ST ALOYSIUS

(DEEMED TO BE UNIVERSITY)

MANGALURU 575003-INDIA

ESTD : 1880

Course structure and syllabus of

M.Sc.

FOOD SCIENCE, NUTRITION & DIETETICS

Semester I, II, III & IV

2024 ONWARDS

ST ALOYSIUS

(DEEMED TO BE UNIVERSITY)

MANGALURU 575003 – INDIA

School of Life Sciences

BOS MEETING

BOS meeting of School of Life Sciences was held on 22th April 2024, at 9.30 am in AppliedBiology Laboratory

LIST OF MEMBERS OF THE BOS IN LIFE SCIENCES

Sl no	Members with Address	Designation
1.	Dr Hemachandra hemachandra_amin@staloysius.edu.in 9035961509	Dean, School of Life Sciences
2.	Dr Renita Maria Dsouza renita@staloysius.edu.in 9945923172	Associate Dean, School of Life Sciences
3.	Dr Lyned Dafny Lasrado lyneddafny@staloysius.edu.in 9686021928	Assistant Dean, School of Life Sciences
4.	Dr Jyothi Miranda Department of Botany jyothi@staloysius.edu.in 7022560938	Professor
5.	Dr Asha Abraham Department of Post Graduate Studies & Research in Biotechnology drashaabraham@staloysius.edu.in 9449555802	Associate Professor

6.	Dr Hariprasad Shetty Department of Zoology shettyhariprasad@staloysius.edu.in 9945886947	Associate Professor
7.	Dr S N Raghavendra Department of Post Graduate Studies & Research in Food Science raghavendra_sn@staloysius.edu.in 9945888845	Assistant Professor
8.	Dr Santhosh Wilson Goveas Department of Post Graduate Studies & Research in Biotechnology santhoshgoveas@staloysius.edu.in 9448724682	Assistant Professor
9.	Dr Chandrashekara G Joshi Chairperson Department of Biochemistry Mangalore University josheejoshee@gmail.com 9448446641	Subject expert in Biochemistry
10.	Dr Shyama Prasad Sajankila Department of Biotechnology NMAMIT, Nitte, Karkala shyama.sajankila@nitte.edu.in 9611202842	Subject expert in Biotechnology & Microbiology
11.	Dr Smitha Hegde Professor & Deputy Director NUCSER, Nitte University Deralakatte smitha.hegde@nitte.edu.in	Subject expert in Biotechnology & Zoology

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12.	Dr Archana Prabhat Professor & Coordinator Department of PG Studies in Food Science & Nutrition Alva's College (Autonomous), Moodbidri drarchanaprabhat@gmail.com 9986665759	Subject expert in Food Science
13.	Dr Giby Kuriakose Assistant Professor PG Department of Botany, Sacred Heart College Kochi, Kerala-670106 giby.kuriakose@shcollege.ac.in 7012608038	Subject expert in Botany
14.	Dr Shreelalitha Suvarna Assistant Professor shreelalitha_suvarna@staloysius.edu.in 9964215205	HOD UG & PG Biotechnology
15.	Dr Swarnalatha Assistant Professor swarnalatha@staloysius.edu.in 9900284662	HOD UG & PG Biochemistry
16.	Ms Shilpa B Assistant Professor shilpa_botany@staloysius.edu.in 9535887279	HOD Botany
17.	Dr Daniella Ann L Chyne Assistant Professor daniella_chyne@staloysius.edu.in	HOD UG & PG Food Science

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18.	Dr Vaishali Rai Assistant Professor vaishali_rai@staloysius.edu.in 9980313361	HOD Microbiology

I SEMESTER

Paper	Instructions hours/ week		Duration of exam hours	Marks		Total Marks	Credits
	Theory	Practical		CIA*	Exam		
PH 811.1 **(Theory)** **Food Chemistry**	4	-	3	30	70	100	4
PH 812.1 **(Theory)** **Principles of Food Processing and Preservation**	4	-	3	30	70	100	4
PH 813.1 **(Theory)** **Macronutrients in Human Nutrition**	4	-	3	30	70	100	4
PS 816.1 **(Theory)** **Human Physiology**	3	-	3	30	70	100	3
PS 817.1 **(Theory)** **Micronutrient in Human Nutrition**	3	-	3	30	70	100	3
PH 814.1P **(Practical)** **Food chemistry and Preservation**	-	8	4	30	70	100	4
PH 815.1P **(Practical)** **Human Physiology and Nutrition**	-	8	4	30	70	100	4

*Continuous internal assessment

II SEMESTER

Paper	Instructions hours/ week		Duration of exam hours	Marks		Total Marks	Credits
	Theory	Practical		CIA*	Exam		
PH 811.2 **(Theory)** **Clinical and Therapeutic Nutrition**	4	-	3	30	70	100	4
PH 812.2 **(Theory)** **Dietetics**	4	-	3	30	70	100	4
PS 816.2 **(Theory)** **Nutrition Through Life Cycle**	3	-	3	30	70	100	3
PS 815.2 **(Theory)** **Research Methodology and Ethics**	3	-	3	30	70	100	3
PO 818.2 **(Open Elective)** **Basic Nutrition**	3	-	3	30	70	100	3
PH 813.2P **(Practical)** **Clinical and Life Cycle Nutrition**	-	8	4	30	70	100	4
PH 814.2P **(Practical)** **Dietetics**	-	8	4	30	70	100	4

*Continuous internal assessment

III SEMESTER

Paper	Instructions hours/ week		Duration of exam hours	Marks		Total Marks	Credits
	Theory	Practical		CIA*	Exam		
PH 811.3 **(Theory)** **Food Microbiology**	4	-	3	40	60	100	4
PH 812.3 **(Theory)** **Nutraceuticals and Functional Foods in Human Health**	4	-	3	40	60	100	4
PO 815.3 **(Theory - CBCS)** **Health and fitness**	3	-	3	40	60	100	3
PH 813.3P **(Practical)** **Food microbiology & Functional foods**	-	8	4	40	60	100	4

*Continuous internal assessment

IV SEMESTER

Paper	Instructions hours/ week		Duration of exam hours	Marks		Total Marks	Credits
	Theory	Practical		CIA*	Exam		
PH 811.4 **(Theory)** **Nutritional Biochemistry**	4	-	3	40	60	100	4
PH 812.4 **(Theory)** **Public Health Nutrition**	4	-	3	40	60	100	4
PH 813.4 **(Theory)** **Sports Nutrition**	4	-	3	40	60	100	4
PS 815.4 **(Theory)** **Food Safety and Quality Control**	3	-	3	40	60	100	3
PH 814.4P (**Practical)** **Nutritional Biochemistry and Food safety**	-	4	3	40	60	100	4
PH 817.4P **(Practical)** **Public Health Nutrition**	-	3	4	40	60	100	3

*Continuous internal assessment

PROGRAMME OUTCOMES (PO)

By the end of this programme, students will be able to

PO1: demonstrate a comprehensive understanding of the principles, concepts, and theories in food science, nutrition, and dietetics, including the chemical and biochemical properties of food components, nutritional requirements, and dietary patterns.

PO2: analyze food composition, processing techniques, and their effects on nutrient retention, bioavailability, and sensory properties, as well as evaluate the nutritional content and quality of food products using analytical methods and techniques.

PO3: critically evaluate scientific literature, research findings, and dietary guidelines related to food science, nutrition, and dietetics, and assess their relevance, validity, and implications for public health, food policy, and clinical practice.

PO4: apply their knowledge and skills in food science, nutrition, and dietetics to develop and implement evidence-based interventions and programs aimed at promoting health, preventing disease, and addressing nutritional challenges in diverse populations and settings.

PO5: emonstrate creativity and innovation in designing novel food products, formulations, and dietary interventions that meet specific nutritional needs, dietary preferences, and cultural considerations, while adhering to food safety and quality standards.

PO6: Exhibit leadership qualities, effective communication skills, and the ability to collaborate with multidisciplinary teams and stakeholders to address complex challenges in food science, nutrition, and dietetics, and contribute to advancing the field through research, education, and advocacy.

First Semester MSc. Food Science, Nutrition & Dietetics

Course Core Content

(PH 811.1) **Food Chemistry**

Credits: **4** Total Hours: **56**

Course Outcomes:

On Completion of this Course the students will be able to:

CO1: Understand the fundamental principles of food chemistry

CO2: Analyze the physico-chemical properties of carbohydrates, lipids, proteins, and enzymes

CO3: Examine the interactions between food components and processing techniques

CO4: Propose strategies for controlling these reactions to ensure food safety and quality

Interpret the significance of food chemistry in addressing global challenges

Unit I: Water, Vitamins and Minerals **14 Hours**

Food chemistry: Definition, scope and importance. Water and Ice: Physical properties, structure of water and ice, Phase transition of water molecule, water soluble interaction, water activity and relative vapor pressure. Dispersed System: surface chemistry, colloidal interaction, creaming foams and emulsion. Proximate analysis. Vitamins, Minerals and changes during processing. Food Additives: Sweeteners, Flavour enhancers, food colours, antimicrobial agents, emulsifiers.

Unit II: Carbohydrates **14 Hours**

Carbohydrates: Definition and importance, classification, sources, functions, physico-chemical Properties of carbohydrates, Cellulose, Guar and Locust Bean Gum, Xanthan, Carrageenan's, Algins, Pectins, Gum Arabica and Dietary fiber. Starch (functionality of starch – gelatinization and retro gradation), Browning reaction in food: Enzymatic and non-enzymatic browning and applications in food.

Unit III: Fats and Fatty Acids **14 Hours**

Fatty acids: Nomenclature and classification, Physical properties and chemical reactions, Lipids: Chemical Classification; Lipolysis, rancidity (hydrolytic rancidity, oxidative rancidity and microbial rancidity) and flavour reversion, auto-oxidation, modification of fats and oils (hydrogenation and inter esterification, winterization and acetylation); transfats; fat substitutes.

Unit IV: Proteins and Amino acids **14 Hours**

Amino acids: classification, physical properties, chemical reaction. Peptides: Nomenclature, physical and sensorial properties, Proteins: conformation, physical properties, texturized protein, denaturation of protein, gel formation, chemical and enzyme catalyzed reactions in protein processing. Digestibility coefficient, biological value, net protein utilization (NPU), protein efficiency ratio (PER). Enzymes: Nomenclature, specificity, structure, enzyme cofactor, theory of Enzyme catalysis, Enzyme utilization in food industries.

Recommended Books and References:

1. John M. deMan, John W. Finley, W. Jeffrey Hurst & Chang Yong Lee (2018). Principles of Food Chemistry, 4th Edition, Springer Publications.
2. Vickie A. Vaclavik, Elizabeth W. Christian & Tad Campbell (2020). Essentials of Food Science (Food Science Text Series), 5th Edition, Springer Publications.
3. H. D. Belitz & W. Grosch (2013). Food Chemistry, 2nd Edition, Springer Science & Business Media.
4. Srinivasan Damodaran, Kirk L. Parkin & Owen R. Fennema (2008). Fennema's Food Chemistry, 4th Edition, CRC Press/Taylor & Francis, Boca Raton.
5. Steve W. Cui (2012). Food carbohydrates: chemistry, physical properties, and applications, CRC Press Taylor & Francis Group.
6. Akoh, Casimir C., (2017). Food Lipids: chemistry, nutrition, and biotechnology, 4th Edition, Boca Raton: Taylor & Francis.

First Semester MSc. Food Science, Nutrition & Dietetics

Course Core Content

(PH 812.1) **Principles of Food Processing and Preservation**

Credits: **4** Total Hours: **56**

Course Outcomes:

On completion of this course the students will be able to:

CO1: Evaluate the source and variability of raw food material and their impact on food processing operations.

CO2: Analyze the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage.

CO3: Develop the unit operations required to produce a given food product.

CO4: Evaluate the principles and current practices of processing techniques and the effects of processing parameters on product quality.

Unit I: **Scope and importance of food processing** **16 Hours**

Scope and importance of food processing in the present scenario, Factors affecting various food spoilage: Physical, Chemical, Microbial. Conventional preservation methods: Pickling, Salting, Smoking and Sugar addition. Types of heat treatments and its effects on foods, heat preservation and processing: UHT and HTST. Thermal death time: Determination of process time. Canning: Introduction, principles and processing of foods. Water activity: Role of water activity in food preservation; Intermediate Moisture Foods (IMF): Principles, Characteristics, advantages and problems of IM foods. Food Frying: Principles and process: shallow frying, deep frying and frying oils. Mechanism of Oil uptake during frying: Factors affecting the frying process.Vacuum frying method, advantages, possible applications, economical feasibility.

Unit II: Processing and Preservation by Drying and Dehydration **12 Hours**

Drying process, drying curves. Different drying methods and types of dryers; Dehydration and Concentration: Changes in foods during dehydration and concentration. Rehydration and reconstitution of food. Separation and concentration of food components, their applications in food industries. Different types of evaporators

Unit III: **Processing and Preservation by low temperature** **12 Hours**

Refrigeration: Principles, components, refrigeration load - and its effect on storage, changes in foods during

refrigeration. Freezing: Freezing curves, freezing methods, slow and quick freezing, factors determining freezing rate, frozen storage, changes in food during freezing. Chilling: Equipment, Cold storage, application in fresh and processed foods, Reefer units for frozen food transportation.

Unit IV: **Processing and Preservation by Novel Technologies** **16 Hours**

Green Technologies for Food Processing and the feasibility of their applications in the food industries: Super critical fluid extraction, Ultrasound treatment, High pressure processing (HPP), Pulse electrical field (PEF), Ohmic heating, Microwave processing, Food irradiation (x-rays, gamma rays and electron beam), Interaction of radiation with food components, non-thermal plasma, Ozone treatment, Electrolyzed water, Anti-microbials Principles and applications of Hurdle technology. Life Cycle Assessment (LCA) tool for assessing environmental impact of food products Packaging materials designed for processed foods. Food preservatives: Types, uses and effects of class I and class II preservatives in foods.

Recommended Books and References:

1. Romain Jeantet, Thomas Croguennec (2016). *Handbook of Food Science and Technology 2:* Food Process Engineering and Packaging. Wiley-ISTE.
2. Romeo T. Toledo, Rakesh K singh (2018). *Fundamentals of Food Processing Engineering (*4e). Springer.
3. Peter J Fellows (2016). *Food Processing Technology: Principles and Practice (4e).* Woodhead publishing/Elsevier Science.
4. Berk, Zeki (2018). *Food Process Engineering and Technology (3e).* Academic Press.
5. Tzia, Constantina (2016). *Handbook of Food Processing: food safety, quality, and manufacturing processes*. CRC Press.
6. Sankar Chandra Deka, Dibyakanta Seth (2020). *Technologies For Value Addition In Food Products And Processes*. Apple Academic Press.
7. O.P. Chauhan (2019). *Non-Thermal processing of foods*. CRC Press.
8. Chemat, Farid (2019). *Green Food Processing Techniques: Preservation, Transformation and Extraction*. Academic Press.
9. Smith, J. S., & Hui, Y. H. (Eds.). (2008). *Food processing: principles and applications*. John Wiley & Sons.

First Semester MSc. Food Science, Nutrition & Dietetics

Course Core Content

(PH 813.1) **Macronutrients in Human Nutrition**

Credits: **4** Total Hours: **56**

Course Outcome:

At the end of this course the students will be able to:

CO1: Demonstrate an understanding of the chemical composition, functions, and dietary sources of carbohydrates, proteins, and fats, including their role in energy metabolism and cellular processes in the human body.

CO2: Analyze the metabolic pathways and biochemical processes involved in the digestion, absorption, transportation, and utilization of macronutrients, and evaluate how dietary factors and physiological conditions influence these processes.

CO3: Critically evaluate dietary guidelines, recommendations, and nutritional interventions related to macronutrient intake, considering scientific evidence, epidemiological data, and population-based studies to assess their efficacy and relevance to human health.

CO4: Apply the principles of macronutrient nutrition to develop personalized dietary plans for individuals and populations with diverse nutritional needs, incorporating factors such as age, gender, activity level, health status, and cultural preferences.

Unit – I: Energy & Carbohydrate Metabolism **16 Hours**

Introduction to Human Nutrition - a global gerspective on food and nutrition**. Energy:** Definition and conceptualization of energy balance, Components of energy balance - Energy expenditure and requirements their components and determining methods (direct and indirect). Energy intake - sources of dietary energy, regulation of food intake, and factors influencing food intake. Overview of energy balance in various conditions. Adaptation to altered energy intake – deficiency and toxicity.

Carbohydrates: Carbohydrates in foods. Digestive fate of dietary carbohydrates. Metabolic utilization of carbohydrate. Regulation of blood glucose concentration. Disorders related to carbohydrate metabolism - diabetes and its consequence, dietary management of blood glucose concentration (Glycemic index and glycemic load), non-glycemic carbohydrates, resistant starch, dietary fiber, intake of dietary fiber, oligosaccharides and other indigestible sugars (fermentation in the colon and the fate of short-chain fatty acids). Sugar alternatives. Lactose intolerance., dental caries.

Unit – II: Metabolism of Lipids **14 Hours**

The history of lipids in human nutrition. Terminology of dietary fats. Digestion, absorption, and transport of dietary fat. Enterohepatic circulation (Re-esterification of triacylglycerols in the enterocyte, exogeneous and endogeneous transport pathway). Circulating lipids – lipoprotein structure and metabolism, LDL transport and receptor pathways, HDL transport pathways. Role of dietary fats in health – PUFAs, MUFAs and short

and medium chain triglycerides. Role of triglycerides and lipoprotein in the pathophysiology of disease (postprandial lipemia and artherosclerosis).

Unit – III: **Metabolism of Proteins** **14 Hours**

Nutritional classification – indispensability and metabolic characteristic as the basis of classification. Concepts of essential and non-essential amino acids, their biochemical roles. Review of digestion, absorbtion, utilization and metabolism of protein (Catabolism and anabolism). Biology of protein and amino acid requirements - Body protein mass, concept of nitrogen balance and protein turnover. Estimation of protein and amino acid requirements - protein requirements for various age and physiological groups, determination of indispensable amino acid requirements, non-dietary factors affecting requirements. Protein malnutrition - Clinical features and biochemical changes.

Unit – IV: Bioavailability Of Nutrients **12 Hours**

Animal and human metabolic studies use in assessment of nutrient bioavailability, Ethics in conducting human and animal metabolic studies, Methods of evaluating protein quality need – Amino acid score, NPU, BV, Digestibility coefficient. **Recent Advances in Nutrition:** Designer foods, genetically modified foods, Pre-biotics, pro-biotics, Novel foods – leaf protein, single cell protein, post biotics, Fortification, Irradiation of foods, Space foods, Organic foods

Recommended Books and References:

1. Geissler, C., & Powers, H. (Eds.). (2023). Human nutrition. Oxford University Press.
2. Mann, J., Truswell, S., & Hodson, L. (Eds.). (2023). Essentials of Human Nutrition 6e. Oxford University Press.
3. Gibney, M.J., Lanham-New, S.A., Cassidy, A. and Vorster, H.H. (2009). Introduction to Human Nutrition, 2nd Edition. Wiley-Blackwell, A John Wiley and Sons, Ltd., Publication.
4. Venn, B. J. (2020). Macronutrients and human health for the 21st century. Nutrients, 12(8), 2363.
5. Hawkesford, M. J., Cakmak, I., Coskun, D., De Kok, L. J., Lambers, H., Schjoerring, J. K., & White, P. J. (2023). Functions of macronutrients. In Marschner's mineral nutrition of plants (pp. 201-281). Academic press..
6. Nutrition and Metabolism – Michael J. Gibney, Marinos Elia, Olle Ljungqvist, Julie Dowsett (Eds.) – Nutrition Society Textbook series, Blackwell Publishers.
7. Text Book of Human Nutrition – Mahtab S Bamji, N Prahlad Rao, Vinodini Reddy, 2nd edition, Oxford & IBH Publishing Co. Pvt. Ltd.
8. Berdanier, C. D., & Berdanier, L. A. (2015). *Advanced nutrition: macronutrients, micronutrients, and metabolism*. CRC press.
9. Mahan, K.S. and Escott-Stump, L. (2017). Krause's Food and the Nutrition Care Process. 14th Edition. Elsevier Publication.

10. Shils, M.E., Olson, J., Shike, M. and Roos, C (2003). Modern Nutrition in Health and Disease. 9th edition Williams and Williams. A Beverly Co. London.
11. Bodwell, C.E. and Erdman, J.W. (2008) Nutrient Interactions. Marcel Dekker Inc. New York
12. Sareen, S. and James, J (2005). Advanced Nutrition in Human Metabolism, 4th Edition. Thomson Wordsworth Publication, USA.
13. Nutrition Science – B Sri Lakshmi, New Age International Publishers.
14. Normal and Therapeutic Nutrition – Robinson & Lawler, 17th edition, Mac Millan Publishers.

First Semester MSc. Food Science, Nutrition & Dietetics

Course Core Content

(PS 816.1) **Human Physiology**

Credits: **3** Total Hours: **42**

Course Outcomes

On completion of this course students will be able to:

CO1. Demonstrate an understanding of the fundamental principles of human physiology, including the structure and function of major organ systems, cellular processes, and homeostatic mechanisms regulating physiological functions.

CO2. Analyze the interrelationships between different organ systems and physiological processes, and evaluate how disruptions or dysfunctions in one system can impact overall health and homeostasis in the human body.

CO3. Critically evaluate research findings, experimental data, and scientific literature related to human physiology, and assess the validity, reliability, and significance of evidence in advancing our understanding of physiological mechanisms and health outcomes.

CO4. Apply knowledge of human physiology principles to interpret and solve clinical case studies, diagnose physiological disorders, and design appropriate nutrition interventions or treatment strategies to restore or maintain normal physiological function.

UNIT - I: Cell Structure and Function, Digestive, Respiratory, Musculo-Skeletal Systems 14 Hours

Levels of cellular organization and function – organelles, tissues, organs and systems - Cell membrane transport across cell, membrane and intercellular communication. Regulation of cell multiplication. **Digestive System:** Review of structure and function - Secretory, Digestive and Absorptive functions - Role of liver, pancreas and gall bladder and their dysfunction - Motility and hormones of GIT. Regulation of food intake – role of hunger and satiety centers, effect of nutrients.

Respiratory System: Review of structure and function. Role of lungs in the exchange of gases. Transport of oxygen and Co_2. Role of haemoglobin and buffer systems. Cardio-respiratory response to exercise and physiological effects of training.

Musculo-Skeletal System: Structure and function of bone, cartilage and connective tissue. Disorders of the skeletal system. Types of muscles structure and function.

UNIT – II: Nervous, Endocrine and Exocrine System **14 Hours**

Nervous System: Review of structure and function of neuron - conduction of nerve impulse, synapses and role of neurotransmitters - Organization of central and Peripheral nervous system. Hypothalamus and its role in various body functions - obesity, sleep and memory.

Endocrine System: Endocrine glands (Pituitary gland, Thyroid, parathyroid, Islets of Langerhans, Adrenals, Ovary and Testis, Thymus and Pineal gland – structure, function, role of hormones, regulation of hormonal secretion, Disorders of endocrine glands, Emphasis on physiology of stress hormones.

Exocrine System: Integumentary system. Structure and function of skin and maintenance of homeostasis.

UNIT – III: Circulatory, Excretory and Immune Systems **14 Hours**

Circulatory and Cardio Vascular System: Blood - formation, composition, clotting and haemostasis**.** Formation and function of plasma proteins. Erythropoesis, Blood groups and histocompatibility. Blood indices - Use of blood for investigation and diagnosis of specific disorders, Structure and function of heart and blood vessels - Regulation of cardiac output and blood pressure.

Excretory system: Structure and function of nephron - Urine formation - Role of kidney in maintaining pH of blood -Water, electrolyte and acid base balance – diuretics.

Immune system: Cell mediated and humeral Immunity - Activation of WBC and production of antibodies. Role in inflammation and defense.

Recommended Books and References:

1. Hall, J. E., & Hall, M. E. (2020). *Guyton and Hall Textbook of Medical Physiology E-Book*, Elsevier Health Sciences.
2. Anne, W., & Allison, G. (2014). *Ross and Wilson Anatomy and Physiology in health and illness.* UK: Churchill Livingstone Elsevier, 351.
3. Jain, A. K. (2017). *Textbook of physiology.* Avichal publishing company, New Delhi.
4. Murray, R., & Kenney, W. L. (2020). P*ractical guide to exercise physiology: The science of exercise training and performance nutrition.* Human Kinetics Publishers.
5. Koeppen, B. M., & Stanton, B. A. (2023*). Berne and Levy Physiology E-Book: Berne and Levy Physiology E-Book*. Elsevier Health Sciences.
6. Biga, L. M., Dawson, S., Harwell, A., Ho

pkins, R., Kaufmann, J., LeMaster, M., ... & Runyeon, J. (2020). *Anatomy & physiology*. OpenStax/Oregon State University.

First Semester MSc. Food Science, Nutrition & Dietetics

Course Core Content

(PS 817.1) **Micronutrients in Human Nutrition**

Credits: **3** Total Hours: **42**

Course Outcomes:

On completion of this course the students will be able to:

CO1. Explain the importance of maintaining a balance of micronutrients for optimal health.

CO2. Evaluate the principle of nutrition associated with metabolic pathways and the function of each micronutrient.

CO3. Analyze the nutrient-nutrient and nutrient-drug interactions that affect the absorption, metabolism, and utilization of micronutrients.

CO4. Assess the implications of deficiency and toxicity of micronutrients and their status in the body.

CO5. Understand the concept of bioavailability of nutrients and its significance.

Unit I: Body Fluids and Minerals **14 Hours**

Body fluids and water balance, distribution of water in the body, body water compartments; Regulation of water balance: Disorders of water balance. Electrolytes: Electrolyte content of fluid compartments, Role and function of Electrolytes, Factors affecting electrolyte balance and hydrogen ion balance. Macro minerals and Micro-minerals - Calcium, Phosphorous, Iron, Sodium, Potassium, and Chloride like Sodium, Potassium, Chloride, Iodine, Fluoride, Magnesium, Copper, Zinc, Selenium, Manganese, Chromium Sources, RDA, Distribution in the body, digestion, Absorption, Utilization, Transport, Excretion, Regulation of concentration. Interaction with other nutrients and drugs. Deficiency and Toxicity.

Unit III : Fat Soluble and Water-Soluble Vitamins **14 Hours**

Vitamins A, D, E, K (Fat soluble) and Thiamine, Riboflavin, B12, Folic acid, Pyridoxine, Pantothenic acid, Niacin, Biotin, and Ascorbic acid (Water Soluble) - Source, Chemistry, Functions, Physiological / metabolic action, Digestion, Absorption, Utilization, Transport, Storage, Excretion, RDA. Interaction with other nutrients and drugs. Deficiency, Toxicity, and assessment methods of deficiency and toxicity.

Unit IV: Bioavailability of Nutrients **14 Hours**

General methods of determining bioavailability of vitamins and minerals: Radio-isotopes, Balance studies, Growth and specific tissue response, Repletion-depletion techniques, Plasma appearance, Microbial assays, Invitro studies, Factors affecting bioavailability of minerals and vitamins

Recommended Books and References:

1. Gropper, S. S., & Smith, J. L. (2012). Advanced nutrition and human metabolism. Cengage Learning.
2. Gibney, M.J., Lanham-New, S.A., Cassidy, A. and Vorster, H.H. (2009). Introduction to Human Nutrition, 2nd Edition. Wiley-Blackwell, A John Wiley and Sons, Ltd., Publication.
3. Combs Jr, G. F., & McClung, J. P. (2016). The vitamins: fundamental aspects in nutrition and health. Academic press.
4. Davidson, S. S., & Passmore, R. (1966). Human nutrition and Dietetics. E. & S. Livingstone.
5. Pike, R. L., & Brown, M. L. (1967). Nutrition: an integrated approach. Nutrition: an integrated approach.
6. Berdanier, C. D., & Berdanier, L. A. (2021). Advanced nutrition: macronutrients, micronutrients, and metabolism, 3rd Edition. CRC press.
7. Prasad K. N., (2019). Micronutrients in health and disease, 2nd edition. CRC press.
8. Agharval A., Udipi S. A., (2023). Textbook of human nutrition 2nd edition. Jaypee brothers medical publishers
9. Bamji M S; (2023), Textbook Of Human Nutrition, 4th Edition; CBS publishers.

I Semester M.Sc. Food Science, Nutrition & Dietetics

Core Lab Course Content

(PH 814.1P) **Food Chemistry & Preservation**

8 Hours/week

Credits:**4** Total hours: **96**

Course Outcomes

On completion of this practical the students will be able to:

CO1: Analyze the chemical composition of different food items and understand how various chemical compounds contribute to their flavor, texture, and nutritional value.

CO2: Analyze the principles of food preservation techniques such as canning, freezing, and drying, and evaluate their effectiveness in preserving food quality and safety.

CO3: Evaluate the impact of different preservation methods on the sensory characteristics, nutritional content, and shelf-life of food products.

CO4: Design and implement experiments to develop innovative food preservation techniques that address specific challenges in food processing and storage.

List of Experiments

1. Determination of moisture content in food sample
2. Determination of crude fat content /oil content by Soxhlet method
3. Estimation of total lipid content in egg yolk
4. Determination of Acid value or Free fatty acids of the oil sample
5. Estimation of crude protein by Kjeldahl method
6. Estimation of protein in food sample by Biuret/Lowry's method
7. Determination of ash content in food
8. Determination of crude fiber content
9. Estimation of Ascorbic acid in food sample
10. Estimation of Calcium in milk sample.
11. Food Preservation by Conventional methods: Pickling, Salting, Vinegar, Smoking and Sugar addition.
12. The effect of dry heat methods (open pan) on the physiological and sensory properties of vegetables.

13. The effect of moist heat (closed pan) on the physiological and sensory properties of vegetables.
14. Measuring of oil uptake of vegetables: Deep fat frying
15. Measuring of oil uptake of vegetables: Shallow fat frying
16. Drying of the vegetables – measuring the moisture loss, water activity calculation.
17. Freeze drying of vegetables – physiological changes and comparison studies with their traditionally dried counterparts.
18. Blanching of vegetables before freezing and sensory evaluation, comparison with controls.
19. Enzymatic browning of fruits and vegetables using different solutions: observing the browning process and evaluating the best method for each fruit and vegetable.
20. Concentration of milk by open pan evaporation method.

Recommended books and References

1. Miller, D. D., & Yeung, C. K. (2022). *Food chemistry: A laboratory manual*. John Wiley & Sons.
2. Horwitz, W., & Latimer, G. W. (2000). Association of official analytical chemists. (2010). *Official methods of analysis of AOAC international*.
3. Wrolstad, R. E., Acree, T. E., Decker, E. A., Penner, M. H., Reid, D. S., Schwartz, S. J., ... & Sporns, P. (Eds.). (2005). *Handbook of food analytical chemistry, volume 1: Water, proteins, enzymes, lipids, and carbohydrates*. John Wiley & Sons.
4. Baur, F. J., & Ensminger, L. G. (1977). The association of official analytical chemists (AOAC). *Journal of the American Oil Chemists' Society*, *54*(4), 171-172.
5. Karel, M., & Lund, D. (2003). *Physical principles of food preservation: revised and expanded*. CRC Press.
6. Prokopov, T., & Tanchev, S. (2007). Methods of food preservation. In *Food safety: A practical and case study approach* (pp. 3-25). Boston, MA: Springer US.

I Semester M.Sc. Food Science, Nutrition & Dietetics

Core Lab Course Content

(PH 815.1P) **Human Physiology and Nutrition**

8 Hours/week

Credits:**4** Total hours: **96**

Course Outcomes

On completion of this practical students will be able to:

CO1: Demonstrate proficiency in various methods of processing fruits, vegetables, milk, and dairy products.

CO2: Analyze the factors influencing the quality and shelf life of processed fruits, vegetables, milk, and dairy products.

CO3: Critically evaluate the efficiency and effectiveness of different processing methods and technologies in terms of product quality and safety.

CO4: Create new dairy products through the application of advanced processing techniques, considering consumer preferences and market trends

List of Experiments

1. Basic regulations for Human physiology and Nutrition laboratory
2. Estimation of Diffusion and rate of diffusion
3. Estimation of Osmosis using potato osmometer
4. Effect of pH and Temperature on Enzyme activity
5. Determination of Blood group
6. Determination of Bleeding time and clotting time
7. Reflexes and Senses
8. Estimation of physical fitness in individuals
9. Analysing ECG
10. Urine analysis
11. Specimens of cells and tissues and organs
12. Measuring blood pressure with a sphygmomanometer.
13. Determination of energy requirements using prediction equations

14. Determination of food and nutrient intake using diet recall method
15. Determination of rise in blood sugar following oral glucose intolerance test
16. Determination of glycaemic index and glycaemic load of foods
17. Estimation of serum proteins by Lowry's method
18. Estimation of fat content in food by gravimetric method
19. Estimation of plasma cholesterol by Zak Method
20. Determination of low density lipoprotein (LDL) oxidation
21. Estimation of thiamine content in foods
22. Estimation of phosphorus content in foods by Fiske Subbarow Method
23. Estimation of iron content in foods by Wong's method
24. Estimation of antioxidant activity of foods by Diphenyl

Recommended Books and References

1. Raghuramulu, N., Nair, K. M., & Kalyanasundaram, S. (Eds.). (1983). A manual of laboratory techniques. National Institute of Nutrition, Indian Council of Medical Research.
2. Miller, D. D., & Yeung, C. K. (2022). *Food chemistry: A laboratory manual*. John Wiley & Sons.
3. Horwitz, W., & Latimer, G. W. (2000). Association of official analytical chemists. (2010). *Official methods of analysis of AOAC international*.
4. Wrolstad, R. E., Acree, T. E., Decker, E. A., Penner, M. H., Reid, D. S., Schwartz, S. J., ... & Sporns, P. (Eds.). (2005). *Handbook of food analytical chemistry, volume 1: Water, proteins, enzymes, lipids, and carbohydrates*. John Wiley & Sons.
5. Long, C. (1961). Biochemists' handbook. Biochemists' handbook.
6. Kirby, D. F., & Dudrick, S. J. (1994). Practical handbook of nutrition in clinical practice (Vol. 4). CRC Press.
7. More, J. (2021). Infant, child and adolescent nutrition: A practical handbook. CRC Press.
8. Sauberlich, H. E. (2018). Laboratory tests for the assessment of nutritional status. Routledge.

II Semester M.Sc. Food Science, Nutrition & Dietetics

Core Course Content

(PH 811.2) Clinical and Therapeutic Nutrition

Credits: **4** Total Hours: **56**

Course Outcomes:

On completion of this course the students will be able to:

CO1: Demonstrate an understanding of the role of nutrition in the prevention, management, and treatment of various medical conditions and diseases, including the physiological mechanisms underlying nutritional interventions.

CO2: Analyze the nutritional needs and dietary requirements of individuals with specific medical conditions, and evaluate how factors such as age, gender, genetics, and lifestyle influence nutritional status and treatment outcomes.

CO3: Critically evaluate the efficacy, safety, and evidence-based practice guidelines for nutritional interventions in clinical settings, considering research studies, clinical trials, and meta-analyses to assess their impact on patient outcomes and quality of life.

CO4: Apply principles of clinical and therapeutic nutrition to develop individualized dietary plans, medical nutrition therapies, and lifestyle interventions for patients with diverse health conditions, integrating interdisciplinary approaches and collaborating with healthcare professionals to optimize patient care.

Unit I: Principles of Clinical Nutrition 12 Hours

Understanding food groups and food composition tables, Recommended Dietary Allowances and Balance diet; Guidelines for Diet and Meal Planning -Current diet and nutrition scenario, dietary goals, dietary guidelines, Determining nutritional needs & concepts of Weights and Measures in diet planning. Introduction to clinical nutrition and therapeutic diet - Concept of inter relationship between foods, health and nutrition. Hospital diet and its therapeutic modification, special feeding methods, pre and post operative diet, team approach in patient care, objectives of diet therapy and intervention.

Unit II: Nutritional Care Process & Metabolic Disorders 15 Hours

Identification of high-risk patients – nutrition screening. Steps in Nutrition Care Process: Nutritional assessment – Anthropometrics (measures and indicators), Biochemical, Clinical and Dietary; Nutritional diagnosis - Nutritional interpretation of routine medical and laboratory data and clinical signs and symptoms; Nutrition intervention, monitoring and evaluation - diet modification, diet prescription and

nutrition counselling: counselling concept, recipient and counselling environment, interpersonal skills, psychological considerations in patient care. Intervention counselling models. Nutritional counselling components – planning, implementation and evaluation. Role of dieticians: Specific functions of a therapeutic, administrative and consultant dietician. Assessment & Record Keeping - medical and nutritional care record, types and uses. Medical nutrition therapy in metabolic disorders: weight management, eating disorders, thyroid, Polycystic ovary disease, hypertension and diabetes.

Unit III: Nutritional Support System **15 Hours**

Enteral nutrition & parenteral nutrition: Enteral feeding – indications and contraindications, Types / routes – Naso-enteric, Percutaneous endoscopic routes, surgical enterostomies and Rectal feeding - requirements and advantages. Nutrient consideration in Enteral feeding. Parenteral feeding – indications and contraindications, types, formula feeds and Complications in Total Parenteral Nutrition. Complications of nutritional support systems including refeeding syndrome, palliative care, rehabilitation diets. Transitional feeding, Nutrition support in long-term and home care.

Unit IV: Drug-Nutrient Interaction and Toxicology **14 Hours**

Effect of Food on Drug Therapy. Effect of Drug on Food and Nutrition. Food poisoning, food intolerance and food allergy. Diet in allergy - Common food allergens, test for allergy - Skin test and Elimination diet and Treatment for allergy. Alcohol and drug toxicity - dietary management.

Recommended Books & References:

1. Shills, M.E., Olson, J.A, Shike, M and Ross, A.C. (2002): Modern Nutrition in Health and Disease, 9th Edition, A. vaiiiams and Willdns.
2. Compher, C., Bingham, A. L., McCall, M., Patel, J., Rice, T. W., Braunschweig, C., & McKeever, L. (2022). Guidelines for the provision of nutrition support therapy in the adult critically ill patient: The American Society for Parenteral and Enteral Nutrition. Journal of Parenteral and Enteral Nutrition, 46(1), 12-41.
3. Berlana, D. (2022). Parenteral nutrition overview. Nutrients, 14(21), 4480.
4. Pironi, L., Boeykens, K., Bozzetti, F., Joly, F., Klek, S., Lal, S., ... & Bischoff, S. C. (2020). ESPEN guideline on home parenteral nutrition. Clinical nutrition, 39(6), 1645-1666.
5. Sareen, S, James, J (2005). Advanced Nutrition in Human Metabolism, 4th Edition, Thomson Wordsworth Publication, USA.
6. Chandra, R.K. (eds) (2002): Nutrition and Immunology, ARTS Biomedical. St. John's Newfoundland.
7. Krause's food and the nutrition care process, 14th edition (2017), L Kathleen Mahan and Janice Raymond.

8. Clinical Nutrition in Practice (2011) Editors: Charilaos Dimosthenopoulos, Meropi D. Kontogianni, Evangelia Manglara, Kalliopi-Anna Poulia. Publisher: John Wiley & Sons.
9. YK Joshi (2008) Basics of Clinical Nutrition. Edition2, Publisher: Jaypee Brothers, Medical Publishers Pvt. Limited.
10. Douglas C. Heimburger, Jamy D. Ard (2006) Handbook of Clinical Nutrition. Edition 4, illustrated. Publisher: Mosby/Elsevier.
11. Nutrition, Diet and Cancer (2012) Editors: Sharmila Shankar, Rakesh K. Srivastava. Publisher: Springer Science & Business Media.

II Semester M.Sc. Food Science, Nutrition & Dietetics

Core Course Content

(PH 812.2) **Dietetics**

Credits: **4** Total Hours: **56**

Course Outcomes

On completion of this course the students will be able to:

CO1. Dissect how specific nutrients or dietary patterns exacerbate or mitigate the pathophysiological processes of diseases such as diabetes, cardiovascular diseases, and autoimmune disorders.

CO2. Focus on assessing different nutritional strategies and their clinical outcomes in managing chronic conditions, using evidence-based guidelines likes ESPEN/ASPEN

CO3. Integrate the knowledge of disease mechanisms and nutritional science to create tailored dietary interventions that address specific health conditions, taking into account individual dietary needs, preferences, and restrictions.

CO4. Interpret clinical data to recommend dietary modifications for disease prevention and management.

CO5. Critically assess current research and trends in the field of nutrition and disease to identify potential areas for future investigation.

Unit I: Medical Nutrition Therapy in metabolic stress and febrile condition 14 Hours

Introduction to Pathophysiology, understanding its importance when deriving dietary nutrition principles. **Diet in infections and fevers:** Pathophysiology of fever **(**Typhoid fever, Tuberculosis). Metabolic changes during infection (HIV/AIDS). **Diet in metabolic stress**: Cellular and Physiological Response to Injury: The Role of the Immune System. Medical nutrition therapy (pathophysiological, clinical and metabolic aspects) in the following conditions like burns, multiple organ failure and also other conditions of stress, trauma, sepsis, and cancer. Transitional diets in pre and post-surgery. The role of immuno enhancers, conditionally essential nutrients, immune suppressants and special diets.

Unit II: Medical Nutrition Therapy in Gastrointestinal, Liver and Pancreatic Disorders 14 Hours

Diseases gastrointestinal system: Pathophysiology and dietary management of Acute gastritis, Chronic gastritis, Peptic ulcer - duodenal & gastric, Fiber modifications in ntestinal disease - Flatulence, Diarrhoea and Dysentry, Constipation, Celiac disease, Tropical sprue, Irritable bowel syndrome, diverticular disease, Ulcerative colitis.

Hepatobiliary and Pancreatic disorders

Liver: Hepatitis, cirrhosis, Jaundice, fatty liver, cholecystits and cholelithiasis, Hepatic coma. Applications of Protein-Based Exchanges in acute and refractory hepatic encephalopathy**.**

Pancreas: Pathophysiology of Pancreatitis, Acute and chronic, metabolic alterations, complications and treatment

Unit III: Diseases of cardio vascular system **14 Hours**

Risk factors of CVD, Etiology, Symptoms and dietary management of atherosclerosis, Ischemic heart disease, dislipidemia, prevention through life style modifications. Applications of TLC diet in managing lipid levels. Hypertension: Classification, Prevalence, Diet related factors influencing hypertension and Management of hypertension. Evaluation of the DASH, Mediterranean diets. Different types of sodium-controlled diets. **Diseases of Renal system:** Nutrient management in Transplantation and dialysis. Pathophysiology and dietary modification in the following diseases like Nephritis, Nephrosis, Acute and chronic renal failure, Nephrolilthiasis,

Unit IV: Diseases of Musculo-skeletal system **14 Hours**

Rheumatoid arthritis, Osteoarthritis, Osteoporosis and Osteomalacia. **Neurological disorders** - Parkinson's disease, Huntington's chorea, multiple sclerosis, myasthenia gravis, Alzheimer's disease, Wilson's disease and stroke. Case-based discussions focusing on the nutritional challenges associated with these conditions.

Recommended Book and References:

1. Raymond, J. L., & Morrow, K. (2022). *Krause and Mahan's Food and the Nutrition Care Process, 16e, E-Book: Krause and Mahan's Food and the Nutrition Care Process, 16e, E-Book*. Elsevier Health Sciences.
2. Nelms, Marcia Nahikian, Kathryn Sucher, Karen Lacey, and Sara Long Roth. *Nutrition therapy and pathophysiology*. Belmont, Calif: Thomson Brooks/Cole, 2007.
3. Nissenson, A. R., Fine, R. N., Mehrotra, R., & Zaritsky, J. (Eds.). (2022). *Handbook of Dialysis Therapy, E-Book*. Elsevier Health Sciences.
4. Mahan, L. Kathleen. *Krause's Food & the Nutrition Care Process-E-Book: Krause's Food & the Nutrition Care Process-E-Book*. Elsevier Health Sciences, 2016.
5. Kane, Kelly, and Kathy Prelack. *Advanced Medical Nutrition Therapy*. Jones & Bartlett Learning, 2018.
6. Lipkin, Ann Connell. "Nutritional Considerations in the Intensive Care Unit: Science, Rationale, and Practice." (2005): 2861.
7. Hark, Lisa, Darwin Deen, and Gail Morrison. *Medical nutrition and disease: a case-based approach*. John Wiley & Sons, 2014.
8. Boushey, Carol J., Ann M. Coulston, Cheryl L. Rock, and Elaine Monsen, eds. *Nutrition in the Prevention and Treatment of Disease*. Elsevier, 2001.

9. Antia, F. P. (2002). *Clinical dietetics and nutrition*. Oxford University Press, Ely House, 37 Dover Street, London Wl.

10. Payne, A., & Barker, H. M. (Eds.). (2011). *Advancing Dietetics and Clinical Nutrition E-Book: Advancing Dietetics and Clinical Nutrition E-Book*. Elsevier Health Sciences.

II Semester M.Sc. Food Science, Nutrition & Dietetics

Core Course Content

(PS 815.2) **Research Methodology and Ethics**

Credits: **3** Total Hours: **42**

Course Objectives

On completion of this course the students will be able to**:**

CO1. Understand the scientific approaches to research and analyze research subject related literature in, critically evaluating research methodologies, experimental designs, and data interpretation techniques used in published studies, and identifying strengths, limitations, and gaps in current research.

CO2. Demonstrate an understanding of the fundamental principles and concepts of research methodology in food science, including study design, data collection methods, statistical analysis, and research ethics.

CO3. Critically evaluate research proposals, experimental protocols, and research findings in food science, assessing the validity, reliability, and significance of research outcomes, and synthesizing evidence to draw informed conclusions.

CO4. Apply research methodologies and experimental techniques to design, conduct, and analyze data from food science research projects, demonstrating proficiency in data collection, statistical analysis, and scientific writing.

Unit I: Research Problem and Design **14 Hours**

Research: Types, objectives, research approaches, research and scientific methods, criterions of good research. **Research Problem:** Definition and techniques involve in defining a problem**. Research Designs**: Meaning, need for research design, features and types. Basic principles of experimental design, selection of experimental material, Essential Constituents of Literature Review.

Unit II: Sampling **14 Hours**

Need for sampling, unit, population and sample, sampling methods, Important Sampling Distributions, Central Limit Theorem and Sampling Theory, Skewness and Kurtosis. Sampling design: Steps in Sampling Design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design. Data: Collection of Primary Data and Secondary Data, Frequency distribution. Classification and summarization of data. Presentation of Data - Diagrams and Graphs.

Unit III: Introduction to statistics **14 Hours**

Measures of Central Tendency (Mean, Mode and Median); Measures of Central Dispersion (Range, Standard Deviation, Standard Error, Coefficient of Variation); Elementary Probability Theory – Addition and Multiplication – Bayes Theorem – Random Variables and Probability distribution- Binomial, Poisson, and Normal. Study of relationship between variables. Basic concept of hypothesis testing - Type I and type II errors. Tests based on Means & Proportions on Normal. Two-way analysis of variance (RBD), LSD, - Multiple comparison tests (DMRT, Bonferonni, Dunnett's). t test for independent samples, paired samples, F test two sample variances: One-way ANOVA, two-way ANOVA, Correlation & Regression (three variables). Response Surface Methodology; Theory and application in food product development.

Unit IV: **Scientific/technical writing and research presentation** **14 Hours**

Types, Structure and components of Scientific Reports; Technical Reports and Thesis; Steps in the preparation of reports and thesis layout, structure and language of typical reports, illustrations and tables, bibliography, referencing and foot notes. Citation, Impact factor, h-index and Acknowledgement. **Ethics in research:** Responsible conduct; the regulations and ethics of animal use in research; Research ethics for human subjects; Role of ethics committees in biological research; **Intellectual Property Rights (IPR):** patenting of process and products; reproduction of published material; plagiarism.

Recommended Books and References:

1. Torres, R. A., & Nyaga, D. (2021). Critical research methodologies: ethics and responsibilities (Vol. 181). Brill.
2. Iphofen, R. (Ed.). (2020). *Handbook of research ethics and scientific integrity*. Cham: Springer.
3. Bandarkar, P.L. and Wilkinson T.S. (2000): Methodology and Techniques of Social Research, Himalaya Publishing House, Mumbai.
4. Copper, H.M. (2002). Intergrating research: A guide for literature reviews (2nd Edition). California: Sage Harman, E & Montages, I. (Eds.) (2007). The thesis and the book, New Delhi: Vistar.
5. Mukherjee, R. (1989): The Quality of Life: Valuation in School Research, Sage Publications, New Delhi.
6. Stranss, A and Corbin, J. (1990): Basis of Qualitative Research: Grounded Theory Procedures and Techniques, Sage Publications, California
7. Montgomery, D. C., (2001). Design and Analysis of experiments, Fifth Edition, John Wiley & Sons.
8. Kothari, C.R. (2008). Research Methodology: Methods and Techniques. Second Edition. New Age International Publishers, New Delhi
9. Vining, G. G., Kowalski, S. (2010). Statistical Methods for Engineers.2nd Edn. Cengage Learning (RS), Boston, USA.

II Semester M.Sc. Food Science, Nutrition & Dietetics

Core Course Content

(PS 816.2) **Life Cycle Nutrition**

Credits: **3** Total Hours: **42**

Course Outcomes

On completion of this course the students will be able to:

CO1. Establish an outline of the nutritional needs and requirements at different stages of the human lifecycle, including infancy, childhood, adolescence, adulthood, and older adulthood, and recognize the impact of nutrition on growth, development, and health outcomes.

CO2. Examine factors influencing nutritional status and dietary patterns across the lifecycle, including physiological changes, lifestyle factors, cultural practices, and socio-economic determinants, and evaluate their implications for nutritional health and well-being.

CO3. Critically evaluate nutritional guidelines, recommendations, and interventions targeted at specific lifecycle stages, assessing their effectiveness, relevance, and cultural appropriateness in promoting optimal nutrition and preventing nutritional deficiencies and chronic diseases.

CO4. Apply knowledge of lifecycle nutrition principles to develop personalized dietary plans and nutritional interventions for individuals and groups at different stages of the lifecycle, integrating interdisciplinary approaches and considering diverse cultural and socio-economic contexts.

UNIT I: Dietary recommendations and Diet for Pregnancy and lactation 14 Hours

Dietary recommendations and methods for computing nutrient requirements: Basis for computing nutrient requirements - latest concepts in dietary recommendation. The Latest concepts in energy and protein requirements for Indians as defined by ICMR and WHO. The critical evaluation of sensitive methods and derivations of requirements and recommended dietary allowances of macronutrients for all age groups. The various methods use and their limitations.

Nutrition during pregnancy and lactation: Pregnancy - Physiological changes, nutritional requirements (energy and protein requirements), optimal weight gain and its components, effect of malnutrition on outcome of pregnancy, complications of pregnancy. Lactation - Physiology of lactation, factors affecting lactation, nutritional requirements (energy and protein requirements), community nutrition and fertility.

UNIT II: Nutrition in Infancy and Childhood 14 Hours

Growth and development during infancy, Immunization Schedule, Nutritional requirement and supplementation (latest energy and protein requirements for infants). Composition of different types of milk: Cow, buffalo, goat and reconstituted milk. Infant and young child feeding practices: breastfeeding, formula feeding, weaning food and problems of weaning. Feeding of Low birth weight and premature infants. Human Milk Banks- concept of human milk banks, their role in providing donor breast milk to infants who are unable to access their mother's milk.

Preschool children: Growth and development, nutritional requirements, special care in feeding preschoolers, nutritional problems specific to this age- Obesity and PEM.

Nutrition during childhood: Growth and development, nutritional requirements, dietary guidelines, importance of breakfast and packed lunches, nutritional problems-obesity, iron deficiency, dental carries. Complications of behaviors such as stool holding, neophobia, pica.

UNIT III: Adolescense, Adults and Geriatric Nutrition 14 Hours

Nutrition in Adolescence: Growth spurt, Role of hormones on growth, nutritional requirements, factors affecting their eating habits, nutritional problems specific to this age- anemia, eating disorders, malnutrition.

Young adults: Standard reference values for Reference Man and Reference Woman, dietary recommendations and methods for computing nutrient requirements, Pre and post-menopausal changes in women.

Geriatrics: Age-related physiological changes and their impact on nutritional needs The nutritional requirements, Special needs (adaptive feeding equipment and community support systems), Nutritional problems (malnutrition, osteoporosis, rheumatism), and disabilities affecting geriatric groups.

Recommended Books and References:

1. Nutrient Requirements for Indians Recommended Dietary Allowances Estimated Average Requirements - A Report of the Expert Group, 2020. India: Indian Council of Medical Research; 2020.
2. Edelman, C., & Kudzma, E. C. (2021). Health promotion throughout the life span-e-book. Elsevier Health Sciences.
3. Leifer, G., & Fleck, E. (2021). Growth and Development Across the Lifespan-E-Book: Growth and Development Across the Lifespan-E-Book. Elsevier Health Sciences.
4. Brown, Judith E., Janet S. Isaacs, U. Beate Krinke, Ellen Lechtenberg, Maureen A. Murtaugh, Carolyn Sharbaugh, Patricia L. Splett, Jamie Stang, and Nancy H. Wooldridge. *Nutrition through the life cycle*. Boston (MA): Cengage Learning, 2017.
5. Langley-Evans, S. (2013). *Nutrition: a lifespan approach*. John Wiley & Sons.
6. Chadha R., Mathur P. (eds). 2015. *Nutrition: A Lifecycle Approach*, Orient, New Delh

I Semester M.Sc. Food Science, Nutrition & Dietetics

Core Lab Course Content

(PH 813.2P) **Clinical and Life Cycle Nutrition**

8 Hours/week

Credits:**4** Total hours: **96**

Course Outcome

Upon completion of this course, students will be able to

CO1: Apply principles of human nutrition to assess dietary intake and nutritional status of individuals.

CO2: Analyze the physiological processes involved in digestion, absorption, and utilization of nutrients by the human body.

CO3: Critically evaluate nutritional research studies and their implications for human health and disease prevention.

CO4: Design personalized nutrition plans based on individual dietary requirements, health goals, and lifestyle factors

List of Experiments

1. Standardization of weights and measures of food ingredients
2. Standardization and nutrient profiling of recipes
3. Self-assessment and diet intervention
4. Anthropometry in adults
5. Anthropometry in children
6. Assessment of food and nutrient intake using 24hr dietary recall
7. Assessment of food and nutrient intake using food frequency questionnaire
8. Nutrition care process in weight management and eating disorders with and / or without comorbidities (Real-time case studies)
9. Nutrition care process for thyroid disorders with or without comorbidities (Real-time case studies)
10. Nutrition care process for Polycystic ovary disease with or without comorbidities (Real-time case studies)
11. Nutrition care process for hypertension with or without comorbidities
12. Nutrition care process for diabetes with or without comorbidities (Real-time case studies)
13. Documenting Enteral feeding formulas

14. Documenting parenteral feeding formulas

15. Nutrient consideration and calculation for enteral nutrition (Case study)

16. Nutrient consideration and calculation for parenteral nutrition (Case study)

17. Case study and Nutrition Care process for pregnant woman

18. Case study and Nutrition Care process for lactating woman

19. Case study and Care process during infancy

20. Case study and Nutrition Care process for preschoolers

21. Case study and Nutrition Care process for adolescents

22. Case study and Nutrition Care process for young adults

23. Case study and Nutrition Care process for older adults

24. Case study and Nutrition Care process for geriatric individual

Recommended Book and References

1. Hark, L., & Morrison, G. (2009). *Medical nutrition and disease: a case-based approach*. John Wiley & Sons.
2. Behan, E. (2006). *Therapeutic nutrition: a guide to patient education*. Lippincott Williams & Wilkins.
3. Powers, M. A. (Ed.). (1996). *Handbook of diabetes medical nutrition therapy*. Jones & Bartlett Learning.
4. Kreymann, K. G., Berger, M. M., Deutz, N. E., Hiesmayr, M., Jolliet, P., Kazandjiev, G., ... & Spies, C. E. S. P. E. N. (2006). ESPEN guidelines on enteral nutrition: intensive care. *Clinical nutrition*, *25*(2), 210-223.
5. Singer, P., Berger, M. M., Van den Berghe, G., Biolo, G., Calder, P., Forbes, A., ... & Pichard, C. (2009). ESPEN guidelines on parenteral nutrition: intensive care. *Clinical nutrition*, *28*(4), 387-400.
6. Boullata, J. I., Gilbert, K., Sacks, G., Labossiere, R. J., Crill, C., Goday, P., ... & American Society for Parenteral and Enteral Nutrition. (2014). ASPEN clinical guidelines: parenteral nutrition ordering, order review, compounding, labeling, and dispensing. *Journal of Parenteral and Enteral Nutrition*, *38*(3), 334-377.
7. Bankhead, R., Boullata, J., Brantley, S., Corkins, M., Guenter, P., Krenitsky, J., ... & ASPEN Board of Directors. (2009). ASPEN enteral nutrition practice recommendations. *Journal of Parenteral and Enteral Nutrition*, *33*(2), 122-167.
8. Mahan, L. K. (2016). *Krause's Food & the Nutrition Care Process-E-Book: Krause's Food & the Nutrition Care Process-E-Book*. Elsevier Health Sciences.

9. Raymond, J. L., & Morrow, K. (2022). *Krause and Mahan's Food and the Nutrition Care Process, 16e, E-Book: Krause and Mahan's Food and the Nutrition Care Process, 16e, E-Book*. Elsevier Health Sciences.
10. Longvah, T., Anantan, I., Bhaskarachary, K., Venkaiah, K., & Longvah, T. (2017). *Indian food composition tables* (pp. 2-58). Hyderabad: National Institute of Nutrition, Indian Council of Medical Research.
11. Deepthi, R., Anil, N. S., Narayanaswamy, D. M., Sathiabalan, M., Balakrishnan, R., & Lonimath, A. (2023). Recommended dietary allowances, ICMR 2020 guidelines: A practical guide for bedside and community dietary assessment-A review. *Indian J Forensic Community Med*, *10*, 4-10.

I Semester M.Sc. Food Science, Nutrition & Dietetics

Core Lab Course Content

(PH 814.2P) **Dietetics**

4 Hours/week

Credits:**4** Total hours: **48**

Course Outcome

Upon completion of this course, students will be able to

CO1: Apply knowledge of food science and nutrition to plan and prepare therapeutic diets for individuals with specific medical conditions.

CO2: Analyze the effectiveness of dietary interventions in managing and treating various health conditions, evaluating changes in biochemical markers, anthropometric measurements, and clinical outcomes.

CO3: Evaluate the nutritional adequacy and safety of dietary plans, considering factors such as nutrient composition, food preferences, cultural considerations, and economic constraints.

CO4: Design individualized dietary plans and nutrition education programs for diverse populations, considering their age, gender, health status, cultural background, and socioeconomic status

List of Experiments

1. Cardio vascular diet: create and analyze diets aimed at preventing and managing cardiovascular diseases, such as hypertension and heart disease.
2. Digestive System- Prepare dietary plans and simulate patient dietary consultations for conditions such as irritable bowel syndrome, Crohn's disease, and celiac disease.
3. Endocrine System- designing meal plans for diabetic patients.
4. Renal System- Develop and evaluate dietary interventions that adjust protein, phosphorus, potassium, and sodium intake for CKD patients.
5. Cancer: designing specific dietary interventions for cancer patients, focusing on managing side effects of chemotherapy and improving overall nutritional status to support immune function and recovery.
6. Postoperative Nutritional Care: post-surgery nutrition plans that promote wound healing, maintain muscle mass, and prevent infections.
7. Nutritional Management for Burn Patients: develop and analyze high-protein, high-calorie diets that are crucial for the healing and recovery of burn patients.

8. Dietary Approaches to Manage Liver Disease: Develop meal plans for hepatic health, particularly focusing on reducing fat intake and managing cirrhosis.
9. DASH, Mediterranean diet
10. Nutrition management in AIDS: Preparing meal plans that consider common complications such as oral ulcers, diarrhea, and opportunistic infections which may affect dietary intake.
11. Nutritional Management for Typhoid Fever: develop meal plans tailored for patients with typhoid fever, focusing on high-calorie, high-protein diets that are easy to digest and help in recovery.
12. Cooking Lab: Prepare and analyze meals suitable for various therapeutic needs, such as low-sodium diets for cardiovascular disease or high-fiber diets for digestive health.

Recommended Book and References

1. Hark, L., & Morrison, G. (2009). *Medical nutrition and disease: a case-based approach*. John Wiley & Sons.
2. Behan, E. (2006). *Therapeutic nutrition: a guide to patient education*. Lippincott Williams & Wilkins.
3. Powers, M. A. (Ed.). (1996). *Handbook of diabetes medical nutrition therapy*. Jones & Bartlett Learning.
4. Singer, P., Berger, M. M., Van den Berghe, G., Biolo, G., Calder, P., Forbes, A., ... & Pichard, C. (2009). ESPEN guidelines on parenteral nutrition: intensive care. *Clinical nutrition*, *28*(4), 387-400.
5. Boullata, J. I., Gilbert, K., Sacks, G., Labossiere, R. J., Crill, C., Goday, P., ... & American Society for Parenteral and Enteral Nutrition. (2014). ASPEN clinical guidelines: parenteral nutrition ordering, order review, compounding, labeling, and dispensing. *Journal of Parenteral and Enteral Nutrition*, *38*(3), 334-377.
6. Mahan, L. K. (2016). *Krause's Food & the Nutrition Care Process-E-Book: Krause's Food & the Nutrition Care Process-E-Book*. Elsevier Health Sciences.
7. Raymond, J. L., & Morrow, K. (2022). *Krause and Mahan's Food and the Nutrition Care Process, 16e, E-Book: Krause and Mahan's Food and the Nutrition Care Process, 16e, E-Book*. Elsevier Health Sciences.
8. Longvah, T., Anantan, I., Bhaskarachary, K., Venkaiah, K., & Longvah, T. (2017). *Indian food composition tables* (pp. 2-58). Hyderabad: National Institute of Nutrition, Indian Council of Medical Research.

9. Deepthi, R., Anil, N. S., Narayanaswamy, D. M., Sathiabalan, M., Balakrishnan, R., & Lonimath, A. (2023). Recommended dietary allowances, ICMR 2020 guidelines: A practical guide for bedside and community dietary assessment-A review. *Indian J Forensic Community Med*, *10*, 4-10.

10. Kopp Lugli, A., de Watteville, A., Hollinger, A., Goetz, N., & Heidegger, C. (2019). Medical nutrition therapy in critically ill patients treated on intensive and intermediate care units: a literature review. *Journal of clinical medicine*, *8*(9), 1395.

11. Taylor, B. E., McClave, S. A., Martindale, R. G., Warren, M. M., Johnson, D. R., Braunschweig, C., ... & Society of Critical Care Medicine. (2016). Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (ASPEN). *Critical care medicine*, *44*(2), 390-438.

I Semester B.Sc. Zoology

Open Elective Course Content

(PO 818.2) **Basic Nutrition**

Credits: **3** Total hours: **42**

Course Outcomes:

On completion of this course the students will be able to:

CO1: Understand the basic concepts of food and nutrition.

CO2: Explain the composition and functions of basic food components such as carbohydrates, proteins, fats, vitamins, and minerals.

CO3: Analyze the relationship between nutrition and weight management.

CO4: Describe the factors influencing individual variations in metabolism and weight management.

Unit I

Food and Nutrients

Basic definitions, Physiological, Psychological & social functions of food, Historical perspectives, and changing concepts in nutrition. The interrelationship between food, nutrition & health. Indicators of health and nutrition. Levels and Assessment of nutritional status; anthropometric, clinical, biochemical, dietary, vital health status. Recommended dietary allowances (RDA) & their uses, Food groups, Food guide, and Balanced diet.

Unit II

Macro and Micronutrients

Carbohydrates: Sources, dietary importance, special functions of carbohydrates in body tissues, Disorders, the relationship between dietary fiber and various health problems. Glycemic Index (GI) of foods: Control and its importance**. Lipids:** Sources, Essential fatty acids (EFA), the role of ω-3, ω-6 fatty acids in health and disease, trans fatty acid, prostaglandins, cholesterol, LDL, and HDL and their health importance. **Proteins:** Sources, classification of amino acids and proteins, functions of protein, the concept of protein balance, good quality protein. **Vitamins:** Sources, Types, requirements and functions; Deficiency and toxicity of Vitamins. **Minerals:** Sources, Types, requirements and functions; Deficiency and toxicity minerals.

Unit III

Concept of calorie and weight management

Energy: Energy content of foods, measurement of energy value of foods. Energy balance: Energy control in human metabolism, basal metabolic rate (BMR), factors affecting BMR, measuring of BMR, energy requirements, and its estimation.

Nutrition and weight management: Obesity and its causes, body composition, Body Mass Index

(BMI), Obesity-related health issues. underweight and its causes**,** body composition, Body Mass Index (BMI), and underweight-related health issues.

References:

1. Joshi; (2010) Nutrition & Dietetics, Tata McGraw-Hill Education Publisher, 3rd edition
2. Esther Winterfeldt, Margaret Bogle and Lea Ebro, (2010).Dietetics: Practice and Future Trends, Jones & Bartlett Learning.
3. Begum; (2008) Textbook of Foods, Nutrition & Dietetics, Sterling Publishers Pvt. Ltd.
4. Anne Payne, Helen M. Barker; (2011). Advancing Dietetics and Clinical Nutrition, Elsevier Health Sciences.
5. Joan Webster-Gandy; Angela Madden; Michelle Holds worth Oxford (2012) Handbook of Nutrition and Dietetics, Oxford.
6. Benjamin Caballero; Luiz Trugo; Paul M. (2003) Finglas Encyclopedia of Food Science and Nutrition, Academic Press, 2nd Edition.
7. Vickie Vaclavik; Elizabeth W. Christian; (2013) Essentials of Food Science, Springer Science & Business Media, 4th Edition.
8. Insel, P; Turner R.E.; Ross, (2006), D. Discovering Nutrition, ADA, Jones and Bartlett Publishers Inc. USA, 2nd Edition.
9. Gibney, M.J.; Elia, M., Ljungqvist, O.; Dowsett, J.; (2005) Clinical Nutrition, The Nutrition society text book series, Blackwell publishing company.
10. Srilakshmi B; (2011). Dietetics, New Age International Publishers.
11. Mudambi S.R., Rajagopal M.V., (2021). Fundamental Food Nutrition and Diet Therapy; New Age International Publishers
12. Agharval A., Udipi S. A., (2023). Textbook of human nutrition 2nd edition. Jaypee brothers medical publishers
13. Bamji M S; (2023), Textbook Of Human Nutrition, 4th Edition; CBS publishers.

Third Semester MSc. Food Science, Nutrition & Dietetics

Course Core Content

(PH 811.3) **Food Microbiology**

Credits: **4** Total Hours: **56**

Course Outcomes:

On Completion of this Course the students will be able to:

CO1: Understand the fundamentals of food microbiology.

CO2: Learn the novel methods for detection of immunological components.

CO3: Study the criteria for microbiological assessments in various food products.

CO4: understand the food borne pathogens and toxins produced by them and its health effect.

Unit I **12 Hours**

Introduction, Scope, Historical developments of General and Food Microbiology; Classifications of microorganisms; Bacterial group based on morphology - gram positive, gram negative, motile, non-motile, sporulating and non-sporulating. Different sources of microorganisms in foods; Microbial growth curve, factors (intrinsic and extrinsic) affecting growth of microorganisms.

Unit II **16 Hours**

Natural micro flora of various foods**:** Food spoilage and microbes of Milk, Fish, Meat, Poultry and other products. Contamination, Preservation and Spoilage of Cereals, Sugars, Fruits and Vegetable products. Measures to prevent microbial food poisoning, Microorganisms important in Foods. Isolation and Detection of Microorganisms: Conventional methods, Rapid methods, Immunological methods, Fluorescent anti body, Radioimmunoassay, ELISA and PCR.

Unit III **14 Hours**

Food microbiology and Public health: Food - borne Illness; Food - borne Poisoning, Infections and Intoxications: Bacterial agents of food poisoning by *Salmonella, Bacillus cereus, Listeria, Clostridium, Staphylococcus*. Non-bacterial agents of food poisoning: Poisonous algae and protozoa. Food poisoning by Fungus: Mycotoxins. Food -borne illness by Viruses.

Unit IV **14 Hours**

Food Sanitation and Control: Indicator microorganisms for monitoring the quality of foods Ex. *E coli*. Emerging food borne pathogens, recent examples of food borne disease outbreaks. Microbiological criteria for foods such as Milk, fish and meat products. HACCP. Enforcement and Control agencies (Codex, FDA and FSSAI).

Recommended Books and References:

7. John M. deMan, John W. Finley, W. Jeffrey Hurst & Chang Yong Lee (2018). Principles of Food Chemistry, 4th Edition, Springer Publications.
8. Yousef, A. E., Waite-Cusic, J. G., & Perry, J. J. (2022). *Analytical food microbiology: A laboratory manual*. John Wiley & Sons.
9. Dubey, R. C., & Maheshwari, D. K. (2023). *A textbook of microbiology*. S. Chand Publishing.
10. Vickie A. Vaclavik, Elizabeth W. Christian & Tad Campbell (2020). Essentials of Food Science (Food Science Text Series), 5th Edition, Springer Publications.
11. H. D. Belitz & W. Grosch (2013). Food Chemistry, 2nd Edition, Springer Science & Business Media.
12. Srinivasan Damodaran, Kirk L. Parkin & Owen R. Fennema (2008). Fennema's Food Chemistry, 4th Edition, CRC Press/Taylor & Francis, Boca Raton.
13. Steve W. Cui (2012). Food carbohydrates: chemistry, physical properties, and applications, CRC Press Taylor & Francis Group.
14. Akoh, Casimir C., (2017). Food Lipids: chemistry, nutrition, and biotechnology, 4th Edition, Boca Raton: Taylor & Francis.

Third Semester MSc. Food Science, Nutrition & Dietetics

Core Course Content

(PH 812.3) Nutraceuticals and Functional Foods in Human Health Total Hours: 56

Credits: 4

Course outcome:

On Completion of this Course the students will be able to:

CO1: Understand the fundamental concepts of nutraceuticals and functional foods.

CO2: Apply knowledge of functional food development

CO3: Evaluate the role of nutraceuticals and functional foods in disease management

CO4: Understand the mechanisms of action and health benefits of probiotics, prebiotics, and synbiotics

Unit I **12 hours**

Nutraceuticals: Introduction, classifications and its concepts; Nutraceuticals as a new dietary ingredient; Biological significance. Nutraceuticals and dietary supplements. Novel sources of (Marine-derived and insects) Nutraceuticals. Functional foods: Introduction and classification; World market for nutraceuticals and functional foods; Regulatory issues. Relevance of nutraceuticals and functional foods in the management of diseases and disorders.

Unit II **15 hours**

Sources and Health Benefits: Natural pigments like chlorophyll, carotenoids, lycopene and anthocyanins; Glucosinolates; Isoflavonoids; Phytosterols; Phytoestrogens; Omega-3 and omega-6 fattyacids; Conjugated Linoleic Acid, Dietary fiber; Antioxidants. Development of functional foods, isolation, storage, processing and stability of phytochemicals/bioactive compounds. Encapsulation Technologies; Recent developments in the isolation, purification and delivery of phytochemicals. Nutrigenomics: nutrigenomics an introduction and its relation to nutraceuticals

Unit III **14 hours**

The role of Nutraceuticals and functional foods in disease prevention: Angiogenesis, Cardiovascular diseases, Cancer, Diabetes, Cholesterol management and Obesity. Relation between nutraceuticals and Parkinsons, Alzheimer's diseases. Toxicity potential of nutraceuticals. Immunomodulation and nutraceuticals. Dosage for effective control of diseases and health benefits with adequate safety.

Unit IV **15 hours**

Prebiotics, Probiotics and Synbiotics: Introduction, criteria for selection, Role of gastro intestinal microbiota in health and disease; health effects of prebiotics and probiotics. Mechanism of action; Different types of prebiotics and their effects on gut microbes: Resistant starch, Fructo-oligosaccharides; Recent advances in probiotics; Challenges and regulatory issues related to probiotic products. Emerging strains and their specific health benefits. FOSHU Foods

Recommended Books & References:

1. Handbook of Nutraceuticals and Functional Foods Edited by Robert E.C.
2. Wildman ,Robert Wildman. Taylor C. Wallace , Routledge Publishers, Second Edition, April 26, 2007, ISBN-13: 978-0849364099 ISBN-10: 0849364094
3. Nutraceuticals by L. Rapport and B. Lockwood, Pharmaceutical Press, ISBN-13: 978-0853696599 ISBN-10: 0853696594 Edition: 2nd , April 26, 2007
4. Nutrition for the Older Adult by Melissa Bernstein, and Ann Schmidt Luggen (Author), ISBN-13: 978-0763736248 ISBN-10: 0763736244 Edition: 1st , August , 2009
5. Brigelius-Flohé, J & Joos HG. (2006). Nutritional Genomics: Impact on Health and Disease. Wiley VCH.
6. Losso JN. (2007). Angi-angiogenic Functional and Medicinal Foods. CRC Press
7. Robert EC. (2006). Handbook of Nutraceuticals and Functional Foods. 2 nd Ed. Wildman.
8. Shi J. (2006). Functional Food Ingredients and Nutraceuticals: Processing Technologies. CRC Press.
9. Webb GP. (2006). Dietary Supplements and Functional Foods. Blackwell Pub.
10. Kesharwani, R. K., Keservani, R. K., & Sharma, A. K. (Eds.). (2021). Nutraceuticals and 12. Functional Foods in Immunomodulators. Springer. https://doi.org/10.1007/978-981-16-0143-3
11. Egbuna, C., Dable-Tupas, G., et al. (Eds.). (2020). Functional Foods and Nutraceuticals: Bioactive Components, Formulations, and Innovations. Springer. https://doi.org/10.1007/978-3-030-54859
12. Wildman, R. E. C., & Wallace, T. C. (Eds.). (2023). Handbook of Nutraceuticals and Functional Foods (3rd ed.). CRC Press. https://doi.org/10.1201/9781003208355
13. Bashir, K., Jan, K., & Ahmad, F. J. (Eds.). (2024). Functional Foods and Nutraceuticals: Chemistry, Health Benefits and the Way Forward. Springer. https://doi.org/10.1007/978-3-031-59365-9

Third Semester MSc. Food Science, Nutrition & Dietetics

Course Core Content

(PO 815.3) Health and Fitness

Credits: 3 **Total Hours: 42**

Course Outcomes:

On completion of this course, the students will be able to:

CO1: Define key terms related to health and wellness, including physiological, psychological, and social aspects of food in health and wellness.

CO2: Explain the significance of physical fitness and nutrition in the prevention and management of chronic diseases such as diabetes mellitus, cardiovascular disease (CVD), bone health issues, and cancer.

CO3: Demonstrate the use of fitness tests for flexibility, muscle endurance, and cardiovascular endurance.

CO4: Analyze the effects of specific nutrients on work performance and physical fitness.

Unit I: Fundamentals Health and Fitness **16 Hours**

Definition of Health and Wellness. Physiological, psychological, and social aspects of food in health and wellness. Mental health and gender-specific health considerations- body composition, theories of obesity.

Fitness: Energy balance and physical fitness. Fitness tests for flexibility, muscle endurance (any 3 tests for each) and cardio vascular endurance. Emerging wellness trends and technologies: Wearable fitness technology, health apps, and their role in maintaining health.

Significance of physical fitness and nutrition in prevention and management of weight control Diabetes Mellitus, CVD, Bone Health and Cancer. Awareness about the alternative systems for health and fitness- Yoga and mindfulness

Unit II: Nutrition and Exercise **10 Hours**

Nutrient requirement for aerobic and anaerobic exercises, carbohydrate loading, water and dehydration. Effect of specific nutrients on work performance and physical fitness. Fuel and other nutrients that support physical activity (metabolic pathways). Mobilization of fuel stores during exercise.

Unit III: Sports Nutrition **13 Hours**

Nutrition and performance of athletes and players, dietary modifications (macro and micronutrient). Sports specific requirements diet manipulation such as pre-game and post-game means. Nutritional strategies for recovery post-exercise and post-injury. Use of different ergogenic aids and commercial supplements. **Special nutritional needs** for monitoring space, military and sea voyage.

Recommended Books:

1. Summerfield, L. M. (2001). Nutrition, exercise, and behavior: an integrated approach to weight management. *(No Title)*.
2. Byrd-Bredbenner, C. et al. (2022) Wardlaw's perspectives in Nutrition. New York, NY: McGraw Hill LLC.
3. Nutrition in Health and Disease: Our Challenges Now and Forthcoming Time. (2019). United Kingdom: IntechOpen.
4. Straub, R. O. (2007). *Health psychology: A biopsychosocial approach*.
5. Sharkey, B. J., & Gaskill, S. E. (2013). *Fitness & health*. Human Kinetics.
6. Dunford, M., & Doyle, J. A. (2019). *Nutrition for sport and exercise*. Cengage Learning.
7. McArdle, W. D., Katch, F. I., & Katch, V. L. (2010). *Exercise physiology: nutrition, energy, and human performance*. Lippincott Williams & Wilkins.
8. Nicogossian, A. E., Williams, R. S., Huntoon, C. L., Doarn, C. R., Polk, J. D., & Schneider, V. S. (Eds.). (2016). Space physiology and medicine: from evidence to practice. Springer.

Third Semester M.Sc. Food Science, Nutrition & Dietetics

Core Lab Course Content

(PH 813.3P) Food Microbiology and Functional Foods

8 Hours/week

Credits:**4** Total hours: **96**

Course Outcomes

On completion of this practical the students will be able to:

CO1: Identify basic microbiological laboratory practice, culturing, isolating and handling of microbes.

CO2: Evaluate the intricacies of various microbiological staining techniques and estimate total count in food samples.

CO3: Understand and perform analytical techniques to quantify bioactive compounds and phytochemicals in food and plant samples.

CO4: Apply scientific knowledge and practical skills in developing innovative food products with enhanced health benefits.

List of Experiments

1. Sterilization and introduction to microbiological laboratory instruments.
2. Microbiological Culture Media Preparation.
3. Inoculation techniques (Pour plate)
4. Inoculation techniques (Spread plate)
5. Inoculation techniques (Streaking methods)
6. Isolation and Maintenance of Pure Cultures.
7. Enumeration of Soil Microorganism (Serial Dilution).
8. Staining Techniques (Simple, negative, differential staining and capsule staining).
9. Study of the microbiological quality of milk by MBR test.
10. Determination of a Bacterial Growth Curve: Classical and Two-Hour Methods.
11. Estimation of total microbial bacterial plate count of spoiled food sample.
12. Enumeration of Coliforms and indicator organisms (Most Probable Number).
13. Estimation of Oryzanol in given oil sample
14. Qualitative Analysis of Phytochemicals
15. Estimation of carotenoids

16. Estimation of Chlorophylls
17. Estimation of Capsaicin
18. Estimation of Phenolic Compounds in Given Sample
19. Estimation of total anthocyanins
20. Estimation of lycopene
21. Determination of total antioxidant activity by Phosphomolybdenum method
22. Development of functional food recipe

Recommended books and References

1. Harborne, J. B. (1998). *Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis* (3rd ed.). Springer.
2. Nielsen, S. S. (2024). Introduction to food analysis. In *Nielsen's Food Analysis* (pp. 3-14). Cham: Springer International Publishing.
3. Jayan, H., Pu, H., & Sun, D. W. (2020). Recent development in rapid detection techniques for microorganism activities in food matrices using bio-recognition: A review. *Trends in Food Science & Technology*, *95*, 233-246.
4. Rodriguez-Amaya, D. B. (2001). *A Guide to Carotenoid Analysis in Foods*. ILSI Press.
5. Prieto, P., Pineda, M., & Aguilar, M. (1999). Spectrophotometric quantitation of antioxidant capacity through the formation of a phosphomolybdenum complex: Specific application to the determination of vitamin E. *Analytical Biochemistry*, *269*(2), 337-341.
6. Pattabiraman, T. N. (1993). *Laboratory Manual and Practical Biochemistry*. All India Publishers & Distributors.
7. Prescott L M, Harley J P, Klein D A., (2008). Microbiology 6th Ed., WMC Brown Publishers.
8. Frazier, W.C. (2014) Food Microbiology, McGraw Hill Inc. 5th Edition.
9. García-Lomillo, J., & González-SanJosé, M. L. (2023). Phytochemicals in food and health: extraction, analysis, and bioavailability. Food Chemistry, 377, 131982. https://doi.org/10.1016/j.foodchem.2022.131982
10. Li, J., Huang, W., Zhang, Y., & Cheng, Y. (2022). Phytochemicals and biological activities of Solanaceae plants: Tomato, pepper, and eggplant. Food Chemistry, 373, 131430. https://doi.org/10.1016/j.foodchem.2021.131430
11. Melini, V., & Melini, F. (2022). Functional foods and nutraceuticals: Bioactive compounds, formulation, and health benefits. Foods, 11(3), 375. https://doi.org/10.3390/foods11030375

Third Semester M.Sc. Food Science, Nutrition & Dietetics

Core Lab Course Content

(PH 814.3P) **Hospital Internship**

8 Hours/week

Credits:**4** Total hours: 96

Fourth Semester M.Sc. Food Science, Nutrition & Dietetics

Core Course Content

(PH 811.4) **Nutritional Biochemistry** **Total Hours:** 56

Credits : **4**

Course learning outcome:

CO1: Elucidate the biochemical pathways and regulatory mechanisms involved in the metabolism of macronutrients

CO2: Analyze thermodynamic principles and their relevance to the function of energy-rich compounds in biological systems.

CO3: Describe the structure, synthesis, and degradation of nucleotides, with a focus on purine and pyrimidine metabolism, as well as the processes involved in DNA replication

CO4: Examine the biosynthesis of hormones and articulate the connections between biochemical pathways and their impacts on health and disease.

UNIT I **15 Hours**

Nutritional biochemistry aspects of carbohydrates: Introduction to carbohydrate; Physiological functions; Metabolism of glucose, metabolic fate of pyruvate, kreb's cycle, metabolism of glycogen (glycogenolysis, glycogenesis), Glucuronic acid pathway of glucose; Hexose monophosphate shunt pathway; Gluconeogenesis; Metabolism of other carbohydrates: Fructose, Galactose, lactose, amino sugars, Glycoproteins; Bioenergetics: Energy producing and utilizing systems, thermodynamic relationships and energy-rich components, Biological Oxidation and Electron Transport Chain.

Unit II **14 Hours**

Nutritional biochemistry aspects of Amino acids and Nucleotides: Introduction to amino acids and protein; Synthesis and breakdown of essential amino acids (transamination and deamination). Structure of Nucleotides, synthesis and breakdown of Purine and Pyrimidines. Nucleic acids: Components, structure and level of organization, Physico-chemical properties, biological importance, DNA replication and enzymes in DNA replication.

Unit III **13 Hours**

Nutritional biochemistry aspects of Lipids: Introduction to lipids, Glycolipids; Prostaglandins;, synthesis and Beta-oxidation of fatty acids, stoichiometry in synthesis and breakdown of fatty acids, biosynthesis of cholesterol, phospholipids, triacylglycerol and compound lipids; Regulation of lipid metabolism by products of lipid metabolism: ketone bodies, ketogenesis and ketolysis.

Unit IV **14 Hours**

Nutritional biochemistry aspects of Enzymes and Hormones: Biochemical classification, nomenclature, general properties, mechanism of enzyme action. Coenzymes and cofactors in enzyme activity. Factors affecting enzyme activity, Enzyme inhibition, Isoenzymes, immobilized enzymes, clinical significance of enzyme assays. Hormones- General features and classifications, Biosynthesis and functions, mechanism of action

Recommended Books & References:

1. Sreemathy, V., & Dandekar, S. P. (2015). Nutrition and Biochemistry for Nurses-E-Book. Elsevier Health Sciences.
2. Yadav, M. (2007). Nutritional Biochemistry and Metabolism, Arise Publishers and Distributors.
3. Gibney, M.J., Lanham-New, S.A., Cassidy, A. and Vorster, H.H. (2009). Introduction to Human Nutrition, 2nd Edition. Wiley-Blackwell, A John Wiley and Sons, Ltd., Publication.
4. Gropper, S. S., & Smith, J. L. (2012). Advanced nutrition and human metabolism. Cengage Learning.
5. DM Vasudevan, Textbook of biochemistry for medical students, Jaypee Brothers Medical Publishers; 8th edition (2016).
6. Satyanarayana, U. (2013). Biochemistry. Elsevier Health Sciences.
7. Stipanuk, M.H., & Caudill, M.A. (2019). *Biochemical, Physiological, and Molecular Aspects of Human Nutrition* (4th ed.). Elsevier.
8. Murray, R.K., Granner, D.K., Mayes, P.A., & Rodwell, V.W. (2018). *Harper's Illustrated Biochemistry* (31st ed.). McGraw-Hill Education.
9. Malik, D., Narayanasamy, N., Pratyusha, V. A., Thakur, J., & Sinha, N. (2023). *Textbook of Nutritional Biochemistry*. Springer. https://doi.org/10.1007/978-981-19-4149-8

10. Berdanier, C. D., Dwyer, J. T., & Feldman, E. B. (Eds.). (2023). *Advanced Nutrition: Macronutrients, Micronutrients, and Metabolism*. CRC Press. https://doi.org/10.1201/9781003093664
11. Brody, T. (2021). *Nutritional Biochemistry* (3rd ed.). Academic Press. https://doi.org/10.1016/C2013-0-15456-2
12. Ferrier, D. R. (2021). *Lippincott Illustrated Reviews: Biochemistry* (8th ed.). Lippincott Williams & Wilkins.
13. Buchanan, B. B., Gruissem, W., & Jones, R. L. (Eds.). (2020). *Biochemistry and Molecular Biology of Plants* (2nd ed.). Wiley. https://doi.org/10.1002/9781119312994
14. Nelson, D. L., & Cox, M. M. (2021). *Principles of Biochemistry* (8th ed.). W.H. Freeman. https://doi.org/10.13112/9781319108243

Fourth Semester M.Sc. Food Science, Nutrition & Dietetics

Core Course Content

(PH 812.4) Public Health Nutrition

Credits: 4 **Total Hours: 56**

Course Outcomes:

On completion of this course, the students will be able to:

CO1: Analyze the relationship between health and nutrition and the role of public nutritionists in the healthcare system.

CO2: Evaluate the nutritional status of emergency-affected populations and design appropriate relief strategies.

CO3: Develop and assess food and nutrition security interventions following principles of various national and international food organizations.

CO4: Apply effective communication strategies to promote nutrition education and behavior change

UNIT -I **13 Hours**

Concept of public nutrition: Relationship between health and nutrition, role of public nutritionists in the healthcare delivery system. The link between nutrition and demographic changes, health and nutrition transitions, economic and public health implications of micronutrient deficiencies, and impact on productivity and national development. Indicators of health and nutrition - vital health status. Basic principles of low-cost menu planning. Corporate Social Responsibility (CSR).

UNIT -II **15 Hours**

Assessment and surveillance of nutritional status in emergency affected populations: Nutrition monitoring and surveillance. Scope for malnutrition assessment, indicators, and simple screening methods. Nutritional relief and rehabilitation: Assessment of food needs, food distribution strategy, targeting food aid, mass, and supplementary feeding, special foods/rations for nutritional relief, the organization for mass feeding/food distribution, transportation and storage, sanitation and hygiene, ethical consideration.

UNIT -III **13 Hours**

Approaches and strategies for improving nutritional status and health: Food and nutrition security – definition and concept, contributing factors and recent development in assessing food and nutrition security. Programmatic options – Merits and demerits. Intervention Programmes – Health-based interventions, Food based interventions including fortification and genetic improvement of foods, Role of international and national organizations in public health.

UNIT -IV **15 Hours**

Information Education Communication approaches to improve health and nutrition: Concepts and Scope. Models of communication; Communication Process; Approaches and Barriers to communication; Communication for Extension Education and Development, telemedicine: virtual nutritional counselling. Introduction to IEC Aims and Objectives, Importance of IEC and Relevance to programmes: Nutrition education for behaviour change, Rationale, Planning Execution, teaching aids, and evaluation of Intervention Programmes. Different Media, their characteristics and use- IEC for different target groups.

Recommended Books & References

1. Owen, A.Y. and Frackle, R.T., (2002): Nutrition in the Community. The Art of Delivering Services, 2nd Edition Times Mirror/Mosby.
2. Barth, M. M., Bell, R. A., & Grimmer, K. (Eds.). (2020). *Public Health Nutrition: Rural, Urban, and Global Community-based Practice*. Springer Publishing Company.
3. Archana, P and Ashwini, K., (2022): A Text Book of Public Health Nutrition. Iterative International Publisher IIP. ISBN 978-81-959356-4-2
4. Part, K. (2000): Part's Textbook of Preventive and Social Medicine, 18th Edition, M/s. Banarasidas Bhanot, Jablpur.
5. Goldsteen, R. L., Goldsteen, K., & Dwelle, T. (2024). Introduction to public health: promises and practices.
6. Beaton, G.H. and Bengoa, J.M. (Eds) (2000): Textbook of Human Nutrition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
7. Park JE & Park K., 2000. Nutrition in the Community. John Wiley & Sons
8. Shukla P.K. (1982). Text Book of preventive and social medicine. Barnasidas Bhanot Publ. SCN News, United Nations. System Forum on Nutrition. WHO.
9. Suryatapa Das (2016) Textbook of Community Nutrition. Publisher: Academic Publishers.
10. Nnakwe (2017) Community Nutrition. Publisher: Jones & Bartlett Learning.
11. Marie A. Boyle, David H. Holben (2012). Community Nutrition in Action: An Entrepreneurial Approach. Edition 6. Publisher: Cengage Learning.

12. Nweze Nnakwe (2012) Community Nutrition: Planning Health Promotion and Disease Prevention. Publisher: Jones & Bartlett Publishers.

Fourth Semester MSc. Food Science, Nutrition & Dietetics

Course Core Content

(PH 813.4) Sports Nutrition Total Hours: 56

Credits : 4

Course Outcomes:

On completion of this course the students will be able to:

CO1. Demonstrate a thorough understanding of sports nutrition principles and their application to athletic performance.

CO2. Analyze the role of macronutrients and micronutrients in supporting physical activity and enhancing performance.

CO3. Conduct comprehensive assessments of athletes' health, fitness, and dietary needs to optimize their performance.

CO4. Evaluate the effectiveness of meal plans, dietary strategies, and nutritional interventions in improving athlete health and performance.

UNIT I 12 hours

Introduction to Sports Nutrition: Definition; History; Role of international agencies in sports nutrition. Exercise Physiology and Metabolism: Definitions of terminologies (Work, Power, speed, strength, efficiency, etc.) Types of exercises (aerobic and anaerobic), limiting factors. Exercise intensity and duration. Adaptations to exercise: physiological and metabolic adaptations to training. Muscle hypertrophy and performance, Fatigue: types, overtraining, oxygen debt theory, EPOC.

UNIT II 12 hours

Assessment of health and fitness of athletes. Ideal body composition and nutrition for different sports (endurance sports, intermittent, strength & power, martial sports, adventure, swimming and yoga) and events (marathon, triathlon and ultrathon). Significance of physical fitness and nutrition in prevention and management of weight control regimes. Strategies for dealing with eating disorders in sports. Incorporation of functional foods in athletes' diets. Nutritional strategies for managing gastrointestinal issues in athletes.

UNIT III 16 hours

Sports specific Nutrition: effect of specific nutrients on work performance (amino acids, vitamins and minerals) and physical fitness. Nutrients that support physical activity, mobilization of fuel stores during exercise, carbohydrate loading and its importance. Fluid and electrolyte balance-fluid requirements, losses, heat stroke, fluid/electrolyte replacement Dietary supplements and

Ergogenic aids: Definitions, Use of different ergogenic aids and commercial supplements, Sports drinks, sports bars etc, doping

UNIT IV **16 hours**

Meal plan development and recipes for peak performance. Nutritional requirement based on condition: vegetarian, female athletes, veteran athletes and young athletes. Pre-game and post-game meals. Diets for persons with high energy requirements. Clinical sports nutrition: Diabetes mellitus, Cardiovascular Diseases, Endocrine disorders. Health issues in athletes - sports anemia, bone density, micronutrient deficiencies. Sports injury: Causes, types, recovery, and role of warm up and cool down. Rehabilitation: concepts, objectives and therapeutic modalities (heat and cold, soft tissue massage). Sports psychology and nutritional counseling, Mental health considerations for athletes.

Recommended Books and References

1. William D. McArdle (2020) Sports and Exercise Nutrition 5th Edition. Publisher: Wolters Kluwer.
2. William D. McArdle (2013) Exercise Physiology: Nutrition, Energy, and Human Performance, Publisher Wolters Kluwer Health.
3. Anita Bean (2013) The Complete Guide to Sports Nutrition Edition 7, Publisher: A&C Black.
4. Dan Benardot (2011) Advanced Sports Nutrition, Edition 2, Publisher: Human Kinetics.
5. Jose Antonio, Douglas Kalman, Jeffrey R. Stout, Mike Greenwood, Darryn S. Willoughby, G. Gregory Haff (Edtrs) (2009). Essentials of Sports Nutrition and Supplements. Publisher: Springer Science & Business Media.
6. Heather Hedrick Fink, Alan E. Mikesky (2017) Practical Applications in Sports Nutrition. Publisher: Jones & Bartlett Learning.
7. Muscle and Exercise Physiology (2018) Editor Jerzy A. Zoladz. Publisher: Academic Press.
8. Clinical Exercise Physiology: Application and Physiological Principles (2004) Editors: Linda M. LeMura, Serge P. Von Duvillard. Publisher: Lippincott Williams & Wilkins.
9. ACSM's Advanced Exercise Physiology (2006) Editor: Charles M. Tipton. Contributor: American College of Sports Medicine. Lippincott Williams & Wilkins.
10. Handbook of Sports Medicine and Science Sports Nutrition (2002) Editors: Ronald J., Louise M. Burke. Publisher: Blackwell Science Ltd.

11. SPORTS NUTRITION Enhancing Athletic Performance (2014) Editor: Bill I CampBell. Publisher: CRC Press,Taylor & Francis Group.
12. Sports nutrition (2014) Editor: Ronald J. Maughan. Publisher: John Wiley & Sons.
13. Nutrition for Sport and Exercise (2014). Marie Dunford, J. Andrew Doyle, Cengage Learning

Fourth Semester M.Sc. Food Science, Nutrition & Dietetics

Core Course Content

(PS 815.4) Food Safety and Quality Control 42 Hours

Credits :3

Course learning outcome:

On completion of this course, the students will be able to:

CO1: Define key concepts and principles of food safety and quality control.

CO2: Identify microbiological, chemical, and physical hazards in food production and processing.

CO3: Analyze and interpret hygiene, food safety regulations, and quality standards.

CO4: Apply quality control techniques to ensure food safety and quality.

Unit I 13 Hours

Concepts of Food safety and labelling - Definition, Food Hazards: Physical, Chemical and Microbial hazards. Importance of food safety in the food processing industry Current challenges in food safety. Nutritional and Ingredient labelling: Mandatory and optional nutrients; Nutritional descriptors and approved health claims; Product Identification: Traceability Systems. Food adulteration: nature of adulterants, methods of evaluation.

Unit II 13 Hours

Hygiene and Sanitation: Definition of Hygiene, Sanitation and their Importance in food industries. Food Hygiene Program: Training programs, hygiene verification. Water Quality in the Food Industry; Cleaning and Sanitation, FIFO (First in and First out), CIP (Clean in Place) and COP (Clean out of Place): Cleaning Agents, Sanitizing Agents, and Evaluation of Sanitation Efficacy. Sanitation Program: Sanitation Standard Operating Procedures (SSOPs). Pest Classification: Insects, Rodents, and Birds; Integrated Pest Management (IPM) and Control Measures. Organic Farming.

Unit III 16 Hours

Food Safety regulations and Quality management systems: National and International food quality regulations: BIS, FSSAI, ISO (9000; 14,000; 15,161, and 22,000) and EU. Codex Alimentarius Commission; Introduction to the legal system, WTO agreements: SPS and TBT

agreements.

Quality Control and Assurance: Objectives, Principles, Importance, and Functions. Statistical quality control in the food industry. HACCP, Total Quality Management (TQM); Good Agricultural Practices (GAP), Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP), and Good Laboratory Practices (GLP). Standard Operating Procedures (SOP), PFA laws related to food adulteration.

Recommended Books & References:

1. Early, R. (2005): Guide to Quality Management Systems for the Food Industry, Blackie, Academic and professional, London.
2. De Vries, J. (Ed.). (2021). *Food safety and toxicity*. CRC press.
3. Gould, W.A and Gould, R.W. (2006). Total Quality Assurance for the Food Industries, CTI Publications Inc. Baltimore.
4. Miller, D. D., & Yeung, C. K. (2022). *Food chemistry: A laboratory manual*. John Wiley & Sons.
5. Pomeraz, Y. and MeLoari, C.E. (2006): Food Analysis: Theory and Practice, CBS publishers and Distributor, New Delhi.
6. Bryan, F.L. (2000): Hazard Analysis Critical Control Point Evaluations a Guide to Identifying Hazards and Assessing Risks Associated with Food Preparation and Storage. World Health Organization, Geneva.
7. FSSAI, FSIS, EU and FAO website for updates
8. Ronald H. Schmidt, Gary E. Rodrick (2005) Food Safety Handbook, John Wiley & Sons Publisher (ISBN 047143227X, 9780471432272)
9. Rajesh, M., and George, J. (2005) "Food Safety Regulations, Concerns and Trade: The Developing Country Perspective", Macmillan.
10. Naomi, R., and Watson, D. (2007) "International Standards for Food Safety", Aspen Publication.
11. Newslow, D.L. (2007) "The ISO 9000 Quality System: Applications in Food and Technology", John Wiley & Sons.
12. Hubbard, Merton R. (2003) "Statistical Quality Control for the Food Industry", 3rd Edition, Springer,
13. Mortimore, S., & Wallace, C. (2013). HACCP: A Practical Approach (3rd ed.). Springer.
14. Lawley, R., Curtis, L., & Davis, J. (2012). The Food Safety Hazard Guidebook (2nd ed.). Royal Society of Chemistry.

Fourth Semester M.Sc. Food Science, Nutrition & Dietetics

Core Lab Course Content

(PH 814.4P) Nutritional Biochemistry and Food Safety

8 Hours/week

Credits:4 **Total hours: 96**

Course Outcomes

On completion of this practical the students will be able to:

CO1: Isolate casein from milk and analyze its significance in nutritional and biochemical contexts

CO2: Estimate free fatty acids and starch content in various samples, and understand their implications for lipid and carbohydrate metabolism

CO3: Gain proficiency in the application of advanced techniques and the analysis of results to detect food adulteration and assess the quality of various food products

CO4: Critically evaluate existing food safety standards and labeling practices through comprehensive market surveys, assessing their effectiveness in informing consumers and ensuring compliance.

List of Experiments

1. Isolation of casein from milk
2. Estimation of starch in plants
3. Quantitative estimation of creatinine
4. Estimation of DNA by Diphenylamine method
5. Isolation of genomic DNA by SDS method
6. Isolation of RNA
7. Identification of DNA by PCR method
8. Quantitative Analysis of Amino Acids Using Paper Chromatography
9. Extraction of Amylase and testing its activity
10. Estimation of Urea
11. Common food adulteration detection tests
12. Qualitative tests for adulteration of milk
13. Quantitative analysis of honey
14. Qualitative analysis of coffee powder
15. Qualitative tests to determine the quality of meat

16. Determination of peroxide value of oils
17. Determination of carotenoid values of palm oil
18. Determination of synthetic food colors
19. Market survey on food labeling of different food products
20. Case study Implementation of HACCP

Recommended Books & References

1. Miller, D. D., & Yeung, C. K. (2022). Food chemistry: A laboratory manual. John Wiley & Sons.
2. Wrolstad, R. E., Acree, T. E., Decker, E. A., Penner, M. H., Reid, D. S., Schwartz, S. J., ... & Sporns, P. (Eds.). (2005). Handbook of food analytical chemistry, volume 1: Water, proteins, enzymes, lipids, and carbohydrates. John Wiley & Sons.
3. Long, C. (1961). Biochemists' handbook. Biochemists' handbook.
4. Linder, M. C. (1991). Nutritional Biochemistry and Metabolism: With Clinical Applications (2nd ed.). Elsevier.
5. Work, T. S., & Work, E. (Eds.). (1969). Laboratory Techniques in Biochemistry and Molecular Biology. North-Holland Publishing Company.
6. Simpson, B. K. (Ed.). (2012). Food Biochemistry and Food Processing (2nd ed.). Wiley-Blackwell.
7. Luthra, A., & Varma, A. (2023). Estimation of starch content in plant samples using colorimetric methods: A comprehensive study. Journal of Plant Biochemistry and Biotechnology, 32(1), 1-11. https://doi.org/10.1007/s13562-022-00779-3
8. Kaur, G., & Bansal, N. (2023). Isolation and quantification of DNA using the diphenylamine method: A comparison with spectrophotometric techniques. Journal of Molecular Biology Research, 13(1), 12-20. https://doi.org/10.5539/jmbr.v13n1p12
9. Muhammad, N., Khan, A. U., & Ali, A. (2021). A simple and rapid method for the quantitative estimation of creatinine in serum using enzymatic assays. Clinical Biochemistry, 95, 14-18. https://doi.org/10.1016/j.clinbiochem.2021.06.009
10. Pomeranz, Y., & Meloan, C. E. (2014). Food Analysis: Theory and Practice.
11. Singhal, R. S., Kulkarni, P. R., & Rege, D. V. (2016). Handbook of Indices of Food Quality and Authenticity. Woodhead Publishing.
12. Bogdanov, S. (2017). Honey Composition. International Honey Commission
13. Nielsen, S. S. (2017). Food Analysis Laboratory Manual. Springer.
14. Fletcher, D. L. (2013). Poultry meat quality. Poultry Science.

15. Shahidi, F., & Zhong, Y. (2015). Lipid Oxidation and Improving the Oxidative Stability. CRC Press.
16. Rossell, J. B. (2016). Measurement of carotenoids in palm oil. In Edible Oil Processing
17. (pp. 217-240).
18. Downham, A., & Collins, P. (2015). Colouring our foods in the last and next millennium.
19. International Journal of Food Science & Technology.
20. Grunert, K. G., Wills, J. M., & Fernández-Celemín, L. (2016). Nutrition knowledge, and use and understanding of nutrition information on food labels among consumers in the UK. Appetite.
21. Mortimore, S., & Wallace, C. (2013). HACCP: A Practical Approach. Springer.
22. Philip,A.C. Reconceptualizing quality. New Age International Publishers,Banglore. 2001.
23. Bhatia,R. and Ichhpujan,R.L. Quality assurance in Microbiology. CBS Publishers and Distributors, New Delhi. 2004.
24. Kher, C.P. Quality control for the food industry. ITC Publishers, Geneva. 2000.
25. FSSAI manual of simple methods for testing of common adulterants in food. Food Safety and Standards Authority of India, Ministry of Health and Family Welfare Government of India New Delhi

Fourth Semester M.Sc. Food Science, Nutrition & Dietetics

Core Lab Course Content

(PH 817.4P) **Public Health Nutrition**

4 Hours/week

Credits:**3** Total hours: **48**

Course Outcomes

On completion of this practical students will be able to:

CO1: Demonstrate proficiency in various methods of assessing dietary adequacy of a population

CO2: Analyze the factors influencing the nutritional / diet adequacy of vulnerable groups

CO3: Critically evaluate the efficiency and effectiveness of nutrition education and the use of various nutrition education aids in alleviating nutritional status of population group

CO4: Use examples of case studies to create new guidelines and policies that aligns with existing principles given by national and international agencies, to combat nutritional inadequacy of a population

List of Experiments

25. Nutrition and diet survey of age group 1-5 years (comparison study between govt, and non-govt. school children)
26. Nutrition and diet survey of age group 6-12 years
27. Nutrition and diet survey of age group 13-18 years
28. Nutrition and diet survey of age group 19-65 years
29. Nutrition and diet survey of age group above 65 years
30. Nutrition education through virtual mode
    a) Instagram
    b) Youtube
    c) Webinar
    d) Radio
31. Nutritional Education Programme - Guest Talk
32. Nutritional awareness extension program
33. Case study – Nutritional status (base on Socio economic status)

Recommended Books and References

9. Raghuramulu, N., Nair, K. M., & Kalyanasundaram, S. (Eds.). (1983). A manual of laboratory techniques. National Institute of Nutrition, Indian Council of Medical Research.
10. Miller, D. D., & Yeung, C. K. (2022). *Food chemistry: A laboratory manual*. John Wiley & Sons.
11. Horwitz, W., & Latimer, G. W. (2000). Association of official analytical chemists. (2010). *Official methods of analysis of AOAC international*.
12. Wrolstad, R. E., Acree, T. E., Decker, E. A., Penner, M. H., Reid, D. S., Schwartz, S. J., ... & Sporns, P. (Eds.). (2005). *Handbook of food analytical chemistry, volume 1: Water, proteins, enzymes, lipids, and carbohydrates*. John Wiley & Sons.
13. Long, C. (1961). Biochemists' handbook. Biochemists' handbook.
14. Kirby, D. F., & Dudrick, S. J. (1994). Practical handbook of nutrition in clinical practice (Vol. 4). CRC Press.
15. More, J. (2021). Infant, child and adolescent nutrition: A practical handbook. CRC Press.
16. Sauberlich, H. E. (2018). Laboratory tests for the assessment of nutritional status. Routledge.

EVALUATION – POSTGRADUATE PROGRAMMES

CREDITS	FORMATIVE ASSESSMENT 40					SUMMATIVE ASSESSMENT 60
	Internals (2 Internals)	Assignment	Seminar	Quiz	Class Participation	End Semester Exam
5 Credits/ 4 Credits/ 3 Credits (Theory)	50 + 50 =100	5	5	5	5	60
Assigned	20	20				
Apportioned to	40					

CREDITS	Internal Assessment	External Assessment	
		Viva voce – External	Evaluation Test
Field work (5 Credits)	40	30	30
Assigned	40	60	

CREDITS	FORMATIVE ASSESSMENT				SUMMATIVE ASSESSMENT
	Internal (I & II)	Record Keeping	Continuous Assessment	Attendance	Practicals
2 Credits (Practical)	25	10	12	3	30
Assigned	25	25			
Apportioned to	20				30
3 Credits/ 4 Credits (Practical)	Lab Test (I & II)	Internals (I & II)	Attendance	Assignment/Class test	Practicals
Assigned	10	20	5	5	60
Apportioned to	40				

ASSESSMENT CRITERIA

Theory: 60:40; Practicum: 50:50

1. **Ratio of weightage (marks) between Internal & End Semester Examinations for**

   THEORY: 60:40

   THEORY INTERNAL COMPONENT: 30

   - Two internal tests: **50×2=100 converted to 20**
   - Assignment: **05**
   - Quiz/ surprise test / MCQs: **05**
   - Seminar: **05**
   - Class participation: 05
   - Total = **40**

2. Practicum component marks: 40

The internal component of practicum:50

Internal:

- Continuous Assessment of all practical experiments: **20**
- Model practical Test: **40 converted to 20**
- Maintenance of Records: **05**
- Viva: 05

End semester Practicum: 60

Theory End Semester Examination Question Paper Pattern. Time 3 hours

End Semester Theory Examinations will be common for all science departments.

The duration of the examination is **3** hours carrying **60 marks.**

The question paper is divided into **Part–A, Part – B, and Part C.**

Part –A -Objective type carrying from each unit - **15** marks.

Part-B -Analytical questions carrying from each unit - **25**marks

Part –C- Descriptive answer for **20** marks.

Question Paper Pattern Sample

I. Section-A –Any 5 out of 8 3 x 5=15 marks.

Q. 1, 2, 3, 4, 5, 6, 7, 8,

II. Section-B -Answer any 5 out of 8 5 x 5=25 marks

Q. 1, 2, 3, 4, 5, 6, 7, 8

III. Section-C -Answer any 2 out of 4 10 X 2 =20 marks

Q. 1, 2, 3, 4

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Paper Code	Reg. No.:							

St Aloysius (Deemed to be University)

Mangaluru 575003-India

End Semester Exam – Month Year

M.Sc. - Semester – III

Paper – I

Paper Title

Time: 3 hrs.	**Max Marks: 60**

Instructions: Draw Diagrams wherever necessary.

Answer all three sections- A, B, and C.

SECTION–A

I	**Define/Answer any TEN of the following:**	**(3x5=15)**
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
II	**Answer <u>any FIVE</u> of the following**	**(5x5=25)**
9.		
10.		
11.		
12.		
13.		

14.		
15.		
16.		
	SECTION – C	
III	**Answer <u>any TWO</u> of the following**	**(10x2=20)**
17.		
18.		
19.		
20.		
	**********	

Paper Code	Reg. No.:							

St Aloysius (Deemed to be University)

Mangaluru 575003-India

Internal Exam – Month Year

M.Sc. - Semester – III

Paper – I

Paper Title

Time: 3 hrs.	**Max Marks: 60**

Instructions: Draw Diagrams wherever necessary.

Answer all three sections- A, B, and C.

SECTION–A

I	**Define/Answer any FIVE of the following:**	**(3x5=15)**
1.		
2.		
3.		
4.		
5.		
6.		
7.		
II	**Answer <u>any FOUR</u> of the following**	**(5x4=20)**
9.		
10.		
11.		
12.		
13.		
14.		

	SECTION – C	
III	**Answer <u>any ONE</u> of the following**	**(15x1=15)**
17.		
18.		
19.		
	**********	