirect methods** – collect secondary data on mortality and morbidity rates	**4**
6	**Planning menu for different age groups** Infants, preschool children, school going children, adolescent, adults, elderly	**16**
7	**Planning menu for special conditions** Pregnancy and lactation	**4**
8	**Planning menu for special events** Sea voyage, high altitude, space travellers, athletes both men and women	**8**
	Total Hours	**60**

Text Books:

1. Srilakshmi B, Dietetics, New Age International Private Limited, 9th edition, 2023
2. Swaminathan, M. Advanced Textbook on Food Science and Nutrition, Vol:2, Second Edition, Reprinted, Bangalore Printed and publishing Co Inc, Bangalore, 2008.
3. Kumud Khanna, Sharda Gupta, Santosh Jain Passi, Ranjana Mahna, Seema Puri, Textbook of Nutrition and Dietetics, 2nd edition, Elite Publishing, 2020

Reference Books:

1. Nutrient requirements for Indians, Recommended Dietary Allowances Estimated Average Requirements – A report of the Expert group, 2020, ICMR NIN
2. Dietary Guidelines for Indians, ICMR, National Institute of Nutrition,
3. Hyderabad,2024
4. Indian Food Composition Tables, ICMR NIN, 2017

Course Outcomes:

1. Identify appropriate nutrition assessment tool in identifying the nutritional status
2. Realize the need for nutrients in growth and development in all stages of life
3. Explain the physiological reasoning for selection of foods in planning diet
4. Get acquainted with growth and development during special conditions
5. Relate the dietary requirements in scaling diet for sea, high altitude, space and sports

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	H	H	H	H	M	H	H	M	H
CO 2	H	H	H	H	L	L	H	M	M
CO 3	H	-	H	-	L	M	H	M	H
CO 4	H	H	H	H	L	L	H	M	M
CO 5	H	H	H	H	-	M	H	M	M

Food Microbiology and Food Safety

Semester I
25MFNC03 **Hrs of Instruction /Week: 3+2**
Course Objectives: **No. of Credits:4**

1. Acquire knowledge and understand the relevance of microbiology and its application in foodindustry and maintenance of health.
2. Gain knowledge about food additives and contaminants from the aspects of safety and hygiene.
3. Understand the importance of food safety and quality management in food processing.

Unit 1: **Introduction to Microbiology** 9

Structure, Growth and Multiplication of micro-organisms
Definition and History: *Microscopy, General Morphology and Types of microorganisms Bacteria, Fungi, Algae, Yeast and Virus –Bacteriophage (SS),* growth curve, batch and continuous culture, factors affecting growth: intrinsic factors, nutrient content, pH, redox potential, antimicrobial barrier and water activity, extrinsic factors: relative humidity, temperature and gaseous atmosphere.

Unit 2: **Microbiology of Foods, Benefits of Microbes** 9

Contamination, spoilage and *preservation of cereal and cereal products, sugar and sugar products vegetables and fruits, milk and milk products and canned foods, meat and meat products, egg and poultry, fish(SS)* food fermentation-types; fermented food products

Unit 3: **Introduction to Food Safety:** 9

Food safety in processing, packaging and labeling, food spoilage, factors affecting food safety, food borne hazards of food poisoning and its types and food intoxication and its types microbial origin.

Unit 4: **Food Additives and Contaminants, Hygiene and Sanitation** 9

Food colors, flavoring agents, preservatives, antioxidants, emulsifiers, stabilizers, antimicrobial substances; natural contaminants, toxins alkaloids, lathyrogens, goitrogens, haemagglutinins, phytates; indirect additives, pesticides in agricultural products, Antibiotics in sea foods, mycotoxins, metallic and microbial contaminants and adulterants *Food hygiene and sanitation–personal hygiene (SS)* and pest control in the food industry, industrial hygiene.

Unit 5 ***Food Laws (SS) and Quality Management, Recent Concerns in Food Safety.*** 9

International and National food laws, Essential Commodities Act (ECA). ISI, BIS, AGMARK, Food Safety and Standards Bill 2005, Food Safety Act, 2006, Food Safety Rules and Regulations of FSSAI, 2011, FAO,WHO, Codex Alimentarius, WTO, JEFA, APDA, ISO 22000 series, *HACCP- definition, principles, and affiliations (SS)*, consumer education, food safety education and training, food sampling and analysis of food

Related Practical Experience 30

1. Basic microbiology laboratory techniques
2. Unit directional flow diagram for infrastructure of microbiology laboratory
3. Handling of microscope, types and its principle
4. Hanging Drop Method – motility of bacteria.
5. Staining of Bacteria – simple staining, gram staining
6. Preparation of media and microbiological analysis of foods
7. Qualitative test for detection of food adulterants
8. CCP – in various foods
9. Market survey with FSSAI standards for foods

Total Hours 75

Text Books:

1. Adams M. R and Moss M. O, Food Microbiology, New Age International (P) Ltd., New Delhi, 2005.
2. James G.Cappuccino and Natalie Sherman, Microbiology – A Laboratory Manual, Pearson EducationPublishers, USA, 2008.
3. Frazier.W, Food Microbiology, Mc,Grawhill co ltd, New Delhi, 2005
4. James M.Jay Modern Food Microbiology, Fourth edition, CBS Publishers and Distributors, NewDelhi, 2005.

Reference Books:

1. Adam Tamine, Probiotic Dairy products, Blackwell Publishing, USA, 2005.6.
2. Curricula On Food Safety, Directorate of General of health Services, Ministry of health &familyWelfare, Govt of India, New Delhi, 2003.
3. David A. Shapton, Naroh F, Shapton ,Principles and practices for the safe processing of foods,Heineman ltd, Oxford,1991

Course Outcomes

1. Understand the general morphology of microorganisms and understand the growth inhibiting andpromoting factors for microorganisms.
2. Categorize the sources, contamination and type of spoilage in respective food groups and infer suitablepresentation techniques.
3. Enumerate food poisoning food borne hazards and food intoxication of microbial origin to ensure foodsafety.
4. Interpret the different clauses used and applications of safety management in food industry.
5. Define different food laws and regulations for quality management in food industry.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PS O 2	PS O 3
CO 1	H	L	L	M	L	L	L		M
CO 2	M	L	L	M	L	L	M	M	L
CO 3	L	L	L	M	L	L	M	L	M
CO 4	H	L	L	M	L	L	L	L	L
CO 5	M	M	L	M	L	L	L	M	L

Semester I **Community Nutrition and Public Health**

25MFNC04 **Hours of Instruction/Week:3**

Course Objectives: **No.ofCredits:3**

1. Learn nutritional programmes and policies over coming malnutrition
2. Understand various nutritional organizations combating malnutrition
3. Applytheprinciplesofsupplementaryfeedinginterventionduringemergency.

Unit1: **Nutrition and National Development**: Community Nutrition –meaning and concept of community nutrition, relationship between health and nutrition. Malnutrition-Definition, Ecology of Malnutrition Strategies to Overcome Malnutrition, Relation of nutrition to national development; nutrition and food security; Consequences of malnutrition; IMR, NMR, MMR and prevalence of common nutritional problems-PEM, Vitamin A Deficiency Diseases, Anaemia, Iodine Deficiency Disorders and Fluorosis. Determinants and indicator of health status. Ecological factors leading to malnutrition; Synergism between malnutrition and infection; Measures to overcome malnutrition. *History of malnutrition in India(SS)* 9

Unit 2: **National,InternationalandVoluntaryOrganizationstoCombatMalnutrition** 9

NutritionInterventionprogrammes–
NutritiousNoonMealProgramme.ICDS,Prophylaxisprogramme,
Empowering women towards improving the nutritional status of the family, community, and nation at large(SS)

National organization – ICAR, ICMR, CSWB, SSWB, NNMB, NIN, CFTRI, DFRL, NIPCCD and NFI; Food Fortification Resource Center. E-Public Distribution System. (Eat Right India Movement, Anemia Mukt Bharat, Poshan Abiyan, NeTProFaN, National Nutrition policy, and National Nutrition Mission.

InternationalOrganizations-
WHO,FAO,UNICEF,WorldBank,FFHC,WFP;Voluntaryorganizations–Global Alliance for Improved Nutrition(GAIN), Micronutrient Initiatives, CARE, CRS, AFPRO, IDA; Concepts of Community Health; Health care of the community.

Unit3: **Nutrition Education**

Nutrition Education- objectives and methods used, integration of nutrition education with extension work, Principles of planning, executing, and evaluating, nutrition education programmes, problems in conducting nutrition education programmes. Meaning, nature and importance of Nutrition education to the community and lessons to be taught *(SS)* Training workers innutrition education programmes, Methods of education when to teach, whom to teach and who is to teach.Use of computers to impart nutrition education, Organization of Nutrition education programmes. 9

Unit4: **Epidemiology of Communicable Diseases**

Definition of epidemiology – causes, signs and symptoms, treatment and prevention of communicable diseases, respiratory infections, intestinal infections, Other infections-dengue, filariasis. Types of immunity-active, passive and herd-group protection, Immunization agents-vaccines, immune globulins.
Immunization schedules (SS) National and WHO Expanded Programme on Immunization-Universal Passive, Combined, Chemoprophylaxis, non-specific Measures. 9

Unit 5: Environmental Sanitation and Disaster Management 9

Relation to nutritional status importance of sanitation and hygiene in health
Pollution, *Bio manure, Vermicomposting(SS)*, Effective Microorganisms
Water purification and recycling
Types of disaster–natural and manmade–earthquakes, volcani corruptions, flash floods, major floods, tsunami and drought, fire accidents, bomb blast.
Disaster management-mitigation strategies-Role of NGO's and GO's and nutritionists, Major nutritional and health considerations in disaster
Emergency feeding, mass and supplementary feeding, management of feeding operations, water and food safety.

Total Hours 45

Text Books

1. Nnakwe, 2017, "Community Nutrition", III Edition , Jones & BartlettLearning, USA.
2. Surya tapa Das,2019, "Text book of Community" Nutrition, IVEdition, Academic Publishers, West Bengal, INDIA

Reference Books

1. ParkA.(2007),Park'sTextbook of Preventive and Social Medicine XIX Edition M/SBanarasidas, BharatPublishers,1167,PremNagar,Jabalpur,428 001(India)
2. BamjiM.S,Prahlad RaoN, Reddy V(2004). TextbookofHumanNutrition, IIEdition, Oxford and PBH Publishing Co.Pvt.Ltd, NewDelhi
3. SwaminathanM (2007), Essentials of Food and Nutrition, Edition: 5th, The Bangalore Printers & Publishing Co. Ltd.

Journals:

1. Reports o f the State of World's Children, WHO and UNICEF, Oxford University.
2. Reports of National Family Health Survey, International Institute for Population Science, Mumbai.
3. Indian Journal of Medical Research, ICMR, New Delhi,
4. Indian Journal of Pediatrics, Valley Nicro, Missouri, U.P.
5. Indian Journal of Nutrition and Dietetics, Avinasilingam Institute for Home Science and Higher Education for Women, Coimbatore. Proceedings of the Nutrition Society of India, NSI, Hyderabad

Course Outcomes

1. Evaluate the impact of community nutrition on national development and analyze the effect of Nutrition education programs on public Health
2. Apply the principles of supplementary feeding intervention during emergency and analyze the nutritional status of community
3. To acquaint them knowledge regarding food security and government and international program running in the field of community nutrition.
4. Understand the principles underlying the strategies and methods that can be used to plan nutrition education programmes for at-risk populations.
5. Analyze the nutritional status of community

COS/POS	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	H	H	L	L	M	H	M	L
CO2	H	M	L	M	M	M	M	M	H
CO3	H	H	L	M	L	M	M	L	H
CO4	H	H	M	M	L	L	H	M	L
CO5	H	H	H	L	M	M	H	M	L

Research Methods and Statistical Applications

Semester I
25MFNC05

Hrs of Instruction /Week: 3+2
No. of Credits: 4

Course Objectives:

1. Understand the fundamental principles and techniques of methodology concerning types of research.
2. Use effective tools and techniques to collect research data, organize them appropriately forfacilitating statistical analysis.
3. Apply statistical procedure to analyse numerical data and the interpreting data using statistical software.

Unit 1: **Introduction to Research, Types of Research and Research process** — 9

Definition, Objectives, significance and characteristics of research
Types of Research – Descriptive, analytical, applied, fundamental, quantitative, qualitative, conceptual, empirical and current types of research
Hypothesis – Definition, concepts, tests of hypothesis
Basic components of research design
Sampling design- Probability and non- probability sampling methods

Unit 2: **Data and Tools of Data Collection** — 9

Primary and secondary data and data sources – Interview, observation, schedules and questionnaires – Definition, types, requirements, advantages, disadvantages, limitations
Census Vs sample survey
Pre-testing and pilot study, Editing and coding of data

Unit 3: **Organization and Representation of Data, Report writing** — 9

Classification – Definition, objectives, requisites, methods, qualitative, quantitative; frequency distribution – definition, terms; discrete and continuous
Tabulation of data- parts of a table, preparation of blank tables
Diagrammatic – One dimensional diagrams, two dimensional diagrams, pictogram and cartographs
Graphical- Frequency graphs- line, polygon, curve, histogram, cumulative frequency graphs- ogives
Components or layout of a thesis (SS)

Unit 4: **Descriptive Measures** — 9

Mean*, median*, mode* and their applications
Measures of dispersion*- standard deviation, coefficient of variation, percentiles and percentile ranks
Correlation coefficient and its interpretation*, Rank correlation*
Regression equations* and predictions. Association of attributes, contingency table

Unit:5 **Probability and Tests of Significance** — 9

Rules of probability and its applications
Normal, binomial – properties, importance in research studies, Wilcoxan Rank Test, Mann Whitnes U test, Kruskal Wallis Test
Large and small sample tests –'t'*, F* and chi square tests* ANOVA* and applications,Multiple paired comparison test – DMRT test, Tukeys test, Duncan'stest

30

Related Experience

1. Identifying the research problems under each type of research
2. Formulation of questionnaires and schedules
3. Consolidating data and forming tables
4. Drawing graphs and diagrams appropriately
5. Working out numerical sums and interpret
6. Numerical applications and drawing inferences
7. Data Analysis using SPSS Software

Total Hours 75

*Inclusive of simple problems

Text Books:

1. C.R.Kothari and Gaurav Garg, Research Methodology: Methods and Technique, New AgeInternational Publishers, 2019, 4th Edition
2. S. P. Gupta, Statistical Methods, Sultan Chand & Sons, 2012.

Reference Books:

1. Devadas.R.P. A Handbook on methodology of Research, Sri Ramakrishna Vidyalaya, Coimbatore,2000
2. Gosh.B.N. Scientific Methods and Social Research Sterling Publishers Pvt.Ltd. New Delhi.
3. Kulbir Singh Sidhu, Methodology of Research in Education Sterling Publishers Pvt. Ltd., New Delhi,2006
4. Srivastava.A.B.L and Sharma. K.K., Elementary Statistics in Psychology and Education, SterlingPublishers Pvt.Ltd.2003
5. G.C.Ramamurthy, Research Methodology, Kindle Edition, Dream tech Press, 2011
6. Ranjit Kumar, Research Methodology, SAGE publications, 2011, 3rd Edition
7. A.C. Gupta and VK Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2014

Course Outcomes:

1. Possess the knowledge on the basic concepts related to research methodology and statistics.
2. Develop understanding on the characteristics of research and sampling design along with datacollection, presentation and analytical tools using software
3. Acquire the skill in the design of sampling along with selection, collection, analysis and interpretationof data using statistical procedures.
4. Analyse the situation for identification of problems and assess for fitting hypothesis and statisticalprocedures for related data.
5. Construct the research design with appropriate tools and statistical analysis in solving problems relatedto food science and nutrition.

CO /PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO 2	PSO 3
CO 1	L	L	-	L	L	L	L	M	L
CO 2	-	L	-	L	-	-	L	M	-
CO 3	L	-	L	L	L	L	L	M	L
CO 4	-	-	M	L	L	L	L	M	L
CO 5	L	L	M	L	L	L	H	M	-

Therapeutic Nutrition

Semester I
25MFNC06

Hrs of Instruction /Week: 4
No. of Credits: 4

Course Objectives:

1. Understand the role of nutrition for health and diseases.
2. Obtain knowledge of different therapeutic diet and their preparation
3. Develop capacity and attitude for taking up the profession as a dietician.

Unit 1: Introduction and concept of therapeutic nutrition 12

Growth and scope of dietetics, definition, purpose and principles of therapeutic diets, role of nutrition in disease prevention and management, dietary guidelines for special therapeutic condition, principles of diet therapy (Preventive, Curative, and Supportive Nutrition), classification of therapeutic diet (Regular, Soft, Liquid, and Specialized Diets), Concept of tube feeding (intravenous feeding & total parenteral nutrition).

Pre and post-operative nutrition, Pharmacological use of nutrients, Characteristics and role of

Dietitians and IDA Nutrition and diet counselling.(SS)

Unit 2: Diets in Fever and Infections and other disease conditions 12

Fevers- causes, metabolic changes, types, fevers of short duration and chronic fever and infections, Typhoid, Tuberculosis, malarial infections Dengue, Swine flu and viral fever

Classification, risk factors, symptoms, general systemic reactions, nutritional problems of cancer therapy, nutritional requirement and dietary management; HIV and AIDS- etiology, signs and symptoms, stages, diagnosis and nutritional/dietary management.

Pathophysiology of Fevers and Cancer (SS)

Unit 3: Diseases of the Gastrointestinal Tract and Liver 12

Diseases of Gastrointestinal tract- etiology, type, clinical, signs and symptoms, diagnosis, nutritional/dietary management-peptic ulcer, diarrhoea, dysentery, constipation and other GIT problems like gastritis, tropical sprue dumping syndrome, lactose intolerance, irritable bowel syndrome, diverticulosis celiac disease. Nutritional Consequence of GIT Disorders- Malabsorption syndromes and role of probiotics and prebiotics in gut health.

Diseases of liver: functions of liver, etiology, physiological and metabolic consequences, clinical signs and symptoms, mode of treatment and nutritional/dietary management of jaundice, hepatitis, Cirrhosis.

Diseases of Gall Bladder and pancreas: cystic fibrosis and pancreatic cancer, cholecystitis, cholelithiasis and pancreatitis. Nutritional Therapy for GI Tract and Liver

Pathophysiology of GI Tract and Liver Diseases (SS).

Unit 4: Diseases of cardiovascular system and renal disease 12

A. Concepts and terms related to cardiovascular disease. Risk factors for cardiovascular diseases, dietary management. Role of fat in the development and prevention of cardiovascular diseases, Functional foods for CVD. Hypertension, atherosclerosis, Hypercholesterolemia, Hyper lipoprotenemia, causes, consequences, prevention and dietary management- DASH diet, Mediterranean diet.

B. Diseases of renal system: function of kidney, etiology, physiological and metabolic consequences, clinical signs and symptoms and nutritional management for nephritis, nephrosis, nephrosclerosis, renal failure-acute and chronic; Dialysis: principles and types. Kidney stones and urolithiasis- etiology, types, nutritional/dietary management- KDIGO guidelines

Pathophysiology of Cardio Vascular and Renal Diseases (SS).

Unit:5 Endocrine and genetic disorders 12

Diabetes mellitus: etiology, types, clinical and biochemical changes, Clinical signs and symptoms, complications, diagnosis, mode of treatments Insulin – Short and Long Acting Carbohydrate Count and menu planning.

A. Disorders of thyroid and para thyroid glands, tetany, gout and arthritis.

B. Obesity- etiology, theories on Obesity, types, nutritional and dietary management, complications. Under weight- etiology, nutritional/dietary management; PCOD & PCOS – Diet Modification and role of insulin resistance.

Pathophysiology on Diabetes Mellitus, Gout and Purine- Restricted Diet and PCOD (SS)

Total Hours 60

Text Books:

1. Geissler,C., Powers.H., Human Nutrition., 14th Edition., Oxford University Press., 2023.
2. Evans.S.L., Nutrition, Health and Disease: A Lifespan Approach., 3rd Edition., Wiley.,2021.
3. Gropper.S.S., Smith.J. L., Advanced Nutrition and Human Metabolism.,7th Edition., Cengage Learning.,2022.
4. Bowman.B.A., Russell,R.M., Present Knowledge in Nutrition., 11th Edition., 2020.
5. Brown.J.E., Isaacs.J., Krinke.B., Murtaugh,M., Lechtenberg.E., Nutrition Through the Life Cycle., 7th Edition., 2021.

References:

1. Robinson C.H. (2015) Normal and Therapeutic nutrition, 12th edition, Macmillan Publishing Co. Inc, Newyork.
2. Kathleen Mahan L ,Krause's Food & the Nutrition Care Process (Krause's Food & Nutrition Therapy): , 18th edition, W.B.Saunders Company, Philadelphia, 2020
3. Srilakshmi. B (2016), Dietetics, New Age International Pvt Ltd, New Delhi.
4. Dietary Guidelines of Indians- A Manual, National Institute of Nutrition, Hyderabad, 2014

Journals:

1. Journal of American Dietetic Association. The American Dietetic Association Mount Arris, Illinois- 61054, USA.
2. The American Journal of Clinical Nutrition Published by the American society for Clinical Nutrition, Inc., USA.
3. The Indian Journal of Nutrition and Dietetics, Sri Avinashilingam Home Science College for Women, Coimbatore.
4. Food and Nutrition Bulletin, United Nations University Press, Japan

Course Outcomes:

1. Understand the concept of therapeutic diets and diet counselling.
2. Learn the formulation of different modified diets and feeding techniques
3. Categorize the diseases and disorders for planning suitable diets
4. Prepare diets and calculate nutrient composition for dietary intervention
5. Plan and prepare therapeutic diets for different disease conditions.

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PS O1	PSO2	PS O3
CO1	M	M	L	M	H	M	H	-	H
CO2	M	M	M	M	H	L	M	M	H
CO3	L	L	M	M	M	M	M	M	H
CO4	M	M	M	H	H	-	H	M	H
CO5	L	M	M	H	H	L	H	L	L

Semester I **Therapeutic Nutrition Practical**

25MFNC07 **Hrs of Instruction/Week: 4**

No.of Credits: 2

Course Objectives:

1. Provide insight for planning and preparation of Therapeutic Diet
2. Plan and Prepare recipes based on Personalized Nutrient Requirement
3. Explore the Diet planning Techniques

Unit 1:	Visits to dietary department of hospitals Preparation of Hospital diets using functional foods and presentation of case studies	**12**
Unit 2:	Preparation of Diet for Febrile Conditions – TB, Typhoid Prepare Bland and Soft Diet	**12**
Unit 3:	Preparation of diet for Obesity and Underweight Prepare High Energy, High Protein and Nutrient Dense Diet Prepare Calcium Rich, Iron Rich Diets	**12**
Unit 4:	Diet for Peptic Ulcer, Diarrhoea, Constipation and Liver Diseases – Jaundice and Cirrhosis Prepare Low Fat Low fibre Diet Prepare High Fibre Low Fat Diet	**12**
Unit 5:	Diet for Cardiovascular disease, Atherosclerosis and Hypertension and Renal Diseases Prepare Low Sodium and Potassium Rich Recipes Prepare Low Protein, Low Fat Recipes	**12**
	Total Hours	**60**

Text Books:

1. Srilakshmi, B. Dietetics ,9th Edition,New Age International P. Ltd., New Delhi,2024.
2. Dietary Guidelines for Indians, ICMR, National Institute of Nutrition, Hyderabad, 2024
3. Garg, M. Diet, Nutrition and Health, ABD Publishers, 2006.

Reference books:

1. Krause, M.V. and Mahan, L.K. Food, Nutrition and Diet Therapy, 9th Ed., W.B. Saunders Company, Philadelphia, 2009.
2. Maimun Nisha, Diet Planning for Diseases, Kalpaz Publishers, 2006

Course Outcomes:

1. Understand the basic principles involved in planning diets for different disease conditions.
2. Plan and prepare diets to meet out the quality and quantity requirements for specific disease conditions
3. Acquire practical knowledge of therapeutic diet to meet their requirement
4. Gain knowledge in planning and preparing diets for CVD, diabetes, hypertension, peptic ulcer, and cancer.
5. Understand the calculations of nutritive value for the planned and prepared diet

CO /PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO 2	PSO3
CO 1	H	-	M	H	-	M	M	H	H
CO 2	H	L	H	H	-	H	-	M	H
CO 3	H	-	M	M	M	-	M	M	H
CO 4	H	-	M	M	L	-	L	H	M
CO 5	H	-	H	M	M	-	H	M	H

Physiological Basis for Nutrition

Semester: II

25MFNC08 **Hrs of Instruction /Week: 3+2**

Course Objectives: **No. of Credits: 4**

1. Understand the significance of blood, body fluids and immunity
2. Comprehend the organization and structural plan of the skeletal, muscular, cardiovascular and digestive systems
3. Gain insight into excretory, endocrine, nervous and renal systems

Unit 1: Blood, Body Fluids and Immunity

Blood- *Composition (SS) and functions,* plasma proteins- origin and its functions, blood volume, haemostasis, *blood coagulation (SS)* Development of red blood cells and anaemia, white blood cells, platelets, blood groups and blood transfusion.

Body Fluids - Compartment of body fluids, composition of body fluids, significance of body fluids, methods of measuring body fluids, lymphatic system and lymph.

Immunity- Types of immunity, Innate and adaptive immunity, Immune responses, Immune disorders, autoimmunity, and immunodeficiency Role of lymphocytes in immunity, antigens, development of cellular immunity, development of humoral immunity, Immunisation 9

Unit 2: Skeletal and Muscular System

Skeletal System – *Classification of organ systems (SS),* Structure of bones- Different types of bone tissue and their functions, Joints: Types of joints and their role in movement, Axial skeleton, Appendicular skeleton, Bone development: Cartilage: Muscle-bone interactions, Skeletal system disorders.

Muscular System - Muscle types: Skeletal muscle, Smooth muscle, Cardiac muscle, Muscle structure: Muscle fibers, Myofibrils, Muscle functions: Locomotion: Movement of the body, Posture maintenance, Heat production, Blood circulation, Respiration. 9

Unit 3: Cardiovascular and Respiratory System

Cardiovascular System- *Introduction to cardiovascular system (SS),* origin and spread of cardiac impulse, *cardiac cycle (SS,)* heart sounds, electro cardiogram, *heart rate (SS)* blood pressure-regulation of blood pressure and factors influencing blood pressure, hypertension, effect of exercise on cardio vascular system.

Respiratory System - *Physiological anatomy of respiratory tract (SS)*, mechanics of respiration, transport of respiratory gases in blood, exchange of respiratory gases pulmonary volumes, regulation of respiration, effect of exercise on respiration, high altitude and acclimatization 9

Unit 4: Digestive and Excretory System

Digestive System - Organization and structural plan of gastrointestinal system, Functions of the stomach, *liver and intestine (SS),* mechanism of secretion of saliva, gastric juice, bile, pancreatic juice and intestinal juice, movements of gastrointestinal tract, Hormones in the gastrointestinal tract, gastric function tests and liver function tests

Excretory System- Structure of kidney and nephron, urine formation, micturition, renal function test, acid base balance by kidney. 9

Unit 5: Endocrine and Nervous System

Structure and functions of pituitary glands, thyroid glands, endocrinal functions of pancreas, adrenal cortex and medulla. *Introduction to nervous system (ss)*, neuron, receptors, synapse, neurotransmitters, reflex activity, structure and function of nervous system. 9

Related Experience

Vital signs - Recording blood pressure in different positions, arms, and before and after exertion; Recording body temperature, recording pulse rate and heart rate, recording respiratory rate, Measuring height, weight, waist and hip circumferences, computing BMI and WHR15

Blood samples - Estimating haemoglobin, using point of care device, examine blood sugar using glucometer, Preparing and examining blood smears, determining blood groups, determining bleeding and coagulation time, studying various systems and organs using charts, models, and specimens, Examining tissues and slides. 30

Total Hours 75

Text Books:

1. ChatterjeeC.C(2025)HumanPhysiology,VolumeIandII,15th Edition, CBS Publishers & Distributors Pvt. Ltd.
2. A K Jain (2023) Textbook of Physiology 10th Edition (Vol 1 & Vol 2) Arya Publlishing House, New Delhi
3. Marieb and Hoehn (2021) Human Anatomy and Physiology, 12th Edition, Pearson Education Ltd, Harlow
4. Tortora and Derrickson (2020) Principles of Anatomy & Physiology (16th edition) John Wiley & Sons, New York
5. Sembulingam,K andPrema Sembulingam (2012):Essential of Medical Physiology,6th Edition,Jaypee Brothers MedicalPublishers (P)Limited,New Delhi.
6. Subramanyam,Mathavan Kutty and Singh(2010):TextBookof Human Physiology,ChandandCompany,NewDelhi.

Reference Books

1. Guyton,A.CandHall,J.B(2016):TextBookofMedicalPhysiology,13thEdition,Elsevier, Philadelphia,
2. Best and Taylor's Physiological Basis of Medical Practice (2011) 13 Edition, Wolters Kluwer India Pvt. Ltd
3. Samson Wright's Applied Physiology (2019) 13th Edition, Oxford University Press, NY.

Course Outcomes:

1. Gain knowledge and comprehend the functions of blood, bodyfluidsand immunity in the human body.
2. Comprehend the functions and mechanism of action of different organ systems
3. Apply the knowledge acquired on physiological systems in the body to health and disease.
4. Acquiretheskillsto perform basicphysiologicaltests, interpret and relate the results to thehealthand disease.
5. Apply basic knowledge on organ systems and the diagnostic tests to detect nutritional deficiencies

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	L	H	L	-	-	-	H	-	-
CO 2	L	H	L	-	-	-	-	M	-
CO 3	L	H	M	-	-	-	-	-	H
CO 4	L	H	L	M	-	-	-	-	-
CO 5	L	H	L	-	M	-	-	-	-

Food Biotechnology

Semester II **Hours of Instruction/ week : 4**
25MFNC09 **No. Of Credits : 4**

Course Objectives:

1. To gain knowledge on the techniques and tools of genetic engineering
2. To understand fermentation and enzymatic technology in food industries
3. To explore biotechnological techniques in the production of food based products

Unit 1: Introduction and Genetic Engineering 12

Definition, scope and importance of biotechnology (SS)

Tools of genetic engineering: Enzymes exonuclease, endonucleases, restriction endonucleases, ligase, reverse transcriptase and alkaline phosphatase.

Commonly used cloning vectors-

plasmids, bacteriophage, cosmids, phasmids: Genetic Engineering and Gene cloning – definition ,basic steps and applications

Unit 2: Microbial Growth and Fermentation Systems 12

Microbial cell growth, microbial metabolism, regulation of metabolism and product secretion (SS). Fermentation systems–batch, fed batch and continuous process; general structure of fermenter, factors influencing fermentation, Bioreactors – definition and types, Downstream processing – steps involved, biosensors and biochips – definition and applications.

Enzyme Technology – soluble enzymes, immobilized enzymes – methods of immobilization, general path way for synthesis of enzymes, Synthesis and applications of enzymes in food industries- amylases, invertase, glucose isomerases.

Unit 3: Tissue Culture and Single Cell Protein (SCP) 12

Plant tissue culture–basic requirements, good laboratory practices echniques and applications, Technique of gene transfer into plants- transgenic plants -tomato, golden rice, Btbrinjal, GM mustard, safety aspects of transgenic crops; animal tissue culture - basic requirements, good laboratory practices and techniques, Applications in food industry.

Microbial biomass and Single cell protein definition, importance and applications, synthesis of single cell protein (SS) spirulina, mushroom culture and yeast biomass production. Single cell cultures for production of food flavours and colours.

Unit 4: Role of Biotechnology in Food Industries 12

a) Food additives, synthesis of acidulants – citric acid, gluconic acid, lactic acid, itaconic acid; sweeteners –glucose syrup and High Fructose Corn Syrup (HFCS):thickeners and gelling agents –xanthan gums.

b)Vitamins and amino acids – vitamin A, ergosterol, riboflavin, vitamin B12, fatty acid; aminoacids –lysine, methionine, glutamate.

c) *Food fermentations- alcoholic beverages, cheese making, fermented soya based foods, meat fermentation, vinegar(SS)*

Unit 5: Xenobiotics, Nanotechnology, Nutrigenomics and Regulatory of Aspects Biotechnological Methods 12

Definition, components, metabolism of xenobiotics- Phase I and Phase II reactions, Biodynamics of xenobiotics, Nanotechnology and Nutrigenomics: Definition, Concepts and applications; *Impact of biotechnology on the nutritional quality of foods(SS),*

Safety aspects of foods produced by biotechnology as per International and National regulations.

Related Experience

Visit to biotechnology laboratory

Visit to plant tissue culture laboratory

Visit to animal tissue culture laboratory

Total Hours 60

Text Books :

1. Briercanon (2014) Fundamentals of food Biotechnology, Agrotech press, New Delhi.
2. RukamS,Tomar,SunilV.Patel, Manoj Prakhia, B.A.Golakiya (2014),2 edition, Handbook of Genetics and Biotechnology.
3. RCDubey, A Textbook of Biotechnology, Fifth Revised Edition 2014,S Chand Publications
4. ByongH.Lee, Fundamentals of Food Biotechnology, 2nd Edition, 2015,Wiley-Blackwell
5. Dr.Sm Satyanarayana, Dr.U.Chaktapani (2019) Biotechnology, Books and Allied Pvt. Ltd, Kolkata.

Reference Books:

1. JoshiVK, Food Biotechnology, Principles andPractices,2013,I K International Publishing House Pvt. Limited
2. Vinay Sharma, Afroz Alam (2019), Plant tissue culture, I.K. International Pvt. Ltd, New Delhi
3. S.N.Jogdand (2016), Gene biotechnology, 4 edition, Himalaya publishing house PVT. Ltd, Mumbai.
4. Mansi, EMT, Bryce, CFA, Demain, A. Land Allman, R(2007)Fermentation Microbiology and Biotechnology,
5. Taylor and Francis, New York.

Course Outcomes:

1. Gain knowledge on the techniques and tools of genetic engineering and food biotechnology
2. Recognize the importance of fermentation, xenobiotics, nanotechnology, nutrigenomics and applications of enzyme technology in food industries
3. Identify key genetically modified foods and animal tissue culture in the production and safety of transgenic plants and animals
4. Explore microbial pathways and appreciate the role of microorganisms in industrial processes
5. Elucidate the nutritional and safety aspects of implications of biotechnology in foods

CO /PO	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3
CO 1	H	L	M	L	-	H	L	H	L
CO 2	-	M	-	M	M	H	L	H	M
CO 3	M	-	L	H	L	M	L	H	H
CO 4	L	L	M	M	M	L	L	H	H
CO 5	M	M	M	H	H	H	M	H	M

Semester II
25MFNC10

Advances in Nutrition- I

Hrs of Instruction /Week: 2+2

No. of Credits: 3

Course Objectives

1. Explore the metabolism and utilisation of macronutrients
2. Relate bioavailability and nutritional significance of macronutrients
   Learn the techniques and methods of assessing nutrients and body fluids.

Unit 1: Energy — 6

Definition of Energy, Components of energy requirements: BMR, RMR, thermic effect of food, physical activity. Energy Content of Foods, Total Energy Expenditure, Energy balance, Factors affecting energy requirements, methods of measuring energy expenditure, Energy utilization in cells, Energy metabolism during Physical Activity, CED and Obesity *Energy requirements and Recommended Dietary Allowances- ICMR, FAO and WHO (SS)*

Unit 2: Carbohydrates — 6

Nutritional Importance of Carbohydrates. Review of Classification, Digestion, Absorption, Utilization and Metabolism of Carbohydrates, Glycemic Index and Glycemic Load. Dietary Fibre – Classification, Sources and its role in Human Nutrition, Interrelationship with proteins and fats.*Disorders related to carbohydrate metabolism(SS)*

Unit 3 Proteins — 6

Classification and Functions, Sources, Digestion, Absorption, Utilization and storage of proteins, Protein Turnover, Amino acids and Peptide transporters. Evaluation of Protein Quality- BV, DC, PER, NPR, NPU, PDCAAS, Supplementary value of proteins related to PEM. Computation of Protein Requirements. Recommended intakes- ICMR, FAO and WHO. *Novel proteins (SS)*

Unit 4 Lipids — 6

Classification and Functions, Digestion and absorption of lipids, metabolism and transport of lipids in blood. Lipid transformation in the liver, Lipotropic factors, role of essential fatty acids, deposition of fat in the body, Free radical formation and role of antioxidant enzymes in mammalian cells, Consequences of high and low fat intakes *Review of Lipid Nutrition - saturated, poly unsaturated, mono unsaturated and trans fat, Fat Burners and Replacers(SS)*

Unit 5 Body fluids and body composition — 6

Body fluid compartments, Water -*Sources, Distribution, Functions and Requirements(SS)* Regulation and disorders of Water Balance, Importance of Dehydration; Assessment of Hydration Status- Common indices

Body composition- Methods of assessment, relation of body composition to nutritional status

Related practical experience — 30

Animal model study on estimation of PER and
Nitrogen balance

Total Hours 60

Text Books:

1. Mahtab S. Bamji, PrahladRao.N and Vinodhini Reddy, Textbook of Human Nutrition, 4th Edition, Oxford IBH Publishing Co Pvt Ltd, 2019
2. Dietary Guidelines for Indians , ICMR, National Institute of Nutrition, Hyderabad,2024
3. ICMR-NIN Expert Group on Nutrient Requirement for Indians, Recommended Dietary Allowances (RDA) and Estimated Average Requirements (EAR) - 2020.

Reference Books:

1. Kathleen Mahan L ,Krause's Food & the Nutrition Care Process (Krause's Food & Nutrition Therapy): , 18th edition, W.B.Saunders Company, Philadelphia,2020.
2. Tammy Stephenson and Caroline Passerrello, Human Nutrition: Science for Healthy Living, 3rd Edition, McGraw Hill, 2024.
3. Indian Food Composition Tables , ICMR, National Institute of Nutrition,Hyderabad,2017.
4. Nutritive Value of Indian Foods , ICMR, National Institute of Nutrition,Hyderabad

Course Outcomes:

1. Comprehend the concepts of Nutrition.
2. Apply the knowledge in professional research on macronutrients
3. Acquire skills to evaluate protein quality
4. Create strategies to improve nutritional significance of macronutrients
5. Develop analytical designs in advanced nutrition research.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	H	M	H	L	L	H	M	M	L
CO 2	H	M	L	M	M	M	H	M	H
CO 3	M	H	L	M	L	M	M	L	H
CO 4	H	M	M	M	M	L	M	M	L
CO 5	H	H	L	L	M	M	H	M	L

Analytical Instrumentation for Foods

Semester II
25MFNC11

Hrs of Instruction /Week: 2+2
No. of Credits: 3

Course Objectives:

1. Learn advanced instrumentation in food and biochemical analysis
2. Outline the principles of instruments
3. Describe the applications of instrumental techniques in food analysis

Unit 1: Spectrometric Techniques 6

Need for analysis and instrumentation, Selecting an appropriate instrumental technique, criteria for selecting a technique, Limit of Detection (LOD) and Limit Of Quantification (LOQ), Validation and Verification of methods in instruments (as applicable). *Colorimetry (SS),* Spectrophotometry -definition and derivation of Lambert-Beer's Law, UV-VIS Spectrophotometer, Atomic-Absorption Spectroscopy (AAS),Inductively Coupled Plasma – Optical Emission Spectrophotometry (ICP- OES/MS)

Unit 2: Chromatographic Techniques 6

Basics and Classification of Chromatography- Adsorption, partition, size exclusion, ion-exchange, affinity

Gas Chromatography, Liquid Chromatography - Instrumentation, Sampling Techniques and applications, Applications of HPLC, *Comparison of HPLC and GC (SS),* Thin Layer Chromatography, High Performance Thin Layer Chromatography (HPTLC)

Hyphenated Techniques - Gas ChromatographyMass Spectrometry (GCMS), Liquid ChromatographyMass Spectrometry (LCMS), ICPMS-HPLC

Unit 3: Fluorimetry and Flame Photometry and Electrophoresis 6

Theory of fluorescence and instrumentation,

Instrumentation in Flame Photometry- oxidant, fuel, filter, detector, amplifier, applications

Principles and procedure of electrophoresis – Paper and Agar Electrophoresis, Moving boundary electrophoresis, SDS-PAGE, *Applications in food systems (SS)*

Unit 4: Radioactivity Measurement and Advanced Microscopic Techniques 6

Radioactive isotopes (SS) Methods and Types

Radioactive Counters- gas and liquid Scintillation- uses, applications and safety

Food Morphology - Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM)

Techniques for Analysis of Physical Properties of Foods 6

Rheology and Viscosity of foods – Rheometer, Viscometer, Barbender

Unit 5: Farinograph, Texture Analyser, Hunter Calorimeter, *Refractometer, practical interpretation of texture profile analysis in food systems (SS),*
Nuclear Magnetic Resonance Spectroscopy (NMR), Fourier Transform Infrared Spectroscopy (FTIR), Thermo gravimetric analysis (TGA) and differential scanning calorimetry (DSC) - Principle, Instrumentation and Applications

Demonstration and Related Experience **30**

Extraction of fat using Soxhlet apparatus
Hydrodistillation
Qualitative identification of phytochemicals
Chromatography and electrophoresis – any one technique
Visit to laboratories – GCMS, LCMS, HPLC, AAS

Total Hours 60

Text Books:

1. Douglas A. Skoog, Donald M.West, F.James Holler, Stanley R Crouch, Fundamentals of Analytical Chemistry, 10th edition, 2022
2. L. Veerakumari, Bioinstrumentation, MJP Publishers, Chennai, 2015
3. H Kaur, Instrumental Methods of Chemical Analysis, Pragati Prakashan Publications, 2012

Reference Books:

1. Official Methods of Analysis of AOAC International, 22nd edition, 2023
2. Yeshajahu Pomeranz and Clifton E Meloan, Food Analysis – Theory and Practice, An Aspen Publication, 3rd edition, 2004
3. Rodney F Boyer, Biochemistry Laboratory: Modern Theory and Techniques, 2nd edition, Pearson Publication, 2010
4. Varley, Practical Clinical Biochemistry, 4th edition, CBS Publishers, 2005

Course Outcomes:

1. Understand the need for analysis and instrumentation
2. Identify an appropriate technique for analysing specific substances
3. Learn the principles of different instruments used for analysis
4. Have an insight into the advanced techniques in food and nutrient analysis
5. Update knowledge on analytical instruments by visiting laboratories

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	L	-	-	L	M	M	-	L	M
CO 2	M	L	-	L	H	M	-	L	M
CO 3	M	L	-	L	H	M	-	L	M
CO 4	M	L	-	L	M	M	-	L	L
CO 5	M	L	-	L	M	M	-	L	L

Techniques for Clinical Nutrition Practical

Semester II
25MFNC12

Hrs of Instruction/Week:4
No. of Credits:2

Objectives:

1. Comprehend the biochemicalanalytical techniques of blood and urine
2. Identify the biochemical parameters with the diagnostic level of nutritional status
3. Understand the clinical significance of biochemical parameters in human health

Topic	Hrs
Determination of	
a. Blood Glucose	3
b. Haemoglobin - Cyanmethaemoglobin method	3
c. Iron and haemoglobin - Wong's method	4
d. Total Cholesterol-kit method	3
e. Triglycerides-kit method	3
f. High Density Lipoproteins(HDL) and Low Density Lipoproteins(LDL) -kit method	3
g. Serum Calcium	4
h. Serum Total Protein and A/G ratio -kit method	3
i. Serum Phospholipid	3
j. Serum Creatinine	3
k. Serum Alkaline Phosphatase -kit method	3
l. Serum Glutamic Oxalate Transaminase -kit method	3
m. Serum Glutamic Pyruvate Transminase -kit method	3
n. Serum Bilirubin -kit method	3
Analysis of Urine for	
a. Creatinine	3
b. Urea	3
c. Total nitrogen	4
d. Calcium	3
e. Phosphorus	3
Total Hours	**60**

Text books:

1. Mahtab S. Bamji, PrahladRao.N and Vinodhini Reddy, Textbook of Human Nutrition, 4th Edition, Oxford IBH Publishing Co Pvt Ltd, 2019
2. Charles George Lewis Wolf, (2007) A Laboratory Hand-book of Urine Analysis anPhysiological Chemistry, W. B. Saunders & Co., Harvard University,
3. Jessica Carol,Textbook of Analytical Biochemistry,Syrawood Publishing House,2016

Reference Books :

1. Raghuramulu N. Madhavan Nair K. KalyanaSundram S (2007) A Manual of Laboratory Techniques Silver Printers, NIN.
2. Nancy A. Brunzel (2004) Fundamentals of Urine and Body Fluid Analysis, Saunders; 2nd Edition
3. Varley, H., Gowenlak, A. H and Hell, M. Practical Clinical Biochemistry, William Itinmaon Medical Books, London, 2000.

Course Outcomes:

1. Acquire the knowledge on diagnostic levels of biochemical parameters in blood and urine
2. Understand the clinical significance of levels of biochemical parameters in association with nutritional status
3. Learn the analytical techniques in the assessment of biochemical parameters.
4. Acquire the analytical skills for the estimation of biochemical parameters in blood and urine.
5. Acquire the skills on employing the appropriate kit methods for the analysis.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO 2	PSO 3
CO 1	H	L	-	L	M	M	H	-	M
CO 2	H	L	-	L	H	M	H	-	M
CO 3	H	M	-	L	H	M	M	-	H
CO 4	M	M	-	L	M	M	M	-	H
CO 5	M	M	-	L	M	M	M	-	M

Professional Development Course

Product Development and Entrepreneurship

Semester II

25MFNPD1

Hrs of Instruction /Week: 3

No. of Credits: Remarks

Course Objectives:

1. Uunderstand the principle, prospect and trends in food product development, commercialization and marketing
2. Develop new marketable and economically viable food products, packaging and labeling of foods, learn about quality management considerations
3. Acquaint the techniques of innovations in new product development; rrecognize the potential for entrepreneurship through marketing.

Unit 1: **Production of food product and quality management** **9**

Criteria for selection of raw materials for food processing. Quality standards for various food groups- based on ISO standards. Production systems used in the manufacture of food - small scale, large scale, manual, automated, computerized. Quality management considerations to achieve safe foods for public consumption- Hazard Analysis and Critical Control Point (HACCP), Food Safety and Standards Authority of India (FSSAI),Vulnerability Analysis Critical Control Point (VACCP) and Traceability Analysis Critical Control Point (TACCP).

Unit 2: **Product development, consumer preference and commercialization** **9**

Principles and stages involved in product development, ssensory, chemical and microbiological evaluation of processed foods. convenience foods, extruded foods, nnutritional supplements, RTS, RTE foods, factors influencing product development, ideas and impact of technology in marketing. Market survey, consumer needs concept, pproduct life cycle, brand value, SWOT analysis, Risk assessment, Break even analysis, product launch, commercialization, testing, evaluation, case studies.

Unit 3: **Packaging materials and food labeling** **9**

Food packing - concept, principles, types, packaging m aterials – paper, wood, plastics, glass, metal, packaging films – polyethylene, cellophane, aluminium foil, laminates, new polymeric packaging films, shrink film, cling and wrap film, edible film. Packaging methods and systems - traditional, lined cartons, bag in box, aseptic, modified atmosphere packaging, vacuum, gas packaging, bio based packaging, eco-friendly and safe packaging for exports ovenable and transport packages, recent developments - equipments, packaging laws and regulations.

Unit 4: **Storage and handling, packaging laws and regulations** **9**

Shelf life testing of Perishable and Non Perishable foods, packaged foods, evaluation of packaged foods labeling – definition, purpose, types, materials, adhesives, purpose of labels, regulatory aspects of food labeling, types, food and nutritional labeling, FSSAI specifications, packaging laws and regulations – national and international specifications. Conditions for sale, license and identification, Studying the global market status, economic feasibility of new products.

Unit:5 **Marketing of food products and entrepreneurship** 9

Concept of market & marketing- approaches of marketing functions, market structure, and marketing efficiency. Product - cost calculation, specifications, marketing strategies, advertising methods, and consumer behavior and food acceptance. Entrepreneurship - concept, definition, types, classification, qualities of an entrepreneur, types of, growth, prospects & problems. Economic contribution and sstrategic planning for small business– steps in strategic planning. Institutional support to entrepreneur- SIDCO, SSIB, SIDO, IDBI

Total Hours 45

Text Books

1. Fuller, Gordon, W., New Food Product Development, 2nd Edition, CRC Press, Boca Raton, Florida, 2015.
2. Food Packaging Technology Handbook, NIIR Board of Consultants and Engineers, National Institute of Research, New Delhi, 2019,
3. Potter, N.M., Food Science, The AVI Publishing Company Inc., West Post, Connecticut, USA
4. Modern Packaging Industries, NIIR Board of Consultants and Engineers, National Institute of Industrial Research, New Delhi, 2014.
5. Paul Baines, BalChansarkar, Introducing Marketing Research, John Wiley & Sons Ltd., 2012.
6. Sudhir Gupta, Handbook of Packaging Technology, Engineers India Research Institute, New Delhi, 2017.

Reference Books

1. Jacqueline H. Beckley, M. Michele Foley lizabeth . Topp &_J. C. Huang Witoon Prinyawiwatkul (2007). Accelerating New Food Product Design and Development, Blackwell Publishing Company. IFT Press. USA
2. Howard R. Moskowitz, I. Sam Saguy & Tim Straus (2009). An Integrated Approach to New Food Product Development. Taylor and Francis Group, LLC.USA
3. Mary Earle and Richard Earle (2008). Case studies in food product development Wood head Publishing Limited and CRC Press LLC.USA
4. Mendiola,A.A. & E.C. Pefianco (2017) Marketing for Beginners:, The Principles of Marketing. Quezon City: Phoenix Publishing House.
5. Miquel Angelo P R C, Ricardo Nuno C P, Oscar Leandro D S R, Jose Antonio C T, Antonio Augusto V , 2016, Edible Food Packaging: Materials and Processing Technologies, CRC Press. Taylor & Francis ,Boca Raton , FL
6. Luciano P, Sara L,(2016), Food Packaging Materials, Springer cham Heildelberg, New York

Course Outcomes

1. Acquire knowledge about the production of food product and quality management the techniques
2. Understand and explore in new Product development, consumer preference and commercialization
3. Learn the different types of packaging material and food labelling
4. Gain knowledge in food storage, handling, packaging laws and regulation
5. Recognize the importance and innovation in food product development, marketing and entrepreneurship in food sector

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3
CO 1	H	L	L	M	M	M	M	H	L
CO 2	H	-	M	-	M	H	L	H	M
CO 3	H	-	-	-	L	M	L	H	H
CO 4	M	-	M	M	M	L	L	H	H
CO 5	H	-	M	-	L	H	M	H	M

Chemistry of Foods

Semester III
25MFNC13

Hrs of Instruction/Week: 4+2
No. of Credits: 5

Course Objectives:

1. Learn the physic chemical properties of food substances.
2. Understand the major chemical reactions in food preparation.
3. Provide in sight in to the chemistry of various food components and non-nutritive components.

Unit1: **Physico Chemical Changes in Foods** **12**

Physical properties of water, structure of water and ice, types of water in foods, water activity in foods, water soluble interactions, role of water in food systems, Hydrogenionconcentration(pH),Solubility,Solutions,Crystallization, Gels, Foams, Colloids, Stabilisers and Emulsions, Oxidation– reduction, Denaturation and Coagulation of proteins *Osmosis ,Enzymeaction(SS)*

Unit2: **Chemistry of Starch and Sugars** **12**

Componentsandcharacteristicsoffoodstarches,nonstarchpolysaccharides,Swelling of starch granules, Gel formation, factors affecting gelatinization, retrogradation, syneresis, effect of sugar, acid, alkali, fat and surface active agents on starch *Stages of sugar cookery (SS),* Crystal formation, factors affecting crystal formation, types of candies, Action of Acid, Alkali and Enzymes, Non enzymatic browning

Unit3: **Chemistry of Proteins and Enzymes** **12**

Physicochemical properties of amino acids, *structure and functional properties of protein (SS)*. Gluten formation, effect of soaking, fermentation and germination, Action of Heat, Acid and Alkali on vegetable and animal proteins – egg, milk, meat and fish

Enzymesinfoods–Natureofenzymes,stabilityandaction,proteolyticenzymes, oxidases, lipases, enzymes decomposing carbohydrates and applications. Enzymes in food fermentations. Immobilized enzymes.

Unit4: **Chemistry of Lipids** **12**

Physicochemical properties of Fats and Oils, Rancidity, hydrogenation,winterization,decompositionoftriglycerides,Shortening power of Fats *Roleoflipidsinflavourenhancement(SS)*,ChangesinFatsandOilsduringheatingandstorag, Factors affecting fat absorption of foods

Unit:5 **Chemistry of Non-nutritive components in foods** **12**

Pectins, phenolic components, vegetable gums, volatile compounds, water and fat soluble pigments, Action of heat, acid and alkali on vegetable pigments, enzymatic browning reactions in fruits and vegetables, preventive measures.

Active principles of spices and condiments(SS)

Over view of Food additives-Definition, types of food additives, role in food processing

30

Related Experience:

1. Gelatinization of starches, microscopic examination of starches .Stages of sugar cookery, preparation of Fondant, Fudge, Caramel, Pulled toffees and brittles and Determination of gluten content in doughs. Smoking temperature of fats and oils.
2. Factors affecting fat absorption in shallow and deep fried foods.
3. Effectofsoakingtime,typesofwater,cooking,acid,alkaliandgerminationonpulses.Fermentation of batter in terms of volume and pH
4. Preparation of cottage cheese, setting of curd using different cultures.
5. Effect of acid, alkali and heat on vegetable pigments
6. Determination of the strength of pectin indifferent fruits and vegetable extracts. Preparation of fruit jelly and tomato soup
7. Mini project on the application of the concepts of food chemistry in food preparation

Total Hours 90

Text Books

1. Chandrasekhar, U (2002)Food Science and applications in Indian Cookery,Phoenix Publishing House New Delhi
2. Gayatri Vaidya(2022)Text Book of Food Chemistry, Book Rivers Publishers,Lucknow.
3. Meyer,L.H.(2004).FoodChemistry. CBSpublishersandDistributors,NewDelhi.
4. Jan velseik (2014).The Chemistry of Food,Wiley-Blackwell publisher,UK

Reference Books

1. Paul,P.C.,andPalmer,H.H.,(2000)FoodTheoryandApplications.JohnWileyandSons,Newyork,RevisedEdition.
2. Belitz,H.DandGrosh.W,(2005).FoodChemistry.Springer –Verlag.
3. Manay,SN.andShadaksharaswamy(2017)Foods:FactsandPrinciples,ThirdRevisedEdition,NewAge International(P)Publishers,NewDelhi.
4. Potter,N.N.andHotchkiss,J.H.(2006),FoodSciences,Fifthedition,CBSPublishersandDistributors,
5. New Delhi.

Journals

1. Journal of Food Science.
2. Advances in Food Research.
3. Journal of Food Science and Technology.
4. Journal of Agricultural and Food Chemistry.

Course Outcomes:

1. Relateandanalysethecompositionandchemicalgroupsonfoodmoleculesandtheirroleinreactionmechanismsinfoods.
2. Acquire knowledge on the physico chemical changes with regard to carbohydrates, lipids, proteins and water
3. Asses simplifications for food formulations to achieve food quality, palatability, cost and health
4. Analyse and interpret the role of food chemistry in food preparations
5. Analyse the components of foods in relation to processing and preservation

CO /PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO 1	H	L	L	H	-	H	-	M	M
CO 2	H	-	M	H	L	L	-	L	M
CO 3	H	L	H	H	L	H	M	M	M
CO 4	H	-	M	M	L	L	L	H	H
CO 5	H	L	M	H	M	M	H	L	L

Semester III **Advances in Nutrition- II**
25MFNC14

Hrs of Instruction /Week: 3+1
No. of Credits: 4

Objectives

1. Understand the interrelationship of micronutrients.
2. Explore the bioavailability and deficiencies of micronutrients
3. Gain insight about role of gut microbiome in nutrition and health.

Unit 1 Fat soluble vitamins **9**

Vitamins A,D,E and K- History, structure, nomenclature, chemistry, functions, metabolism, transport, storage, excretion and methods of assay, Bioavailability and factors affecting bioavailability, Interaction with other nutrients. *Human deficiency, hyper vitaminosis Dietary sources, recommended intakes (SS)* Pseudo vitamins

Unit 2 Water soluble vitamins **9**

Thiamine, riboflavin, niacin, vitamin B12, folic acid, pyridoxine, panthothenic acid, biotin, ascorbic acid - History, structure, chemistry, functions, metabolism, , transport, storage, excretion, Bioavailability and factors affecting bioavailability, methods of assay, *dietary sources, recommended intakes, human deficiency, antivitamins (SS)*

Unit 3 Macro Minerals **9**

Calcium, Phosphorus, Magnesium, Sulphur, Chloride, Sodium and Potassium Distribution, functions, absorption and utilization, , deficiency and toxicity, calcium - phosphorus ratio, absorption and utilization, Phosphates in blood, Inter relationship of Ca, P ,Vitamin D and parathyroid hormone, calcium balance, Sodium and potassium balance *Hypocalcaemia, hypo kalemia, hyponatremia and hyper calcaemia, hyper kalemia, hyper natremia sources, requirement (SS).*

Unit 4 Micro minerals **9**

Iron, Zinc, Flouride and Copper - Distribution, functions, absorption, metabolism, transport and utilization, deficiency, assessment of iron status, *sources, requirement, effect of excess iron retention and deficiency (SS)*
Interaction with macro and micro nutrients
Ultratrace Minerals- Iodine, cobalt, copper, molybdenum, manganese, selenium, nickel, chromium, boron, cadmium- Functions, sources and requirements , Pharmacological and therapeutic effects.

Unit 5 Gut microbiome in Nutrition and Health **9**

Gut microbiome- An Introduction, Human microbiota, distribution, composition and functions of the gut microbiota, role of gut microbiota in nutrition, *The Human Microbiome project- implications for human health (SS),* models to study gut microbiota, future perspectives for gut microbiome research in nutrition.

Tutorial 15
Total hours 60

Text Books:

1. Mahtab S. Bamji, PrahladRao.N and Vinodhini Reddy, Textbook of Human Nutrition, 4th Edition, Oxford IBH Publishing Co Pvt Ltd, 2019.
2. Dietary ;Guidelines for Indians, ICMR, National Institute of Nutrition, Hyderabad,2024
3. ICMR-NIN Expert Group on Nutrient Requirement for Indians, Recommended Dietary Allowances (RDA) and Estimated Average Requirements (EAR) - 2020.

Reference Books:

1. Kathleen Mahan L ,Krause's Food & the Nutrition Care Process (Krause's Food & Nutrition Therapy): , 18th edition, W.B.Saunders Company, Philadelphia, 2020
2. Edward Ishiguro Natasha Haskey Kristina Campbell , Gut microbiota: Interactive effects on Nutrition and Health, 1st Edition, Academic Press, 2018
3. Dirk Haller , The Gut microbiome in health and disease , 1st Edition, Springer, 2018
4. Ana Maria R. Moise , The Gut microbiome: Exploring the connection between, microbes, diet and health, 1st Edition, Greenwood Press, USA, 201
5. Indian Food Composition Tables,ICMR, National Institute of Nutrition,Hyderabad,2017
6. Nutritive Value of Indian Foods , ICMR, National Institute of Nutrition, Hyderabad,

Course Outcomes:

1. Identify the role of micronutrients in health and disease.
2. Associate the inter relationship between vitamins and minerals.
3. Develop intervention strategies to combat micronutrient malnutrition.
4. Exhibit professionalism in micronutrient research
5. Interpret the significance of gut microbiome in human nutrition

CO / PO	PO1	PO 2	PO3	PO4	PO5	PO6	PSO1	PSO 2	PSO 3
CO 1	H	H	H	L	M	M	M	H	H
CO 2	H	M	H	M	H	H	M	H	H
CO 3	H	H	H	H	H	M	M	H	H
CO 4	H	M	H	M	H	M	L	H	H
CO 5	H	H	H	L	H	H	H	H	H

Biomolecules and Intermediary Metabolism

Semester III
25MFNC15

Hours of Instruction/Week : 4
No.of.Credits: 4

Course Objectives:

1. To enable the students to obtain depth in the study of biochemistry of major nutrients
2. To help the students to understand the basic metabolic pathways
3. To gain knowledge about the defects in various metabolic pathways

Unit 1: Carbohydrates 12

Introduction, Classification. Structure and Properties of monosaccharide (hexoses and pentoses). Reactions of monosaccharides – oxidation, reduction and reaction with hydrogen cyanide, hydroxyl amine and phenyl hydrazine.
Oligosaccharides – Sucrose, maltose, lactose, isomaltose, cellobiose.
Homopolysaccharides - Structures of storage polysaccharides (Starch and glycogen).
Heteropolysaccharides – Structures of Hyaluronic acid, Heparin and Chondroitin sulphate.Metabolism – Glycolysis, TCA cycle, HMP Shunt and energy production in the above pathways. Glycogenesis and Glycogenolysis.
Oxidative phosporylation and Electron Transport Chain, Uronic acid pathway.
Hormonal regulation of blood glucose(ss)

Unit 2: Lipids 12

Classification – Triglycerides (Fats), Phospholipids and other non-phosphorylated lipids – cerebrosides, gangleosides, sulfolipids.
Characterisation of fats. Rancidity of fats. Chemistry of Essential fatty acids.
Metabolism – Oxidation of fatty acids, biosynthesis of fatty acids (palmitic acid). Biosynthesis of triacyl glycerol, phospholipids.
Classification and functions of Lipoproteins(ss)

Unit 3: Aminoacids and Proteins 12

Structure and classification of aminoacids.
Classification of proteins – denaturation
Metabolism – General breakdown of aminoacids, deamination, transamination, decarboxylation and urea formation.
Structure of proteins with special reference to insulin, myoglobin and haemoglobin(ss)

Unit 4: Nucleic acids 12

Composition and function.
Structure and properties of DNA and RNA (t-RNA, m-RNA and r-RNA), minor RNA types.
Metabolism – Biosynthesis and breakdown of purine nucleotides.
Biosynthesis and breakdown of pyrimidine nucleotides.*Defects in nucleic acid metabolism(ss)*

Unit 5: Enzymes 12

Classification of enzymes. IUB classification

Enzyme kinetics – MichaelisMenten equation.

Factors affecting enzyme activity (pH, temperature, substrate concentration and enzyme concentration).

Enzyme inhibition – Competitive, Non- competitive and Uncompetetive (Kinetics not necessary).*Clinical significance of enzymes in myocardial infarction and liver disorders(SS)*

Total Hours 60

Text Books:

1. Nelson, D.L. and Cox, M.M (2020), Lehninger Principles of Biochemistry, 7thEd, W.H.Freeman and Company, New York
2. Murray, K.R., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, W.V. and Weil, P.A. (2018), Harper's Illustrated Biochemistry, 30th Ed, The McGraw-Hill Companies
3. Voet, D and Voet, G. (2012), Fundamentals of Biochemistry, John Wiley and Sons, New York.

References:

1. Zubay, G. L. (2017), Principles of Biochemistry, 5th edition, William C. Brown Publications.
2. Bery, J.M., Tymoezko, J.L. and Stryer, L. (2008) Biochemistry, 6th Ed, W.H. Freeman and Company, New York
3. Devlin, T.M. (2002), Textbook of Biochemistry with Clinical correlations, 5th edition, John Wiley & Sons Inc, Publications

Course Outcomes:

1. Gain basic knowledge about the classification and various aspects of carbohydrate metabolism
2. Describe the classification and oxidative process of lipid metabolism
3. Recognize the structure and metabolism of proteins and specialized structure of proteins
4. Integrate the biosynthesis and degradative pathways of nucleic acids and their disorders
5. Correlate the classification of enzymes and enzyme kinetics and iso enzymes of clinical importance

CO /PO	PO 1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO 1	-	-	M	-	-	M	-	L	M
CO 2	-	-	M	-	-	M	-	M	M
CO 3	-	-	M	-	-	M	-	L	M
CO 4	-	-	M	-	-	M	-	L	M
CO 5	-	-	M	-	-	M	-	H	M

Post Production System

SemesterIII
25MFNC16

Hrs of Instruction/Week:3
No. of Credits:3

Course Objectives:

1. Learn about National and International agencies controlling food losses, and agents causing Food loss.
2. Understand the importance and methods of post-production techniques for foods
3. Gain knowledge in food processing and food conservation

Unit1: **Introduction To Post Production Technology and Agencies Controlling Food Losses** 7

Need for post-production technology, important measures adopted by Government to augment food production, *Green, Blue, and white revolution(SS)*
Role of SGC, FCI, CWC, SWC, IGS, Pest Control of India(PCI) in controlling food losses

Unit2: **Agents Causing Food Loss and Control Measures** 9

Types and reasons for losses of foods, extent and cost of losses; Agents causing losses-insects, rodents, micro-organisms, Birds and other physical agents *Importance and methods of sanitary handling(SS)*
Physical, chemical, biological measures to control insects, rats, rodents and birds; Fumigants, fumigation, safety measures and integrated pest control

Unit3: **Storage of Grains, Fruits and Vegetables** 7

Importance and requirements of storage structures, *Study of traditional structures and improvements needed (SS)*, modern storage structures, metal bins, silos, storage godown, cold storage chains in India.

Unit4: **Food Processing I** 9

Importance of processing-methods of processing cereals(wheat, rice, maize), breakfast cereals, *premixes and convenience foods(ss)*, Processing of pulses, Processing of fruits and vegetables, meat, fish, poultry, egg, Processing of sugars

Unit:5 **Food Processing II** 9

Processing of oil seeds – ground nut, coconut, soya, gingerly, sunflower, cotton seed
Processing of milk and milk products , Processing of condiments and spices–cumin, mustard, pepper, turmeric, chili, ginger, coriander, cinnamon, Clove, aniseed and garlic
Beverages, tea, coffee and cocoa(SS)

Related Experience 4

Visit to FCI,TNAU, Milk processing unit and cold storage facilities
Visit to sugar manufacturing and oil processing units

Total Hours 45

Text Books:

1. NIIR Board (2010) Handbook on spices Asia Pacific Business press ,New Delhi
2. Swaminathan,M(2005)FoodScience,ChemistryandExperimentalFoods,BappcoPublisher
3. Ratikantmaiti(2018) Post harvest management of agricultural produce
4. Publisher: R.k. Maiti Research foundation, New Delhi

References:

1. Fellows,P(2000)FoodProcessingTechnology-PrinciplesandPractice2nd edition,CRCpressWoodLeadPublishingLtd,Cambridge,Engl and,.
2. Srilakshmi, B(2022), Food Science, New Age International(Pvt) Ltd, New Delhi.
3. SivasankarB(2002)Food Processing and Preservation, Prentice-Hall of India Private Limited,New Delhi,
4. Mehas,K.Y., andRodgers, S. L(2000)FoodScienceandYou. McMillanMcGrawHillCompany.

Journals

1. Journal of Technology, Institute of Food Technology, Illinois, USA
2. FoodTechnology-AbstractsCentralFoodTechnologicalResearchInstitute.
3. Food Processing. Pitman publishing Company, New York, USA
4. Journal of Food Science, the Institute of Food Technologists, Illinois, USA.

Course Outcomes

1. Understand the various roles of national and international agencies in preventing and reducing food losses.
2. Acquire knowledge about the agents casing food losses and the measures to control the food losses.
3. Learn the different types of the storage of grains, fruits and vegetables-traditional and modern.
4. Understand the importance of the processing of sugar, cereals, pulse, fruit, vegetables and Meat and meat products.
5. Gain knowledge about the processing of oilseeds, condiments and spices.

CO /PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO 1	L	M	L	M	L	M	L	M	M
CO 2	M	-	M	M	H	M	M	M	M
CO 3	L	M	L	M	M	M	L	M	M
CO 4	M	M	M	M	M	M	M	M	M
CO 5	M	M	M	M	M	M	M	M	M

Techniques for Experimental Nutrition Practical

Semester III
25MFNC17

Hrs of Instruction/Week: 6
No.of Credits :3

Course Objectives:

1. Know the analytical procedures in estimation of nutrients of foods.
2. Acquire skills in the analysis of macro and micronutrient contents of foods.
3. Demonstrate the analysis of nutritional quality of foods and Get equipped in the use of high end equipments

	Topic	Hrs
Analysis of Food for		
a)	Calories and Carbohydrate- Anthrone method	**6**
b)	Fibre – Crude and Dietary	**9**
c)	Moisture	**6**
d)	Nitrogen by Kjeldahl Method	**6**
e)	Ash	**3**
f)	Calcium	**3**
g)	Phosphorus	**3**
h)	Iron	**6**
i)	Total and β Carotene	**6**
j)	Vitamin A	**3**
k)	Thiamine	**3**
l)	Riboflavin	**3**
m)	Vitamin C	**3**
n)	Fat	**6**
o)	Starch	**3**
p)	Fats – Saponification Value	**3**
q)	Iodine Number	**3**
r)	Acid Number	**3**
s)	RM Value	**3**
t)	Sorenson's Formal Titration Method	**6**
u)	Estimation of Total Antioxidant Activity	

Total Hours 90

Text Books:

1. Raghuramulu, N., Madhavan Nair, K., Kalyanasundaram, S. A Manual of Laboratory Techniques. Silver Printers, NIN, 2019.
2. Sadasivam, S and Manickam, A., Biochemical Methods, New Age International Pvt. Ltd., Publishers, New Delhi, Second Edition, 2018.

Reference Books

1. Oser, B. L. Hawk's Physiological Chemistry, XIV Edition, Tata McGraw Hill Publishing Company Ltd, Mumbai, 2001.
2. Varley, H., Gowenlak, A. H and Hell, M. Practical Clinical Biochemistry, William Itinmaon Medical Books, London, 2000.

Course Outcomes:

1. Gain knowledge on the analytical techniques in the nutritional estimation of foods.
2. Understanding of the principles in the estimation of nutritional composition of foods.
3. Acquire analytical skills in the analysis of macro and micronutrient content of foods.
4. Enable to demonstrate the analysis of nutritional quality of foods.
5. Able to identify and analyse the constituents in foods in a logical sequence of steps analysis.

CO / PO	PO1	PO2	PO 3	PO4	PO 5	PO6	PSO1	PSO2	PSO3
CO 1	H	H	L	L	L	M	H	M	L
CO 2	M	M	M	M	M	M	L	M	H
CO 3	M	M	M	M	H	H	M	L	H
CO 4	M	M	M	M	H	H	H	M	L
CO 5	L	M	M	M	M	L	H	M	L

Functional Foods and Nutraceuticals

Semester III
25MFNC18

Hrs of Instruction /Week: 3
No. of Credits: 3

Course Objectives:

1. Learn the development of functional foods along with the types of functional foods
2. Understand the category of nutraceuticals based on sources, mechanism of action and chemical nature
3. Acquire the skills on identification of foods of bioactive compounds with functional efficiency

Unit 1: **Introduction to Functional Foods and Nutraceuticals** — **6**

Definition, History, Classification-designer foods and pharma foods, *Health effects of functional foods(ss),* Stages involved in development of functional foods.

Unit 2: **Categorization of Nutraceuticals** — **9**

Classification - Based on food source- plant, animal and microbial mechanism of action – anti diabetic, anti cancer, anti inflammatory and cardio protective with examples and chemical nature - isoprenoid, phenolic substances, fatty acids and structural lipids, terpenoid: *saponins, carbohydrates and amino acid based derivatives, iso flavones(ss).*

Unit 3: **Probiotics, Prebiotics and Synbiotics** — **9**

Probiotics: Concept, Human gastro intestinal tract and its microbiota, Classification of probiotics, role of probiotics in health and diseases.
Prebiotics: Oligosaccharides, Dietary fiber, Resistant Starch, Gums, Spirulinaas bioactive component.
Synbiotics: Concept and Synbiotic foods with examples(ss)

Unit 4: **Functional nature of Nutraceuticals** — **12**

Polyphenols: Flavonoids, Catechins, Isoflavones.
Tannins: Phytoestrogens, Phytosterols, Glucosinolates, Pigments, Organo sulphur compounds, proteins and peptides, Conjugated linoleic acid, Omega-3 Fatty acids, Vitamins and Minerals.
Bioactive compounds: Saponins, Heamagglutinins, *Reservatrol, Quercetin, Cinnam aldehyde, Capsaicin, Gingerol, Eugenol(ss).*

Unit 5: **Regulatory Aspects of Functional Foods and Nutraceuticals** — **9**

Regulatory aspects-International and national regulatory aspects of functional foods in India, ICMR guidelines for Probiotics, *Regulatory perspective of FOSHU Foods(ss).*

Total Hours 45

Text Books

1. Gibson, G.R. and Williams, M.C. (2001). Functional Foods Concept to Product, CRC Press.
2. Wildma, R.E. (2016).Handbook of Nutraceuticals and Functional Foods. CRC Press.
3. Yashwant Patak (2010).Handbook of Nutraceuticals Volume I Ingredients, Formulations and Applications, CR

Reference Books:

1. Webb G.P (2016), Dietary Supplements and Functional Foods, Blackwell Publishing Ltd, New York.
2. Tamine. A (2015), Probiotic Dairy Products, Blackwell Publishing Ltd, United Kingdom.
3. USFDA regulations on functional foods (2016)
4. FSSAI regulations of India (2021)

Course Outcomes:

1. Gain knowledge on the development of functional foods with the conceptual difference between functional foods and nutraceuticals.
2. Acquire skills to categorize nutraceuticals.
3. Gain awareness on the functional foods and nutraceuticals of biotic origin.
4. Apply the knowledge of functional nature of nutraceuticals
5. Understand the regulatory aspects of functional foods and nutraceuticals

CO / PO	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PSO1	PSO 2	PSO 3
CO 1	H	-	M	L	L	H	-	M	M
CO 2	L	M	M	H	M	M	M	M	M
CO 3	M	M	L	M	H	M	L	M	H
CO 4	M	L	M	-	L	M	L	M	M
CO 5	L	L	-	L	M	M	M	M	-

Food Safety and Security (Self Study)

Semester III
25MFNC19

Hrs of Instruction/Week: 2
No. of Credits: 2

Course Objectives:

1. Getinsightonfoodsafetyissuesand FoodSafetyLaws
2. UnderstandtheSafetyManagementoffuturefoods,FoodsinHouseholdandFoodIndustries
3. Learn about the Food Security Management Concepts and Practices

Unit1:	Introduction to food safety and issues in India, food adulteration, food hazards(physical, chemical and biological) natural toxins, Need and importance of food safety in house hold and food industries; Factors affecting food safety in house hold and food industries; Regulatory authorities Ensuring food safety in food industries	6
Unit2:	Good Manufacturing Practices (GMP), Good Agricultural Practices (GAP) and Good Hygienic Practices, Management of disposal of food wastes. National Food legislation-FSSAI, Essential Commodities Act, ISI/BIS, AGMARK, International Organization for food safety-FAO, WHO, Codex Alimen tarius ,APEDA and WTO	3
Unit3:	Safety assessment of food additives, adulterants, pesticide residues, safety aspectsof water, beverages such as soft drinks, tea, coffee, cocoa and safety evaluation of heat treatments and related processing techniques. Artificial Intelligence and Robotics in food safety	6
Unit4:	Food and Nutrition Security: Hunger and malnutrition, Definition and measurement. Factors contributing to food insecurity, Food security model, Food availability. Foreign aid, food aid and development. Global sustainability, environmental impacts of the world food system .National and international intervention. Globalization of the food system	9
Unit:5	Food and agricultural policies including Supply side policies, Infrastructure and production policies, Food assistance programs Policies on future foods and packaging:-Super and Organic foods, In vitro meat, Plant based meat Analogue, Insect based foods; Intelligent or smart packaging, Edible Packaging	6
	Total Hours	**30**

Text Books:

1. VijayalakshmiD(2023) Food Safety and standard Law, Tools and Management System
2. Publisher: Genx Electronic Resource And Solution pvt, New Delhi
3. Fogel,R.W.(2004).Health,nutrition,andeconomicgrowth.EconomicDevelopment&
4. CulturalChange
5. Southgate,D., Graha, D.H.andTweeten, L.,(2007)TheWorldFoodEconomy, BlackwellPublishing,
6. Prashant Chaturvedi(2019)Food safety officer and technical officer : Publisher: FSSAI New Delhi

Reference Books:

1. Early,R.(1995).GuidetoQualityManagementSystemsfortheFoodIndustry,Blacki e,Academic and Professional, London
2. Gould,W.A.andGould,R.W.1988.TotalQualityAssurancefortheFoodIndustries, CTIPublications Inc, Baltimore
3. Pomeranz,Y.andMeloan,C.E.1996.FoodAnalysis:TheoryandPractice,CBSPubli shersandDistributor,New Delhi
4. Askar,A.andTreptow,H.1993.QualityAssuranceinTropicalFruitProcessing,Spri nger–Verlag,Berlin
5. Leathers,H.D.and Fosters, P.,The World Food Problem: Tackling the Causes of Under nutrition in the Third World,3rd Edition.LynneRiennerPublishers,2004

Course Outcomes

1. Understand the food safety issues in India
2. Enumerate on the good practices in food production
3. Gain knowledge on safety assessment of food additives and supporting laws
4. Acquire insight on food and nutrition security and globalization of food system
5. Learn about the food and agricultural policies and safety policies on future foods and recent Packaging Technologies.

CO /PO	PO1	PO 2	PO 3	PO 4	PO5	PO 6	PSO1	PSO2	PSO3
CO 1	H	M	L	H	-	L	H	M	L
CO 2	M	L	-	H	-	L	M	-	-
CO 3	H	-	H	H	-	L	-	M	L
CO 4	H	M	M	H	-	-	H	-	M
CO 5	M	M	H	H	-	L	L	L	-