Learning Outcome-based Curriculum Framework for M.Sc. Nutrition Biology

New Education Policy-2020

CHOICE BASED CREDIT SYSTEM COURSE (CBCS- 2021 COURSE)

Department of Nutrition Biology
School of Interdisciplinary and Applied Sciences
Central University of Haryana
Mahenderagrh, Haryana

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Background

The Department of Nutrition Biology has been commenced in the year 2015 under the umbrella of School of Interdisciplinary and Applied Life Sciences with the aim to impart high quality education to the students in the field of Nutrition Biology. The thrust area of research includes assessment of nutritional status of different vulnerable groups, management of nutritional deficiency diseases, nutrition counselling, nutrition in special conditions, nutrient evaluation, development of functional food products and their nutrient estimation, chemical and biochemical assessment of various deficiency disorders, biosafety assessment of fermented foods and nutrigenomics. The department has trained and experienced faculty having diverse background of Nutrition Biology. The Department got externally funded research project from SERB/DST (Govt. of India), New Delhi. The department is also involved in extension activities in the adopted villages of CUH for the development of the community/society/nation by imparting nutrition education with the involvement of students. To enhance the knowledge of the students, department is covering all aspects of nutritional science. The department is offering courses on fundamentals of food and nutrition science, therapeutic nutrition, nutritional biochemistry, human physiology, food microbiology, food biotechnology, bioinformatics, human nutritional requirements, nutrition in metabolic disorders and many more. By considering NEP, 2020 department has also offered skill enhancement courses for better understanding of the students. The structure of scheme has been given in detail also. To ensure the implementation of curricular reforms envisioned in NEP-2020, the University has decided to implement various provisions in a phased manner. Accordingly, the curriculum may be reviewed annually.

Program Objectives:

- To become a landmark institute for qualitative nutritional studies, covering but not limited to study of various foods and food components on human body.
- To build empowered individuals who can be catalysts to change in dietary habits of various age groups.
- To reach out to communities in general and vulnerable groups in particular, educating, monitoring and correcting the food habits to lead a healthy life.

Programme Outcomes (POs)

- **Basic and applied knowledge:** Interdisciplinary knowledge to find solution for the complex biological problems
- **Problem analysis:** Ability to analyse society related/ applied research problem, design and execute experiments to find relevant solutions
- **Advanced Usage of Technology**: Apply advanced instrumentation tools, online resources with an understanding of the troubleshooting and limitations
- **Ethics:** Commitment towards professional ethics and responsibilities as a social endeavour to bring harmony with nature
- **Lifelong learning:** Scientific skills for industrial applications and entrepreneurship

Programme Specific Outcomes (PSOs)

- **PSO-1**: Development of an understanding between food, nutrition, health and diseases
- **PSO-2**: Development of critical thinking of role of macro and micro nutrients in diet
- **PSO-3**: Development of an understanding of role of nutrients in terms of metabolism as well as nutrient-gene interaction
- **PSO-4:** Development of an understanding of food spoilage and safety
- **PSO-5:** Development of critical thinking for meal planning and role of diet therapy in management of diseases
- **PSO-6:** Development of an understanding of physiological mechanisms of the human body and Patho-physiological processes of diseases and its management
- **PSO-7:** Development of an understanding of food laws, national healthcare delivery system, national and international agencies in the management of diseases
- **PSO-8:** Development of an understanding to assess and manage nutritional deficiency diseases at individual and community level

Postgraduate Attributes

On completion of the post graduate programme in Nutrition Biology, students are expected to equip with the skills of creative, critical and rational thinking associated with Nutrition and its use for human society. The following attributes are expected from the students of M.Sc. Nutrition Biology:

- Disciplinary Knowledge: Be able to demonstrate advanced knowledge and skills in the interdisciplinary field of Nutrition Biology

- Creative and Critical Thinking: Ability to critically think, analyse, evaluate and create new skills in the chosen discipline and across other field.
- Scientific Knowledge: Apply the knowledge of Food Science and nutrition to solve the complex problems for promotion of health, to increase the nutritional status of individual and community.

- Problem Solving: Develop an understanding of problem solving and research methodologies and demonstrate personal accountability by applying solutions to diverse challenges facing food production, supply, food and nutritional security.
- Communication Skills: Ability to participate in public discourse on varied themes and topics.
- Research Skills: Ability to design and carry out independent research, to update oneself with advance research trends and contemporary inputs in the discipline of food science, and to evaluate research contributions.
- Life Skills: Develop the cognitive, technical and creative skills necessary to support understanding of recent innovations in food science
- Modern tool usage: Create, select and apply appropriate techniques, resources, and modern technology and IT tools to complex food science and technological activities.
- Life-long Learning: Ability to learn and relearn knowledge and skills in the emerging area of Nutrition and Food science.

Structure of master Course

Department of Nutrition Biology
Master of Science in Nutrition Biology (Semester-wise Scheme 2021-2022)

Semester-I (Total credits - 25)

Course code	Course title	L	T	P	Type of course	Credit
SIAS NB 1 1 01 C 4004	Fundamentals of Food and Nutrition Science	4	0	0	Core	4
SIAS NB 1 1 02 C 4004	Nutritional Biochemistry-I	4	0	0	Core	4
SIAS NB 1 1 03 C 4004	Human Nutritional Requirements	4	0	0	Core	4
SIAS NB 1 1 04 C 4004	Human Physiology	4	0	0	Core	4
SIAS NB 1 1 05 C 4004	Practical-I	0	0	10	Core	5
	Generic Elective Course (to be opted from another Department)	4	0	0	GEC	4

Semester-II (Total credits - 25)

Course code	Course title	L	T	P	Type of course	Credit
SIAS NB 1 2 06 C 4004	Nutritional Biochemistry-II	4	0	0	Core	4
SIAS NB 1 2 07 C 4004	Functional Foods and Nutraceuticals	4	0	0	Core	4
SIAS NB 1 2 08 C 4004	Food Microbiology and Food Safety	4	0	0	Core	4
SIAS NB 1 2 09 C 4004	Therapeutic Nutrition	4	0	0	Core	4
SIAS NB 1 2 10 C 4004	Practical-II	0	0	10	Core	5
SIAS NB 1 2 01 DCEC 4004	Nutritional Toxicology*	4	0	0	DCEC	4
SIAS NB 1 2 02 DCEC 4004	Public Health Nutrition*	4	0	0	DCEC	4

* One of the courses will be opted by student.

Semester-III (Total credits - 26)

Course code	Course title	L	T	P	Type of Course	Credit
SIAS NB 1 3 11 C 4004	Nutrient Deficiencies and Assessment	4	0	0	Core	4
SIAS NB 1 3 12 C 4004	Nutrition in Metabolic Disorders	4	0	0	Core	4
SIAS NB 1 3 13 C 4004	Bioinformatics and Nutrigenomics	4	0	0	Core	4
SIAS NB 1 3 14 C 4004	Practical-III	0	0	8	Core	4
SIAS NB 1 3 145C 0202	Seminar	0	2	0	Core	2
SIAS NB 1 3 03 DCEC 4004	Nutrition and Immunity*	4	0	0	DCEC	4
SIAS NB 1 3 04 DCEC 4004	Food and Nutritional Biotechnology*	4	0	0	DCEC	4
SIAS NB 1 3 05 DCEC 4004	Sports Nutrition*	4	0	0	DCEC	4
	Generic Elective Course (to be opted from another Department)	4	0	0	GEC	4

*One of the courses will be opted by student**.**

Semester-IV (Total credits - 24)

Skill Enhancement Course

Course code	Course title	Type of course	Credit
SIAS NB 1 4 01 SEEC 0024	Dissertation	Core	24
	Total credits of the Program		**100**

L- Lecture; T- Tutorial P-Practical; C- Core course; DCEC - Discipline Centric Elective Course –opted by the student; SEEC- Skill Enhancement Elective Course; GEC- Generic Elective Course

Note: 40% of the courses of Nutrition Biology in each semester will be offered through online mode.

Credit Summary of Courses Offered by Department of Nutrition Biology

(Academic Session 2021-22)

Total Credits: 100

Semester	Credits				Total credits
	Core courses	Skill enhancement course	Elective courses		
			DCEC (For Department of Nutrition Biology students)	GEC (For other Department students)	
I	21	-	-	4	**25**
II	21	-	4	-	**25**
III	18	-	4	4	**26**
IV	-	24	-	-	**24**
Total	**60**	**24**	**8**	**8**	**100**

Generic Elective Course: Offered by Department of Nutrition Biology to students from other Departments of University.

Semester	Type of course	Course code	Course title	Credit
I	GEC	SIAS NB 1 1 01 GEC 4004	Hospital Food Service Administration	4
		SIAS NB 1 1 02 GEC 4004	Community Nutrition	
III	GEC	SIAS NB 1 3 03 GEC 4004	Work Physiology, Physical Fitness and Health	4
		SIAS NB 1 3 04 GEC 4004	Nutritional Counselling	

Learning Outcome Index

Learning Outcome Index for Core Courses

PSO	CC1	CC-2	CC-3	CC-4	CC-5	CC-6	CC-7	CC-8	CC-9	CC-10	CC-11
PSO-1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X
PSO-2	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓
PSO-3	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓
PSO-4	✓	X	✓	X	✓	X	✓	✓	✓	✓	✓
PSO-5	✓	✓	X	✓	✓	X	X	✓	✓	✓	X
PSO-6	✓	✓	X	✓	✓	X	X	✓	✓	✓	X
PSO-7	✓	X	✓	X	X	X	X	✓	✓	X	X
PSO-8	X	X	✓	✓	X	✓	✓	✓	✓	✓	X

(✓) Indicates meeting the PSOs
(X) indicates not meeting the PSOs

Learning Outcome Index for GEC

PSO	GEC-1	GEC-2	GEC-3	GEC-4
PSO-1	✓	✓	✓	✓
PSO-2	✓	✓	✓	✓
PSO-3	✓	✓	✓	✓
PSO-4	✓	✓	✓	✓
PSO-5	✓	✓	X	✓
PSO-6	✓	✓	X	✓
PSO-7	✓	✓	X	✓
PSO-8	✓	✓	✓	✓

(✓) Indicates meeting the PSOs
(X) indicates not meeting the PSOs

Learning Outcome Index for DCEC

PSO	DCEC-1	DCEC-2	DCEC-3	DCEC-4	DCEC-5
PSO-1	✓	✓	✓	✓	✓
PSO-2	X	✓	✓	✓	✓
PSO-3	X	✓	✓	✓	✓
PSO-4	✓	✓	X	✓	✓
PSO-5	X	✓	✓	X	✓
PSO-6	X	✓	✓	X	✓
PSO-7	✓	✓	X	X	✓
PSO-8	X	✓	✓	X	✓

(✓) Indicates meeting the PSOs
(X) indicates not meeting the PSOs

Semester-wise Courses and Credit Distribution

SEMESTER-I

Course title: Fundamentals of Food and Nutrition Science **Credit: 4**
Course code: SIAS NB 1 1 01 C 4004 **Lectures: 60**

Course objectives: This course will enable the student to learn about various food groups, balanced diet, digestion, absorption and function of various nutrients and their sources.

Learning outcomes:

- Understand about energy expenditure
- Critical analysis of meal planning
- Understand the relationship between food, nutrition and health

UNIT I

Basic terminologies related to food and nutrition, reference man, reference woman, food groups, functions of food-physiological, psychological and social, balanced diet, food pyramid, dietary guidelines for Indians, healthy eating habits, nutrient losses during cooking and processing, methods of conserving nutrients and enhancing nutritive value of foods, relationship between food, nutrition, health and disease.

UNIT II

Classification, functions, dietary sources, RDA, clinical manifestations of deficiency and excess and digestion and absorption of the following in brief: Energy, Carbohydrates, lipids and proteins, Fat soluble vitamins, Water soluble vitamins, Minerals.

UNIT III

Energy- definition, BMR, Factors affecting BMR, energy value of foods, energy requirement, energy expenditure, measurement of energy expenditure. Methods of nutritional assessment, nutritional labelling in India. Major nutritional deficiency diseases in India and programmes for combating nutritional deficiency diseases.

UNIT IV

Meal planning, factors affecting meal planning, concept of exchange food list, understanding specific considerations for planning meal for different groups of people. Methods of cooking: Dry, moist, frying and microwave cooking, advantages, disadvantages and the effect of various methods of cooking on foods.

Recommended Readings:

1. Bamji MS, Krishnaswamy K, Brahmam GNV (2009). Textbook of Human Nutrition, 3rd Edition. Oxford and IBH Publishing Co. Pvt. Ltd.
2. Srilakshmi (2007). Food Science, 4th Edition. New Age International Ltd.
3. Srilakshmi (2005), Dietetics, Revised 5th edition. New Age International Ltd.
4. Wardlaw MG, Paul M Insel Mosby (1996). Perspectives in Nutrition, Third Edition.
5. Codex Guidelines on Nutrition Labelling (CAC/GL 2_1985) (Rev.1_1993). Rome, Food and Agriculture Organisation of the United Nations / World Health Organisation, 1993.
6. Food Safety and Standards Authority of India portal, Government of India
7. Gopalan, C (1990). NIN, ICMR. Nutritive Value of Indian Foods.
8. Seth V, Singh K (2005). Diet planning through the Life Cycle: Part 1. Normal Nutrition. A Practical Manual, Fourth edition, Elite Publishing House Pvt Ltd.

Course title: Nutritional Biochemistry-I **Credit: 4**
Course code: SIAS NB 1 1 02 C 4004 **Lectures: 60**

Course objectives: To understand the basic of enzymes, carbohydrates, lipids and amino acid metabolism

Learning outcomes:

- Having coherent and systematic knowledge on carbohydrate, lipid and amino acid metabolism.
- Understanding the mechanism adopted by the human body for regulation of metabolic pathways.
- Understand the properties and role of macronutrients.

UNIT I

Energy value of foods, measurement of energy content of food. Thermogenesis, energy utilization by cells, Energy balance - BMR, physical activity, Mechanism of control- hunger, appetite, Mechanism of action of enzymes and co-enzymes involved in biological oxidation and reduction, enzyme inhibition, Respiratory chain, Role and mechanism of phosphorylation in biologic oxidation and energy capture

UNIT II

Carbohydrates: Basic Structures and Nomenclature, Sources, functions , properties, Reducing Sugars – Chemical and Biochemical Significance. Digestion and absorption. Glycolysis, Glycogenolysis, Gluconeogenesis, TCA cycle, HMP shunt, bioenergetics, Hormonal Regulation of Carbohydrate Metabolism, Diabetes

UNIT III

Lipids : Structure and functions, Classification and properties of lipids, essential fatty acids Digestion and absorption, utilization and storage, Effects of deficiency and excess of fat
Fatty acid oxidation and biosynthesis Cholesterol: Properties, Biosynthesis, Functions, Lipoproteins Structure, Properties and their significance.

UNIT IV

Amino acids and Proteins: Types and structure of amino acids, properties, nutritional classification of amino acids, Amino acid balance, imbalance and toxicity, amino acid pool.
Protein – Introduction to general properties, structure, sources, functions, digestion, absorption, utilization and storage, denaturation, protein quality evaluation. Nitrogen metabolism, urea cycle Inter Relationship Between Carbohydrate, Fat and Protein

Recommended Readings:

1. Nelson DL and Cox MM (2005) Lehninger Principles of Biochemistry, W.H. Freeman & Com.
2. Victor W Rodwell (2015)Harpers Illustrated Biochemistry 30th Edition. Lange.
3. Devlin DT (2010)Text book of Biochemistry with Clinical Correlations. 7th edition. New York, John Wiley and Sons.

Course title: Human Nutritional Requirements **Credit: 4**
Course code: SIAS NB 1 1 03 C 4004 **Lectures: 60**

Course objectives: The aim of this course is to provide knowledge on fundamental concepts nutritional requirements for different age groups.

Learning outcomes:

- Comprehensive knowledge about nutritional considerations changes with age and physiological group.
- Understanding of body composition changes through the lifecycle.
- Understanding the ways for improving nutritional quality of diets.

Unit -I

Historical perspective of nutrient requirements and definitions (recommended nutrient intakes, minimum requirements, subsistence requirements, dietary reference intakes, optimum nutrient intake), recommended dietary allowances of macronutrients for all age groups, food pyramid, dietary guidelines for Indians, dietary guidelines for physical activity (national and international).

Unit-II

Aspects of growth- cellular to physical, determinants of growth and development in children, impact of altered nutrition on growth and development of children, maternal malnutrition and pregnancy outcome, malnutrition and cognitive development, body composition changes through the lifecycle and its consequences.

Unit-III

Physiological changes and altered nutritional requirements in: Extreme temperatures - low and high, high altitude, space nutrition and food systems and sports nutrition. Nutrition during infancy, childhood, adulthood and old age

Unit-IV

Ongoing nutrition transition and its implications, ways of improving nutritional quality of diets, assessment of protein quality, dietary diversification, bioavailability of nutrients, nutrient losses during cooking and processing, emerging concepts in human nutrition-nutrigenomics, nutraceuticals, functional foods and bioactive compounds.

Suggested readings:

1. Chadha R and Mathur P. (2015) Nutrition: A Lifecycle Approach. 1st Edition., Orient Blackswan, New Delhi.
2. Narasinga Rao BS, Sivakumar B (2010) Nutrient Requirements & Recommended Dietary Allowances for Indians. 2nd Edition. ICMR, National Institute of Nutrition, Hyderabad., ASIN: B06XKXGF58
3. Bamji MS, Rao NP, Reddy V (2009) Textbook of Human Nutrition. 3rd Edition. Eds Oxford and IBH publishing Co Pvt Ltd New Delhi, ISBN:81-204-1109-9
4. Nutrition in Developmental Transition. (2006)., NFI, NFI-WHO (SEARO) Symposium.
5. Kathleen Mahan L, MS, RD, CDE and Janice L Raymond, MS, RD, C (2017) Krause's Food and Nutrition care process. 14th DSt. Louis, Missouri: Elsevier, USA., ISBN:9780323340755

Course title: Human Physiology **Credit: 4**
Course code: SIAS NB 1 1 04 C 4004 **Lectures: 60**

Course objectives: To introduce the physiological concepts of homeostasis and control mechanisms and to study the functions of body systems with emphasis on clinical relevance.

Learning outcomes:

- Understanding of all aspects of general and systemic physiology.
- Understanding of physiological mechanisms of the human body and Patho-physiological processes of diseases.

Unit-I

Cell as the living unit of the body, Homeostasis and Control systems, Transport across cell membranes, Functional systems in the cells, Hematology**,** Erythropoiesis, Destruction and fate of RBCs, Classification and functions of each type of WBC, Blood Groups, blood disorders-Anemias, Polycythemias, Leucopenia, Leukemias, Thalassemia.

Unit-II

Body fluid compartments, water balance-regulation of fluid balance, Urine formation, Regulation of extra cellular sodium and osmolarity, Renal mechanisms for the control of blood volume, blood pressure and ionic composition and regulation of acid-base balance, Micturition, Diuretics, Renal failure and Kidney function tests.

Unit-III

Properties of cardiac muscle and specialized tissues, Cardiac cycle, Cardiac output, Blood pressure (factors & regulation), Cardiac failure, Atherosclerosis, Ischemia, Myocardial Infarction, Hypertension, Gastro-intestinal Physiology, General principles of GI function, Digestion and absorption, Pathophysiology of peptic ulcer and diarrheal disease.

Unit-IV

Classification of hormones and mechanism of hormone action, Endocrine function of the hypothalamus, Pituitary, Thyroid, Adrenals, Endocrine pancreas, Pathophysiology of diabetes, Male and female sex hormones, Hyper and hypogonadism.

Suggested readings:

1. Fox and Stuart Ira (2016) Human Physiology, 14th edition New York, NY, Mcgraw Hill.

2. John E. Hall, Guyton and Hall (2015) Textbook of Medical Physiology (Guyton Physiology), 13th edition, Saunders.

3. Gerad J, Tortora and Sandra R (2003) Grabowski. Principles of Anatomy and Physiology, control systems of human body, 10th edition, Wiley and Sons.

4. Anne Waugh and Allison Grant, Ross and Wilson (2018) Anatomy and Physiology, 13th edition, Elsevier.

5. Cole, Peter and R Kramer (2017) Human Physiology, Biochemistry and Basic Medicine by Laurence A. Academic Press, Elsevier ISBN 978-0-12-803689-0

SEMESTER – I

Course Title: Practical-I **Credit: 5**
Course Code: SIAS NB 1 1 05 C 4004 **Lecture: 150**

1. Preparation of standard solutions.
2. Qualitative analysis - Reaction of pentoses, hexoses, dextrin, starch, glycogen.
3. Determination of moisture and ash content in a food sample
4. Estimation of fat and fibre in a food sample
5. Estimation of Total protein
6. Estimation of carbohydrates in a food sample
7. Estimation of antinutrients in a food sample
8. Estimation of Creatinine in urine
9. Estimation of Blood glucose
10. Measurement of energy value of foods by using Bomb calorimeter
11. Identification of food sources which are rich in Energy, Proteins, Fat, Calcium, Iron, Vitamin A, Thiamine, Riboflavin, Niacin, Vitamin C.
12. Development of food exchange list
13. Planning of diet for all vulnerable group of the society
14. Assessment of protein quality of dishes and meals by NDpCal%
15. Familiarisation with the working of instruments used in analytical work

Recommended Reading:

1. FAO/WHO/UNU. (2004) Human Energy Requirements. Report of a Joint Expert Consultation.
2. Gopalan C et al (1990). Nutritive Value of Indian Foods. National Institute of Nutrition, Hyderabad.
3. WHO (2007). Protein and Amino acid Requirements in Human Nutrition. Report of a joint WHO/FAO/UNU expert consultation. WHO Technical Report Series 935.
4. ICMR. (2010) Nutrient Requirements and Recommended Dietary Allowances for Indians. National Institute of Nutrition, Hyderabad.
5. Raghuramulu N, Nair M.K. and Kalyansundaram S (eds) (2003). A manual of laboratory techniques. 2nd edition. National Institute of Nutrition, ICMR.
6. Sundararaj P and Siddhu A. (2002) Qualitative Tests and Quantitative Procedures in Biochemistry : A Practical Manual. Phoenix Publishers, Revised Edition.
7. Ranganna S. 2007. Handbook of analysis and quality control for fruits and vegetables products. 3rdedition. Tata Mcgraw – Hills: 25-45

SEMESTER-II

Course title: Nutritional Biochemistry- II **Credit: 4**
Course code: SIAS NB 1 2 06 C 4004
Lectures: 60

Course objectives: To learn about physiological role of electrolytes, vitamins, minerals and hormones in the body

Learning outcomes:
1. Understanding of systematic knowledge on electrolyte, vitamins, minerals and hormones
2. Understanding the mechanism adopted by the human body for regulation of metabolic pathways. 3. Understand the physiological role of micronutrients.

UNIT I

Electrolytes : Electrolyte content of fluid compartments, Functions of electrolyte- Sodium, Potassium and Chloride, Absorption, Transport and balance, Factors affective electrolyte balance and hydrogen ion balance.

UNIT II

Vitamins : Vitamins A,D,E, K, Thiamine, Riboflavin, Niacin, Folic acid, Pyridoxine, Cyanocobalamin, Pantothenic acid, Biotin, Ascorbic acid– Chemistry, Functions, Physiological action, Digestion, Absorption, Utilization, Transport, Storage, Excretion, Sources, Deficiency, Diagnosis of deficiency

UNIT III

Minerals : Calcium, phosphorus, iron, iodine, fluoride, zinc, selenium, manganese, chromium- Distribution in the body, Physiological Functions, Digestion, Absorption, Utilization, Transport, Excretion, Factors affecting absorption, Balance, Deficiency, Toxicity, Sources, Regulation of serum calcium concentration, Calcium: Phosphorus ratio

UNIT IV

Hormones : Overview of endocrine glands, hormones as chemical messengers, stimulus for hormone release: change in homeostasis , sensory stimulus and others. Structures, Receptor type, Regulation of biosynthesis and release (including feed back mechanism). Physiological and Biochemical actions

Recommended Reading:

1. Nelson, D.L. and Cox, M.M.(2005). Lehninger Principles of Biochemistry, W.H. Freeman & Com
2. Victor W. Rodwell. (2015)Harpers Illustrated Biochemistry 30th Edition. Lange.
3. Devlin D.T. (2010)Text book of Biochemistry with Clinical Correlations. 7th edition. New York, John Wiley and Sons.
4. Plummer D.T. (1997). An Introduction to Practical Biochemistry. New Delhi, Tata McGraw Hill Publishing Company.
5. Widmaier, E.P.,Raff, H. and Strang, K.T.(2008).Vander,Sherman,Luciano's Human Physiology, McGraw- Hill Higher Education.
6. Darnell, J.,Lodish, H. and Baltimore, D.(2008). Molecular Cell Biology, Scientific American Books.
7. Eccles R. (1993). Electrolytes , Body fluids and Acid Base balance, London, Edward Arnold - A division of Hodder and Stoughton

Course title: Functional Foods and Nutraceuticals **Credit: 4**
Course code: SIAS NB 1 2 07 C 4004 **Lectures: 60**

Course objective: To provide enormous knowledge on role of nutraceutical and functional foods in human diet. The course will also provide an understanding of recent advancements in formulation and processing of functional foods.

Learning outcomes:

- Understanding fundamental concepts and knowledge related to functional foods
- Critically evaluation of the mechanism of action and health benefits of different types of nutraceuticals
- Understanding national and international regulations regarding nutraceuticals

Unit-I

Definition and examples of nutraceuticals, functional foods, dietary supplements, fortified foods (scope and relevance), Classification of nutraceuticals, according to source of origin: phyto-nutraceuticals, animal origin, microbial, algal, Nutrient andnon-nutrient, Probiotic, prebiotic and synbiotic. Extraction and isolation of nutraceuticals, Perspective for food applications.

Unit-II

Recent advancements in formulation and processing of functional foods, Nanotechnology and functional food. Cellular and molecular mechanisms of action of different types of nutraceuticals relative to their Bioavailability and bio-accessibility, Absorption, disposition, metabolism and elimination of nutraceuticals, Functional foods and nutraceuticals for chronic disease prevention, Adverse effects and toxicity, Gut microbiota, metagenomics.

Unit-III

Probiotics: Important features of probiotic micro-organisms, Conventional and non-conventional probiotics; Designer probiotics; Health effects including mechanism of action, use in various foods: fermented milk products, non-milk products etc., Prebiotics: Meaning, Chemical Nature, sources & mechanism of production, metabolism, Importance of Prebiotics in Functional Foods, effects on human health and potential applications in risk reduction of diseases, Perspective for food applications for the following: Non-digestible CHO/Oligosaccharides: Dietary fibre (soluble and insoluble), resistant starch (types and functions),gums; role of short-chain fatty acids; Bio-active proteins and peptides; omega fatty acids in health, Synbiotics: Important features of synbiotics, Health effects including mechanism of action, use in various foods, effects on human health and potential applications in risk reduction of diseases, Perspective for food applications.

UNIT-IV

Important regulatory authorities/bodies and Regulations on functional foods/nutraceuticals: FAO, EFSA and FSSAI; Indian regulations for nutraceuticals/functionalfoods, Quality assurance of probiotics and safety, ICMR Guidelines on Probiotics, Consumer acceptance –issues for the future. Regulatory compliance, health claims and labelling

Suggested readings:

1. Rotimi EA (2012) Functional foods and Nutraceuticals. 1st Edition, Springer Publications.
2. Day RL, Harper AJ, Woods RM, Davies OG and Heaney LM (2019) Probiotics: current landscape and future horizons. Future Sci OA. May 3,5 (4):FSO391. doi: 10.4155/fsoa-2019-0004. Review.
3. Sarao LK and Arora M (2017) Probiotics, prebiotics, and microencapsulation: A review.

Crit Rev Food Sci Nutr. Jan 22;57 (2):344-371.

4. Ghosh D, Das S, Bagchi D, Smarta RB (2016) Innovation in Healthy and Functional Foods (2016) 1st edition, CRC Press, London, DOI https://doi.org/10.1201/b13022.
5. Galankis C (2017) Nutraceuticals and Functional Food Components , 1st edition, Academic press.
6. Debsis Bagchi, Francis Lau, Manashi Bagchi (2010) Genomics, Proteomics, and Metabolomics in Nutraceuticals and Functional Foods. Wiley-Blackwell Publishers.
7. Gopinanadhan P, Bakovic M and Shetty K, Wiley-Blackwell (2011) Functional Foods, Nutraceuticals and Degenerative disease prevention 1st edition, ISBN: 0812824532, 978081324536, 9780470960844
8. Saarela M (2011) Functional Foods: Concept to Product. 1st edition, Woodhead Publishing. ISBN: 1845696905, 9781845696900
9. Liong MT (2015) Beneficial Microorganisms in Food and Nutraceuticals. First Edition, Springer International Publishing Switzerland, ISBN: 3319231766.

Course title: Food Microbiology and Food Safety **Credit: 4**
Course code: SIAS NB 1 3 04 C 4004 **Lectures: 60**

Course objective:

1. The major learning objectives of this course will be to study the scope of food microbiology and food safety

2. To gain the essential knowledge and applications of various techniques (traditional to advanced) for preserving food.

Learning outcomes:

- Understanding techniques (traditional to advanced) for preserving food
- Understanding the role of microorganisms in food spoilage, food fermentation and foodborne diseases
- Understanding microbiological quality control and foodborne illnesses investigation procedures for ensuring food safety and hygiene
- Understanding the requirements and components of food safety management system (FSMS) and practical applications of microbiological risk assessment (MRA) tools for assessing microbiological risks in the food sector

Unit-I

Introduction to food microbiology and food safety; Microflora of food; Intrinsic and extrinsic factors affecting microbial growth and survival in food; Microbiological examination of food; Advances in isolation and enumeration of microorganisms in food; Principles of food preservation and significance; Preservation of food by physical methods – low, high temperatures, radiation; Preservation of food by chemical methods; Bio preservation of food.

Unit-II

Modified environment for storage of food; fermentative microorganisms as food and value-added product, single and mixed fermentation- lactic, yeast-lactic, mold-lactic fermentation in food; starter cultures for food fermentation; fermented milk, milk products, juices, vegetables and other beverages; fermented meat and fish products.

Unit-III

Food spoilage: causes and solutions; spoilage of fruits, vegetables, and their products; spoilage of dairy products, canned food, bakery and egg products, meat, fish, and seafood; newer methods for controlling spoilage of food; predictive modelling for food spoilage; food-borne outbreaks-bacterial agents for food-borne illnesses; fungal and algal agents for food-borne illnesses; food-borne animal parasites.

Unit-IV

Investigation of food-borne illnesses outbreaks; indicators of food microbial quality and safety; principles and applications of hurdle technology in food industry; principles of hygiene and sanitation in food service establishment; food safety laws; food safety and quality management system; principles and guidelines for conducting microbiological risk of food.

Suggested readings:

1. Adams M R, Moss M O and McClure P (2016) Food Microbiology (2016) 4th edition Publisher: Royal Society of Chemistry, ISBN: 9781782627623
2. Frazier W C and Westhoff D C (2013) Food Microbiology. 5th edition, Publisher: Mc Graw Hill India, ISBN: 978-1259062513
3. Jay J M, Loessner M J and Golden D (2005) Modern food microbiology, 7th edition, A, Publisher: Springer US, DOI: 10.1007/b100840, eBook ISBN 978-0-387-23413-7.

4. Karl R Matthews K R, Montville T J, Kniel K E (2017) Food Microbiology: An Introduction, 4th edition, Washington, DC : ASM Press, ISBN: 9781523112579.
5. Willey J, Sherwood L and Woolverton J C (2017) Prescott's Microbiology.10th edition, Publisher: McGraw Hill Education, ISBN: 9781259281594

Course title: Therapeutic Nutrition **Credit: 4**
Course code: SIAS NB 1 2 03 DCEC 4004 **Lectures: 60**

Course objective: To provide an understanding of role of therapeutic nutrition for the management of various diseases

Learning outcomes:

- Understanding the principles of meal planning
- Critical assessment of nutritional state and surveillance
- Understanding the role of diet in management of diseases

Unit-I

Introduction to meal meal planning, principles, factors affecting meal planning, steps involved in meal planning, food exchange list(s), diet plan for preschool and school children, adult man, woman and elderly, diet therapy, diet & stress in current scenario. Food faddism & the faulty food habits, Nutritive value of common Indian foods.

Unit-II

Nutrition in pregnancy - physiological stages of pregnancy, nutritional requirements, complication of pregnancy, diet during pregnancy, nutrition during lactation - physiology of lactation, nutritional requirements, nutrition during infancy - growth & development, nutritional requirements, breast feeding, infant formula, introduction of supplementary foods. Nutrition during early childhood (toddler/preschool)- growth & nutrient need, nutrition related problems, feeding patterns, nutrition of school children- nutritional requirement, nutrition during adolescence - growth & nutrient needs, food choices, eating habits, nutrition during adulthood - nutritional requirements, geriatric nutrition: factors affecting food intake and nutrient use, nutrient needs, nutrition related problems.

Unit-III

Nutritional problems in emergencies in vulnerable groups, macro and micronutrient deficiencies, nutritional assessment and surveillance. Nutritional screening and assessment of patients – out patient & hospitalized. Nutrition care plan and implementation. monitoring and follow up, ethical issues, dietary counselling. Nutritional relief and rehabilitation – assessment of food needs, food distribution strategy, mass and supplementary feeding, sanitation and hygiene, evaluation of feeding programs. Nutritional approach to tackle nutrition problems in emergencies. Therapeutic diets (clear fluid, full fluid, soft diet and Regular normal diet), types of hospital diets, diet in different diseases namely cancer, obesity, peptic ulcer, and stone patients

Unit-IV

Overview of enteral and parenteral nutrition in Indian context, principles underlying enteral and parenteral feeding, constituents of enteral and parental nutrition formulations, types of eternal and parenteral formulations, access techniques and devices available for eternal and parenteral feeding, formulation of guidelines, ethical issues and legal considerations, complications of eternal feeding overview of diseases, etiology, symptoms and dietary management of diabetes mellitus, hypertension, hypotension, hypothyroidism,and Rheumatoid arthritis.

Suggested readings:

1. Lewis JD, Ruemmele FM, Wu GD (2014) Nutrition, Gut Microbiota and Immunity: Therapeutic Targets for IBD: 79th Nestlé Nutrition Institute Workshop, New York, Nestlé Nutrition Institute Workshop Series, Vol. 79, 3318026697, 9783318026696
2. Kathleen Mahan L, MS, RD, CDE and Janice L Raymond, MS, RD, CD, (2017) Krause's Food & Nutrition Care Process. 14th edi., Saunders-Elsevier. ISBN: 9780323340755

3. Food, Nutrition, Physical Activity and the Prevention of Cancer- A Global Perspective. (2007) Washington E.D. WCRF (World Cancer Research Fund & American Institute for Cancer Research) Available from: http://discovery.ucl.ac.uk/4841/1/4841.pdf
4. Robert D. Lee, David C. Nieman (2013) Nutritional Assessment. 6th edition, , McGraw Hill Higher Education ISBN-13: 9780071326360
5. Mary JM, Pamela W-M and Jennifer MB (2016) Integrating Therapeutic and Complementary Nutrition (Modern Nutrition). CRC PRESS, Taylor and Franscis Group ISBN: 084931612X, 9780849316128, 9781420003413.

Course: Practical-II **Credit 5**
Course Code: SIAS NB 1 2 10 C 4004 **Lecture 150**

1. Estimation of calcium and phosphorus in food sample.
2. Estimation of total carotenoids in food sample
3. Estimation of iron in a food sample
4. Estimation of ascorbic acid in food sample
5. Isolation of microorganisms by pure culture technique and microbial count by Standard Plate Count Method
6. Morphological characteristics of various bacteria and fungi associated with food.
7. Use of biochemical tests for identifying bacteria.
8. Detection of aflatoxin in peanuts by thin layer chromatography
9. Microbiological analysis of water, milk, fruit juices, street foods
10. Isolation and screening of potential probiotic microorganisms
11. Preparation of probiotic fortified food products
12. Effect of prebiotics on the growth of selected probiotic microorganisms
13. Dietary assessment methods in epidemiological studies
    a. Duplicate diet approach
    b. Food frequency questionnaire
    c. Food consumption record
    d. 24-Hour dietary recall
    e. Dietary record
14. Planning a diet for infants, preschool children, pregnant and lactating women
15. Planning a diet for overweight, underweight, diabetic and celiac patients
16. Assessment of patient needs – nutritional assessment and screening

Suggested readings:

1. Raghuramulu N, Nair MK and Kalyansundaram S (2003) A manual of laboratory techniques. 2nd edition. National Institute of Nutrition, ICMR.
2. Bell C, Neaves Pand Wiliams AP (2006) Food Microbiology and Lab Practice.
3. Cappuccino JG and Sharman N (2002) Lab Manual of Microbiology. Pearson Education Publishing Co.
4. Ranganna S (2007) Handbook of analysis and quality control for fruits and vegetables products. 3rdedition. Tata Mcgraw – Hills: 25-45.

Course title: Nutritional Toxicology **Credit: 4**
Course code: SIAS NB 1 2 01 DCEC 4004 **Lectures:60**

Course objectives: To provide profound knowledge on the basic principles of toxicology and how different toxicants affect human health.

Learning outcomes:

- Identify and describe different sources of toxicity in the food supply
- Describe toxic effects of nutrients eaten in excess of requirements
- Understanding the relationship between nutrient uptake and drug bioavailability

Unit-I

Introduction to basic terms in toxicology, general principles of toxicology, classification of toxicants, mechanisms of toxicants, nature and complexity of food, antinutritional substances in food, overview of methods of toxicity testing (in vivo and in vitro studies), concept of risk analysis, steps involved in risk assessment.

Unit-II

Physical, chemical and biological hazards- types, sources, potential toxic effects of different hazards, naturally present toxicants in foods and their repair mechanism, foodborne illness – causes, prevention, treatment microbial toxins: types, properties, mode of action and toxin inactivation, food allergies and intolerances, food poisoning, types ,causative factors, symptoms and prevention, anti-nutritional factors their course of action, harmful effects and their mitigation.

Unit-III

Toxicity of Vitamins, minerals and dietary supplements, Food additives toxicity, Safety Determination of direct and indirect Food Additives, concept of Generally Regarded as Safe (GRAS), Acceptable Daily Intake (ADI), Estimated daily intake (EDI), adverse health effects of different additives, role of Joint FAO/WHO Expert Committee on Food Additives (JECFA) in assessing safety of food additives, Regulatory aspects of additives (FSSAI regulation).

Unit-IV

Disease states/drugs and nutrient deficiency, Food–Drug Interactions: mechanism of action, Interactions of drugs, food, alcohol and nutraceuticals, Strategies for prevention and management. Food packaging material, potential contaminants from food packaging material. Food laws and standards: Farmer Producer Organisation (FPO), ISI, Ag Mark, Codex Alimentarius, ISO, mark for vegetarian and non vegetarian foods, eco-friendly products and others in operation Carcinogens and carcinogenesis, Process-induced toxic compounds; nitrites, nitrates, and nitrosamines, lipid oxidation, Toxic components in foods of marine origin.

Suggested readings:

1. Yeung AWK, Tzvetkov NT, Jóźwik A, Horbanczuk OK, Polgar T, Pieczynska MD, Sampino S, Nicoletti F, Berindan-Neagoe I, Battino M, Atanasov AG (2019) Food toxicology: quantitative analysis of the research field literature.. Int J Food Sci Nutr. May 29:1-9. doi: 10.1080/09637486.2019.1620184. [Epub ahead of print] PMID: 31140340
2. Stanley TO (2004) Food and Nutritional Toxicology.1st edition, CRC Press, Boca Raton, FLA., ISBN :1587160714, 9781587160714.
3. Shaw IC (2013) Food safety: The science of keeping food safe. Wiley-Blackwell, ISBN: 144433722X.
4. Püssa T (2013) Principles of Food Toxicology (2013) 2nd edition, CRC Press, ISBN: 9781466504103.
5. Hathcock, JN (2012) Nutritional Toxicology Nutrition: Basic and Applied Science Series, Volume 1, Publisher: Elsevier, ISBN: 0323146937, 9780323146937
6. Sherrow V (2015) Food Safety (Point Counterpoint) 3rd edition, ISBN, 0791092895,

9780791092897, 978143810612.

Course title: Public Health Nutrition **Credit: 4**
Course code: SIAS NB 1 2 02 DCEC 4004 **Lectures: 60**

Course objectives: To familiarize the students with the concept of Public Health Nutrition and methods of nutritional assessment

Learning Outcomes:

- Become familiar with the concept of food and nutrition security as well as public health nutrition.
- Obtain the exposure of national healthcare delivery system and gain knowledge of assessment of nutritional status of individuals and community.
- Understand the public health aspects of malnutrition prevalent in the community.

UNIT I

Public Health Nutrition : Aim, scope and content of Public Health Nutrition, Role of Public Health Nutritionist in National development . Health – definition, dimensions, determinants and indicators , National Nutrition Mission- maternal nutrition (antenatal and postnatal care)

UNIT II

Assessment of Nutritional Status of Individual and Community, Meaning and significance of nutritional status assessment, Methods of nutritional assessment: Anthropometry, Biochemical and Biophysical methods, clinical methods, dietary intake and ecological variables including socio-cultural, biologic, environmental and economic, and vital health statistics. Errors in methods of assessing nutritional status, Rapid assessment procedures for community nutrition assessment

UNIT III

Public Health Aspects of Undernutrition: Etiology, clinical features, public health implications, preventive strategies for : Chronic Energy Deficiency/ Protein Energy Malnutrition and Severe Acute Malnutrition , Micronutrient deficiencies - Vitamin A deficiency, Nutritional Anemias, Iodine deficiency disorders, Vitamin D deficiency and Osteoporosis, Zinc Deficiency

UNIT IV

Public Health implications and preventive strategies for: Obesity, Hypertension, Cardiovascular diseases, Diabetes. Food and Nutrition Security : Concepts and definitions of food and nutrition security at the national, regional, household and individual levels, Impact of food production, losses, distribution, access, availability, consumption on food and nutrition security

Suggested Readings:

1. Community based Management of children with severe acute malnutrition, Operational & Technical guidelines (2012) Ministry of health & Family Welfare, NirmanBhawan, New Delhi
2. Indian Council of Medical Research: Dietary Guidelines for Indians. (2011)Dietary Guidelines for Indians: A manual (2nd ed.) second edition , NIN.
3. Gibney MJ, Margetts, BM, Kearney JM, Arab I (2004) Public Health Nutrition. NS Blackwell Publishing.
4. Longvah T, Ananthan R, Bhaskarachary K, Venkaiah K (2017) Indian food composition tables. National Institute of Nutrition.
5. Jelliffe DB and Jelliffe EFP (1989) Community Nutritional Assessment. Oxford University Press.
6. Management of SAM children through medical nutrition therapy (2009) Vol I & II. National Consensus Workshop. Published by DBT. Ministry of Science & Technology. Government of India and ICMR, New Delhi

7. Owen AY and Frankle RT (1986) Nutrition in the Community: The Art of Delivering Services (2nd ed.) Times Mirror/Mosby.
8. Park K (2017) Park's Textbook of Preventive and Social Medicine. 24th ed. Jabalpur M/s. Banarsidas Bhanot.
9. Ross AC (2012) Nutrition in health and disease. (Eds) Lippincott Williams & Wilkins.
10. Shils ME (1998) Nutrition in health and disease. (Eds) Lippincott Williams & Wilkins. 17
11. Vir S (2011) Public health nutrition in developing countries Part-1 & 2. Woodhead Publishing India limited.
12. Wadhwa A and Sharma S (2003) Nutrition in the Community. A text book.
13. SCN News, UN ACC/SCN Subcommittee on Nutrition.
14. https://www.who.int

SEMESTER-III

Course title: Nutrient Deficiencies and Assessment **Credit: 4**
Course code: SIAS NB 1 3 11 C 4004 **Lectures: 60**

Course objectives: The student will be able to understand nutritional deficiency diseases and their management

Learning outcomes:

- Identify the signs and symptoms of diseases related to nutrients deficiency
- Understand the aetiology and preventive measures for the different deficiency diseases
- Assess the nutritional status using anthropometric measurements and biochemical parameters.

UNIT I

Relationship between nutrition, health and disease, Macronutrients and micronutrients – functions, food sources, Recommended Dietary Allowances according to age, sex, activity, physiological condition. Impact of deficiency, excess or imbalanced intake of nutrients on health.

UNIT II

Nutritional deficiency diseases: Protein energy malnutrition, Nutritional anemias, Vitamin A deficiency, Iodine deficiency disorders, Vitamin D deficiency, etiology and pathogenesis, Clinical manifestations and biochemical changes.

Unit III

Public health aspects of malnutrition : Treatment of deficiency diseases- hospital and community setting. Prevention strategies- overview of National policies and programs, Nutrition surveillance and monitoring

Unit IV

Methods of Assessment of Nutritional Status: Types of diet surveys, Concept of diet quality and adequacy, Anthropometric measurements – indices and reference standards, biochemical parameters and clinical examination

Recommended Readings

1. Chadha R and Mathur P (2015) Nutrition: A Lifecycle Approach. Orient Blackswan, New Delhi.
2. ICMR (2010) Nutrient Requirements and Recommended Dietary Allowances for Indians.National Institute of Nutrition, Hyderabad.
3. Maurice E Shils and Moshe Shike A (2005) Nutrition in Health and Disease. Catharine Ross and Benjamin Caballero. 10th edition. Lipincott, William and Wilkins.
4. Gibson RS (2005) Principles of Nutritional Assessment. 2nd edition. Oxford University Press.

Course title: Nutrition in Metabolic Disorders **Credit: 4**
Course code: SIAS NB 1 3 12 C 4004 **Lectures: 60**

Course objective: To understand the concepts of different diseases and role of diet in the management of disease.

Learning outcomes:

- Understanding importance of nutritional assessment in the care of patients
- Understanding metabolic changes in various diseases/disorders and the associated principles of diet therapy
- Comprehend the rationale of prevention of various diseases/disorders

Unit-I

Concept, purpose and principles of diet therapy, basic concepts and methods of - (a) oral feeding (b) tube feeding (c) parental nutrition (d) intravenous feeding, etio-pathophysiology, metabolic and clinical aberrations, diagnosis, complication, treatment, dietary management and recent advances in obesity, overweight and underweight, Diabetes Mellitus – Type 1, Type 2, Diet in Diabetes mellitus: Incidence and predisposing factors, symptoms-types and tests for detection. Metabolism in diabetes dietary treatment & meal management hypoglycaemic agent, insulin and its types. Complication of diabetes.

Unit-II

Diet in surgical conditions and burns. Gout- Nature and occurrence of uric acid, causes, symptoms and diet. Diet in allergy and skin disturbances: Definition, classification, manifestations, common food allergies and dietetic treatment, incidence of Atherosclerosis, dietary principles, hyperlipidaemia, hypertension- causes and dietary treatment, etio-pathophysiology, metabolic and clinical aberrations, diagnosis, complication, treatment, dietary management and recent advances in cardio vascular diseases.

Unit-III

Diet in fever and infections- Types- metabolism in fever, general dietary consideration. Diet in gastritis, peptic ulcer- symptoms, clinical findings, treatment, chemically and mechanically irrigating foods, four stage diet (Liquid, soft, convalescent, liberalized diet). Overview of Nutrition in gastrointestinal disorders, nutrition in diseases of liver, nutrition in food allergy and intolerance.

Unit-IV

Diet in renal diseases: basic renal function, symptoms and dietary treatment in acute and chronic glomerulonephritis, nephrosis, renal failure, dialysis. urinary calculi-causes & treatment. diet in disturbances of small intestine and colon. aetiology, symptoms and dietary treatment in - jaundice, hepatitis, cirrhosis and hepatic encephalopathy. aetiology and dietary management in cancer, effect of cancer therapy on nutritional status, factors affecting carcinogenesis process

Suggested readings:

1. Kathleen Mahan L, MS, RD, CDE and Janice L Raymond, MS, RD, CD (2017) Krause's Food & the Nutrition Care Process, 14th Edition., Sylvia Escott-Stump., Saunders Elsevier. ISBN: 9780323340755
2. Michael J. Gibney, Marinos Elia, Ljungqvist O and Dowsett J. Blackwell Science (2011) Clinical Nutrition (The Nutrition Society Textbook), UK ISBN: 0632056266
3. Shils ME, Shike M, Ross AC, Caballero B and Cousins RJ (2012) Lipincott Modern Nutrition in Health and Disease. 11th edition, William and Wilkins. ISBN-10: 1605474614

4. Gilbert-Barness E, Barness LA and Farrell PM (2017) Metabolic Diseases: Foundations of Clinical Management, Genetics, and Pathology. 2nd Edition.. IOS Press. ISBN: 978-1-61499-717-7
5. Laurie E. Bernstein, Fran Rohr and Joanna R (2015) Helm Nutrition Management of Inherited Metabolic Diseases: Lessons from Metabolic University. Springer International Publishing. DOI: 10.1007/978-3-319-14621-8 ISBN 978-3-319-14621-8

Course title: Bioinformatics and Nutrigenomics **Credit: 4**
Course code: SIAS NB 1 3 13 C 4004 **Lectures: 60**

Course objective: To introduce the students in the field of bioinformatics and enables them to understand the concepts of gene and nutrient interaction.

Learning outcomes:

- Understanding the role of computer science in predicting structure and function of biomolecules
- Understanding similarities and differences among living organisms on the basis of genetic information
- Understanding the concept of gene and nutrient interaction.
- Understanding how genetic modification of crops can be used to more effectively deliver drugs, vaccines, nutrients and bioactive substances.
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Unit-I

Historical background. Scope of bioinformatics - genomics, proteomics, computer aided drug design (structure based and ligand based approaches), Applications of bioinformatics. Introduction to biological databases - primary, secondary and composite databases, Different formats of molecular biology data. NCBI, nucleic acid databases (GenBank, EMBL, DDBJ, NDB), protein databases (PIR, Swiss-Prot, TrEMBL, PDB)

Unit-II

Similarity, identity and homology. Alignment-local and global alignment, pairwise and multiple sequence alignments, BLAST and CLUSTALW. Construction of phylogenetic tree; Protein structure prediction methods

Unit-III

Nutrient/diet gene interactions, bioactive food components, practical applications. Introduction to various target validation models (cell-line models, zebrafish model and animal models); Single nucleotide polymorphism and associated metabolic aberrations, Diseases which can be addressed by nutrigenomics; genes and gene products which are important in these diseases,

Unit-IV

Concept and scope of personalized nutrition. Metabolic effects of the dietary fibre and the modulation of gut microbiota. Scope of genetic modification in altering nutritional properties and content of bioactive substances in food with details of ongoing research in the field, concept and feasibility of GM therapeutic foods for drug and phytochemical delivery.

Suggested readings:

1. Xiong J (2006) Essential Bioinformatics. 1st edition, Cambridge University Press, ISBN 13: 978-0521600828.
2. Krane DE and Raymer ML Pearson (2003) Fundamental concepts of Bioinformatics . ISBN: 978-8177587579. (Incomplete)
3. Knight R, Larsen and Keller (2017) An Introduction to Bioinformatics, 1st edition, Education, ISBN: 978-1635490459.
4. Momand J, McCardy A, Heubah, S and Warter-Perez N (2016) Concepts of Bioinformatics and Genomics. 1st edition, Oxford University Press, ISBN: 978-0199936991

5. Qi L (2012) Gene-Diet Interactions in Complex Disease: Current Findings and Relevance for Public Health. Current nutrition reports, 1(4): 222–227. doi:10.1007/s13668-012-0029-8
6. Tucker KL, Smith CE, Lai CQ and Ordovas JM (2013) Quantifying diet for nutrigenomic studies. Annual review of nutrition, 33: 349–371. doi:10.1146/annurev-nutr-072610-145203.
7. Tanaka, T, Ngwa, JS, van Rooij, FJ, Zillikens, MC, Wojczynski, MK, Frazier-Wood, AC Nettleton, JA (2013) Genome-wide meta-analysis of observational studies shows common genetic variants associated with macronutrient intake. The American journal of clinical nutrition, 97(6): 1395–1402. doi:10.3945/ajcn.112.052183
8. Madden J, Williams CM, Calder PC, Lietz G., Miles E. A, Cordell H. et al (2011) The Impact of Common Gene Variants on the Response of Biomarkers of Cardiovascular Disease (Cvd) Risk to Increased Fish Oil Fatty Acids Intakes, Annual Review of Nutrition: 31: 203-234.
9. Institute of Medicine. 2007. Nutrigenomics and Beyond: Informing the Future: Workshop Summary. Washington, DC: The National Academies Press. https://doi.org/10.17226/11845.
10. Kaput J and Rodriguez R L (2006) Nutritional Genomics: Discovering the Path to Personalized Nutrition. John Wiley & Sons, Inc. https://doi.org/10.1002/0471781797

Course title: Practical-III **Credit: 4**
Course code: SIAS NB 1 3 14 C 4004 **Lecture : 120**

1. Isolation and characterization of microorganisms of food origin.
2. Detection of common adulterants in food.
3. Determination of mineral contents in the food sample.
4. Assessment of Anthropometry Measurements including clinical signs of Nutrient deficiency..
5. Diet plan to weight loss and weight gain.
6. Planning of diet for fever and infections
7. Planning of diet for diabetes mellitus
8. Planning of diet for renal disease patient
9. Planning of diet for cancer patient
10. Planning of diet for hepatitis patient
11. Sequence retrieval (protein and gene) from NCBI.
12. Structure download (protein and DNA) from PDB.
13. BLAST suite of tools for pairwise alignment.
14. Multiple sequence alignment using CLUSTALW.
15. Primary sequence analyses (Protparam).

Suggested readings:

1. Raghuramulu N, Nair MK and Kalyansundaram S (2003) A manual of laboratory techniques. 2nd edition. (eds). National Institute of Nutrition, ICMR.
2. Cappuccino J G (2019) Microbiology: A Laboratory Manual, 12th edition Pearson
3. Forsythe SJ (2010) The Microbiology of Safe Food . 2nd edition, Willey-Blackwell, U.K, ISBN: 978-1-405-14005-8
4. Lawley R, Curtis L and Davis J (2012) The Food Safety Hazard Guidebook. 2nd edition, Royal Society of Chemistry publishing, Cambridge, United Kingdom ISBN: 101849733813
5. Cappucino J and Sherman N (2010) Microbiology: A Laboratory Manual. 9th edition. Pearson Education limited.

Course title: Seminar
Course code: SIAS NB 1 3 145C 0202 **Credit: 2**

Seminar will be of 45-minute duration during which the presentation will be followed by questions session by the audience comprising of faculty and students. Every student shall be required to submit the topic of his/her seminar in consultation with the Head of the Department/Faculty members/student advisors well in advance so that the same may be displayed on the notice board. The presenter has to write an Abstract to be distributed during Seminar in addition to two copies of write-up giving relevant details of the background of the subject, methods used and references/List of sources from where the material for presentation has been collected.

Course title: Nutrition and Immunity **Credit: 4**
Course code: SIAS NB 1 3 03 DCEC 4004 **Lectures: 60**

Course objective: To provide knowledge on fundamental concepts of nutrition, immunity and diseases.

Learning outcomes:

- Understanding the relationship between nutrition, immunity and infection
- Comprehensive knowledge about the role of different nutrients in enhancing immunity
- Understanding Relationship between disease and immunity

Unit-I

Terminology related to immunity, introduction to infections and immunity, classification and history, overview of the auto defence mechanisms of the human body, cell and organs related immune system, Phagocytes their role and structure, antigen and antibodies, reaction between antigen and antibody, assessment of the immune response.

Unit-II

Interrelationship between nutrition and immunity. Effect of malnutrition i.e under and over nutrition on immune system. Different macro and micro nutrients and their relationship with immunity. Effect of amino acids on immunity. Antioxidants and immunity. Role of vitamins in immune functions and effect of deficiency, effect of deficiency and excess of vitamins and minerals on immune cell functions, role of micronutrients in improving immunity, effect of infection on the nutritional status, other factors affecting immunity- ageing, obesity, stress, exercise, alcohol, phytochemicals, pre- and probiotics.

Unit-III

Immune system: diseases, disorders and functions, effect of different disease and disorders on the immunity level of persons: allergies, autoimmune diseases , other diseases linked to immune system viz., autoimmune polyglandular syndrome, leukemia, chronic myeloid and ataxia telangiectasia.

Unit-IV

Probiotics and antioxidants – their effect on immune system. Immunity against infection – role of immunization. Maternal & children nutrition - Infections and birth outcomes immunity & infections of infants and children, Impact of breast feeding on immunity of infants, Immunization , prevention of communicable diseases, Relationship of Probiotics, prebiotics with immunity and nutrition.

Suggested readings:

1. Gershwin ME, Nestel P, Keen CL (2017) Handbook of Nutrition and Immunity (2017) 1st ed., Humana Press, DOI: 10.1007/978-1-59259-790-1, ISBN: 9781592597901
2. Pammi M, Vallejo JG and Abrams SA (2016) Nutrition-Infection Interaction and Impact on Human Health.1st ed., ,CRC Press, Taylor & Franscis Group, ISBN 9781138033764
3. Calder P and Yaqoob P (2013) Diet, Immunity and Inflammation. 1st ed., Woodhead Publishing ISBN: 9780857095749
4. Wu D, Lewis ED, Pae M and Meydani SN (2019) Nutritional Modulation of Immune Function: Analysis of Evidence, Mechanisms, and Clinical Relevance, Front Immunol. 15;9:3160. doi: 10.3389/fimmu.2018.03160. e Collection 2018 . Review. PMID: 30697214
5. Saika A, Nagatake T, Kunisawa J (2019) Host and Microbe-Dependent Dietary Lipid Metabolism in the Control of Allergy. Front Nutr. 10;6:36. doi: 10.3389/fnut.2019.00036. eCollection 2019. Review. PMID: 31024921

Course title: Food and Nutritional Biotechnology **Credit: 4**
Course code: SIAS NB 1 3 04 DCEC 4004 **Lectures: 60**

Course objective: The major objective of this course is to develop the understanding of role of biotechnology in relation to food and nutrition

Learning outcomes:

- Understand food fermentation for improved nutrition
- Understand novel food additives and supplements
- Understand mechanism and process of food spoilage and its preservation
- Understand monitoring of food quality and packaging of food

Unit-I

Introduction: microorganisms in food-historical developments, food fermentation Technology: origin, scope and development of fermented products, primary feed stock, raw materials and conversions, fermented food and microbial starters, commercial potential..

Unit-II

Development of novel food and food Ingredients: Single cell protein, polysaccharides, low calorie sweeteners, naturally produced flavor modifiers, amino acids, vitamins, food supplements, food coloring, neutraceuticals, water binding agents. Bioreactors in food fermentations: Cultivation of microorganisms, instrumentation regulation and process control, submerged and solid state fermentation, , Technological trends for improving the functionality of foods.

Unit-III

Food spoilage and preservation: general principle of spoilage, microbial toxins (endotoxins and exotoxins), contamination and preservation, factors affecting spoilage. Methods of food preservation (thermal processing, cold preservation, chemical preservatives & food dehydration); Role of radiations in food preservation, characteristics of radiation of interest in food preservation. Principles underlying the destruction of microorganisms by irradiation. Effect of irradiations on food constituents. Legal status of food irradiation.

Unit-IV

Biological controls and monitoring of food quality, packaging of food: Need for packaging, containers for packaging (glass, metal, plastics, molded pulp and aluminium foil), dispensing devices.

Suggested readings:

1. Perry Johnson (2002) Introduction to Food Biotechnology. Green Publisher; CRC Press. USA; ISBN 9780849311529
2. Jay James M, Loessner Martin J, Golden and David A (2006). Modern Food Microbiology 7th Edition, Springer, ISBN 978-0-387-23413-7
3. Buchanan, Robert and Doyle, Michael P (2013) Food microbiology: fundamentals and frontiers. 4th edition. & American Society for Microbiology ASM Press, Washington, DC, ISBN: 1555816266
4. Marwaha S S and Arora J K (2003)Biotechnological Strategies in Agro-processing. 2nd Edition Asia tech Publishers, New Delhi. ISBN-10: 8187680091
5. Parmjit S. Panesar and Satwinder S (2013) Biotechnology in Agriculture and Food Processing: Opportunities and Challenges. 1st edition,. Marwaha., CRC Press ISBN:1439888361, 9781439888360

Course title: Sports Nutrition **Credit: 4**
Course code: SIAS NB 1 3 05 DCEC 4004 **Lectures: 60**

Course objective:

1. To gain the knowledge and understanding of nutrition required for exercise and sport in order to enhance performance
2. To learn the role and significance of macro nutrients and micronutrients in achieving fitness.

Learning outcomes:

- Comprehensive knowledge about nutritional guidelines for athletes performing under altered climatic conditions.
- Understanding the importance and process of nutritional counselling for athletes.
- Gaining information about special nutritional concerns of travelling athlete and athletes with physical disabilities.

Unit-I

Introduction to Sports Nutrition – History, organizations working for sports nutrition, Importance of Nutrition in sports. Nutritional guidelines and nutritional requirements for younger and older athletes, nutritional concerns of travelling and vegan athletes, athletes performing under altered climatic conditions-high altitude mountaineers, high and low climatic temperature, nutrition guidelines for athletes with physical disabilities.

Unit-II

Integrated approach to care for athletes, assessment of sports performance, bioenergetics and body metabolism of physical activity and sports, macro- and micro nutrients for sport performance temperature regulation, fluid balance, fluid requirements of athletes and rehydration strategies for sports.

Unit-III

Recommended allowances and nutritional guidelines for different categories of high-performance sports, nutritional care during training, weight management and day-today recovery, nutrition for the pre-competition, competition and post competition recovery phase, supplements in sport: performance enhancing substances, drugs, ergogenic aids and herbs in sports performance, Meal replacement products (MRP), World Anti Doping Agency (WADA)

Unit-IV

Anaemia, osteoporosis, Diabetes Mellitus, hypertension and heart disease (physiology, effect of nutrition, age, sex and exercise on health, preventive and curative strategies), gastro intestinal disorders: peptic ulcer, gastroesophageal reflux disease (GERD), irritable bowel syndrome (IBS), etc., aetiology, pathophysiology and effect of exercise.

Suggested reading:

1. Tudor Bompa, Boris Blumstein, James Hoffman (2018) Integrated Periodization in Sports Training & Athletic Development: Combining Training Methodology, Sports Psychology, and Nutrition to Optimize Performance. 1st edition, Meyer & Meyer Sport, USA, ISBN: 1782551417
2. Marni Sumbal (2018) Essential Sports Nutrition: A Guide to Optimal Performance for Every Active Person. Callisto Media Incorporated. ISBN:1641521694
3. Burke L Y and Deking V (2006) Clinical Sports Nutrition. 3rd edition. Tata McGraw HillPub. England. ISBN: 9780074716021

4. Jeukendrup, Asker, Gleeson, Michael (2018) Sport Nutrition. 3rd Edition., Human Kinetics. USA ISBN: 1492529036.
5. Wolinsky Ira and Driskell, J (2004) Nutritional Ergogenic aids, 1st Edition, CRC Press NY. Management, Belmount (USA). Wadsworth/Thompson Learning. ISBN: 9780849316265

Generic Elective Courses

Course title: Hospital Food Service Administration **Credit: 4**
Course code: SIAS NB 1 1 01 GEC 4004 **Lectures: 60**

Course objectives: To enable students to gain knowledge in hospital functions and administration

Learning outcomes:

- Understanding of acquiring skills in maintaining medical records
- Understand the management of resources in hospitals

UNIT I

Hospital based health care and its changing scenario, effects of globalization on health care, concepts of corporate hospitals in developing countries, infrastructure and lay out of an ideal corporate hospital, functioning of modern, hospital and changing needs of patients, hospitality in hospital care

UNIT II

Patient Care Services Patient Admission / discharge, cafeteria and dietary services, front office services, housekeeping services, blood bank, diagnostic services, lab, physiotherapy, pharmacy operation theatre, outpatient and inpatient ward –admission

UNIT III

Principles of Hospital management Managerial activities for effective hospital functioning duties and responsibilities of hospital managers, qualities of office managers, effective inter and intra departmental co-ordination, understanding functioning of corporate multi specialty hospital

Unit IV

Marketing and Material management Human resource management, managerial accounting and financial management, importance of material management, principles of material management, inventory management. Hospitality in hospital care Management of dietary department, diet planning for hospital diets, purchasing, storage and quantity food production, patient compliance, food production, serving to patient- tray and trolley service, plate waste management, washing and garbage disposal.

Suggested readings:

1. . Sudhir Andrews (2008) Front Office Management and Operations, Tata Mc Graw – Hill Publishing Company Ltd.
2. Sakharka B M (2009) Principles of Hospital Administration and Planning, 2nd Edition, Jaypee Brothers Medical Publishers (p) Ltd.
3. Sherry Glied and Peter Smith (2011) The Oxford Handbook of Health Economics.
4. Jan Abel Olsen (2009) Principles in Health Economics and Policy, Oxford University Press.
5. Mohinder Chand (2009) Managing Hospitality Operations, 1st Edition, Anmol Publications Pvt. Ltd. New Delhi.
6. Goel S L (2009) Health Care System and Hospital Administration, Vol.7, Deep and Deep Publications Pvt. Ltd.
7. Kalkar SA (2010) Hospital Information Systems, Published by Asoke K.Ghosh, PHI Learning Pvt. Ltd.
8. http://eurpub.oxfordjournals.org/content.

Course title: Community Nutrition **Credit: 4**
Course code: SIAS NB 1 1 02 GEC 4004 **Lectures: 60**

Course objectives: To introduce students about health indicators and various programmes for the upliftment of the community

Learning outcomes:

- Understanding of health care system
- Role of various national and international agencies in the management of diseases

Unit -1

Community health concept: Definition and brief study of community, family, village and block. Definition, dimension and determinant of health, positive health, health situation in India,. Role of public nutritionist in health care delivery. Health Indices: fertility indicator, vital statistics, mortality, morbidity and demographic indicator, Human development Index, Reproductive health index. IMR, MMR, birth rate, sex ratio, poverty level. Concept of disease, causation (Agent, host, environmental factors) concept and control & prevention, modes of intervention.

Unit -II

Nutrition programs: National anemia prevention, Prevention of night blindness, National iodine prophylaxis program. The package programmes of immunization, nutrition education, feeding programmes. Malnutrition - causes, ecological factors, effects of malnutrition. Demographic changes due to malnutrition. Vitamin deficiency - B1, B2, Niacin, C, D - prevalence, programmes to combat. Protein deficiency diseases - PEM, Kwashiorkor prevalence, epidemiology and programs to combat, Nutritional Anaemia - Prevalence, programmes to control.

Unit—III

Nutrition and National Development: National nutritional policy - Aim, objectives, guidelines and thrust areas. PDS - Public distribution system. Need for voluntarism in community development, Assistance available to voluntary agencies from Ministries, Departments, Government of India, Central State Social Welfare Board etc, National nutrition surveillance system. Food for work etc.

Unit -IV Nutrition intervention Programmes - Objectives, operation of feeding programmes. ICDS, TINP, NNMS, IRDP, DWACRA. National organizations and their role in nutrition programmes - ICMR, NIN, NNMB, ICAR, CFTRI, NIPCID. International organizations - FAO, WHO, UNICEF, UNESCO, World Bank. Nutrition education - Meaning, nature and importance of nutrition education to the community, Training of workers in nutrition education programme . Principles of planning, executing and evaluation nutrition education programme. Methods and Techniques of organizing nutrition programmes using audio, video aids and exhibition, Problems of nutrition , Health care delivery - PHC, School Health services and their role in preventing communicable diseases

References:

1. Srilakshmi (2007) Food Science, 4th Edition. New Age International Ltd.
3. Srilakshmi (2005) Dietetics, Revised 5th edition. New Age International Ltd.
4. www. Mohfw.gov.in
5. Ann Burgess et al. (2009) Community Nutrition: A Handbook for Health and Development Workers. Oxford: Macmillan Education

Course title: Work Physiology, Physical Fitness and Health **Credit: 4**
Course code: SIAS NB 1 3 03 GEC 4004 **Lectures: 60**

Course objective: To provide an understanding of effect of physical activity on body composition, fitness and health.

Learning outcomes:

- Understanding the concepts & components of health and physical fitness
- Comprehensive knowledge of energy metabolism during exercise or physical activity
- Understanding the importance of maintaining thermoregulation, fluid & electrolyte balance

Unit-I

Definition of health, components of health, holistic health, positive health concept, Physical fitness- definition, components, methods of assessing, role in maintenance of healthy & wellness and types of exercises for fitness training, guidelines for physical activity to maintain health, prevention of obesity and its co-morbidities, techniques to assess physical fitness, Aging theories, physiology, mechanism and role of nutrients in arresting aging process

Unit-II

Body composition, Methods of measuring body composition: direct and indirect. Body composition in different physiological conditions, factors affecting body composition, muscle - structure, muscle classification and types of muscle contraction, major muscles of neck, shoulder, arms, chest, abdominal, back, hip and lower limbs, principles of muscle mechanics, Introduction of weight training, significance and principles of weight training, Do's and Don'ts of weight training

Unit-III

Energy metabolism and physical fitness: concept, importance, influencing factors, Techniques to measure energy expenditure and energy intake, types of energy systems, energy continuum and energy release, cardiovascular response to training and measurement of anaerobic & aerobic capacity, concept of isotonic/isometric/isokinetic exercises, various isotonic, isometric and isokinetic exercises for various muscles of the body, weight training exercises for the women, elderly people and for competitive sports person**.**

Unit-IV

Exercise and thermo regulatory mechanism, fluid and electrolyte balance, improving physical performance, Ergogenic aids: definition, market, types and effects, exercise and the neuroendocrine system, body composition and fat estimation calculation of kilocalories, harmful effects of quick weight reduction, Scientific approaches of weight reduction.

Suggested readings:

1. Alvero JC, Ronconi M, García JR, Carrillo MD, Jiménez ML, Correas LG, Álvarez EC. (2017) Body composition changes after sport detraining period. Nutricion hospitalaria. 34(3):632-8.doi: 10.20960/nh.618.
2. Mazzoccoli G (2016) Body composition: Where and when. European journal of radiology. Aug 1;85(8):1456-60.doi: 10.1016/j.ejrad.2015.10.020. Epub 2015 Oct 31
3. William D. McArdle BS, Frank I. Katch EdD, Victor L. Katch EdD (2015) Essentials of Exercise Physiology (2015) 5th edition**,** Publsher: Wolters Kluwer, ISBN/ISSN 9781496302090
4. Per-Olof Astrand , Kaare Rodahl, Hans A. Dahl , Sigmund B (2003)Textbook of Work Physiology: Physiological Bases of Exercise, 4th Edition, Stromme Publisher: Champaign (Ill.) : Human kinetics ISBN: 0736001409

5. Ira Wolinsky (1997) Nutrition in Exercise and Sport 3nd edition, CRC Press. ISBN 9780849385605

Course : Nutrition Counselling **Credit 4**
Course Code : SIAS NB 1 3 04 GEC 4004 **Lecture 60**

Course objectives: To study the effect of acute and chronic diseases on the emotional and psychological state and behaviour of the individuals.

Learning outcomes

- Understand the principles and procedures of nutrition counselling and the role of the counsellor.
- Develop an understanding in lifestyles influence on health and well-being

UNIT I

Nutrition Counselling: Definition, concept, role of clinical dietician, the recipients, counselling environment. A systems approach to nutritional care: overview of the system, components of the system. Dietician as part of the medical team and outreach services

UNIT II

The Counselling Process Techniques for obtaining relevant information, Clinical Information, Medical History and General Profile, Dietary Diagnosis -Assessing food and nutrient intakes, Lifestyles, physical activity, stress, Nutritional Status, Correlating relevant information and identifying areas of need: Problem exploration and clarification, Developing new perspectives and setting goals, implementation, follow up and evaluation.

UNIT III

Counselling techniques: strategies and communication skills, rapport building and opening techniques, questioning, listening, reflecting, acceptance, silence, leading reassurance, non-verbal behaviour, terminating skills. Group Counselling: developing resources and aids for education and counseling, audio visual aids, computer in education, e- resource. Working with different groups, hospitalised patients (adults, pediatric, elderly, handicapped), adjusting and adapting to individual needs. Outpatients (adults, pediatric, elderly and handicapped), patient's education, techniques and modes, follow up, Monitoring and Evaluation of outcome: Home visit

UNIT IV

Policies and programmes: Components and evaluation of programmes for prevention and control of micronutrient deficiencies and improving food and nutrition security .National Nutrition Policy and National Nutrition Mission, National Food Security Act, National Health policy, Population policy, National water policy , National Urban Sanitation Policy etc.

References

1. Alam S (2008) Basics of Guidance and Counselling. Global Vision Publishing House, New Delhi
2. Nayak A K (2007) Guidance and Counselling. A P H Publishing Corporation, New Delhi.

SEMESTER-IV

Course title: Dissertation **Credit: 24**
Course code: SIAS NB 1 4 01 SEEC 0024

Guidelines for Project File

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The file is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.
- The guidelines and format for dissertation is given below:
  .

Dissertation Guidelines

1. **GENERAL :**

The manual is intended to provide broad guidelines to the M.Sc. candidates in the preparation of the dissertation report. In general, the project report shall report, in an organised and scholarly fashion an account of original research work of the candidate leading to the discovery of new facts or techniques or correlation of facts already known.

2. NUMBER OF COPIES TO BE SUBMITTED:

Students should submit three copies to the Head of the Department concerned on or before the specified date.

3. ARRANGEMENT OF CONTENTS OF DISSERTATION:

Dissertation material should be arranged as follows:

1. Cover Page & Title page
2. Declaration
3. Certificate
4. Abstract (Hindi and English)
5. Acknowledgements
6. Table of Contents
7. List of Tables
8. List of Figures
9. List of Symbols, Abbreviations and Nomenclature (Optional)
10. Chapters
11. References
12. Appendices
13. One page CV

The Tables and Figures shall be introduced in the appropriate places.

4. PAGE DIMENSIONS AND MARGIN:

The dimensions of the dissertationshould be standard A4 size paper may be used for preparing the copies, **standard margin** with 1.5 line spacing.

5. MANUSCRIPT PREPARATION:

The general text of thesis shall be typed in font style Times New Roman and font size 12. Same quality of paper should be used for the preparation of the entire report/thesis; except figure, photos are shown.

5.1 Cover Page & Title Page - A specimen copy of the Cover page & Title page for report/thesis are given in Annexure I.

5.2 Certificate-The Bonafide Certificate as per the format shown in Annexure II

5.3 Abstract: Abstract should be an essay type (HINDI and ENGLISH) of narration not exceeding 500 words outlining the research problem, the methodology used for tackling it and a summary of the findings, typed in 1.5line spacing.

5.4 Acknowledgements: The acknowledgements shall be brief and should not exceed onepage. The student's signature shall be made at the right bottom above his / her name typed in capitals.

5.5 Table of contents - The table of contents should list all material following it as wellas any material which precedes it. The title page, Bonafide Certificate and Acknowledgment will not find a place among the items listed in the Table of Contents but the page numbers in lower case Roman letters are to be accounted for them. One and a half spacing should be adopted for typing the matter under this head. A specimen copy of the Table of Contents for report / thesis is given in Annexure III.

5.6 List of Table - The list should use exactly the same captions as they appear above thetables in the text and the caption shall follow 'sentence case'. One and a half spacing should be adopted for typing the matter under this head.

5.7 List of Figures - The list should use exactly the same captions as they appear belowthe figures in the text and the caption shall follow 'sentence case'. One and a half spacing should be adopted for typing the matter under this head

5.8 List of Symbols, Abbreviations and Nomenclature - One and a half spacing shouldbe adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used.

5.9 Chapters - The chapters may include

Chapter I – Introduction

Chapter II - Literature Review

Chapter III –Materials and Methods

Chapter IV- Results and Discussion

5.10 Research output/outcome if any published or presented in conference/seminar/symposium may be included.

5.11 List of References - Any works of other researchers, if used either directly orindirectly, should be indicated at appropriate places in the report/thesis. The citation may assume any one of the following forms**. APA Style.**

APA in-text citation style uses the author's last name and the year of publication, for example: (Field, 2005).

Example:

Derwing, T. M., Rossiter, M. J., & Munro, M. J. (2002). Teaching native speakers to listen to foreign-accented speech. *Journal of Multilingual and Multicultural Development*, 23(4), 245-259.

Thomas, H. K. (2004). *Training strategies for improving listeners' comprehension of foreign-accented speech* (Doctoral dissertation). University of Colorado, Boulder.

6. TYPING INSTRUCTIONS

6.1 General

This section includes additional information for final typing of the thesis. Some information given earlier under 'Manuscript preparation' shall also be referred. The impressions on the typed/duplicated/printed copies should be black in colour. Corrections, interlineations and crossing out of letters or words will not be permitted in any of the copies of the report/thesis intended for submission. Erasures, if made, should be neatly carried out in all copies. A sub-heading at the bottom of a page must have at least two full lines below it or else it should be carried over to the next page. The last word of any page should not be split using a hyphen. One and a half spacing should be used for typing the general text. The general text shall be typed in Font Style Times New Roman and Font Size 12.

Single spacing should be used for typing:

(i) Long Tables
(ii) Long quotations
(iii) Foot notes
(iv) Multilane captions
(v) References

6.2 Chapters The format for typing chapter headings, division headings and sub division headings shall be same as given in Table of Contents.

7. BINDING SPECIFICATIONS

Thesis should be spiral or soft cover book bound, the cover of thesis should be of dark greencolor, printed with golden ink and the text for printing should be identical as prescribed for the title page.

APPENDIX I A:(A typical Specimen of Cover Page & Title Page– **DISSERTATION**)

<Font Style Times New Roman - Bold>

TITLE OF DISSERTATION

<Font Size 18><1.5 line spacing>

DISSERTATION

<Font Size 14>

Submitted by

<Font Size 14><Italic>

NAME OF THE CANDIDATE

<Font Size 16>

Under the Supervision of

NAME OF THE SUPERVISOR

in partial fulfillment for the award of the degree of

<Font Size 14><1.5 line spacing>

MASTER OF SCIENCE IN

NAME OF THE PROGRAMME

<Font Size 16>

DEPARTMENT OF

SCHOOL OF ……..

CENTRAL UNIVERSITY OF HARYANA,

MAHENDERGARH-HARYANA

<Font Size 14><1.5 line spacing>

MONTH AND YEAR

DECLARATION

I ……, student of the School of Interdisciplinary and Life Sciences, Central University of Haryana, Mahendergarh hereby declare and certify with my signature that my thesis entitled

…… submitted to the Department of ……., Central University of Haryana, India in partial fulfillment of the requirements for the award of the Degree of Masters of Science is a record of original research work done by me and the dissertation has not been the basis for the award of any degree/diploma/associateship/fellowship or similar title of any candidate of any University. I have faithfully and accurately cited all my sources, including books, journals, handouts and unpublished manuscripts, as well as any other media, such as the Internet, letters or significant personal communications.

I understand the concept of "plagiarism" and declare that while drafting this dissertation I have refrained from plagiarism. I know that plagiarism not only includes direct copying, but also the extensive use of other's ideas without proper referencing or acknowledgement (which includes the proper use of references and quotation marks).

If my dissertation found to be plagiarized at any point of time, I'll be solely responsible and will be ready to accept any decision taken by the competent authority including rejection of my dissertation.

(Supervisor) (Signature of student)

APPENDIX – I B: ***(A typical Specimen of Certificate)***

For example -

(A typical Specimen of Table of Contents)

<Font Style Times New Roman, Font Size 14>

TABLE OF CONTENTS

ANNEXURE II

Curriculum vitae

<Font Style Times New Roman, Font Size 14>

Personal Details

Name :

Date of birth : DD Month, YYYY

Place of birth :

Nationality : Indian

Permanent Address :

Email Id :

Mobile No. :

Education

M.Sc. (Subject) : YYYY Central University of Haryana, India

B.Sc. (Subject). : YYYY (Name of the University) with …. % of marks

Higher Secondary : YYYY (Name of the board) with …. % of marks

Secondary : YYYY, (Name of the board) with …. % of marks

Course-level Learning Outcomes

The course level learning outcomes have been given in the scheme of syllabus. Depending upon the nature of the course, every course has planned with different learning outcomes.

Teaching-Learning Process

The teaching learning processes incorporate a variety of modes and a regular use of ICT. These are listed below:

1. Classroom Teaching for topics which are intensely information-based. This is a very regular feature of all the courses in Nutrition Biology.

2. PowerPoint slides for topics which involve information related to intricate biological pathways such as metabolic pathways in the human body and microorganisms. Use of PowerPoint presentations are also made whenever the lectures are to be summarized in a crisp and pointwise manner to highlight salient /important conclusions from the topics.

3. Classroom Discussions are a regular feature while teaching. The students are drawn into impromptu discussions by the teacher during the process of teaching.

4. Video Displaying, both real-time and animations, are used for topics which require 3D dimensional viewing of the biological mechanisms to drive the point home. These have proved to be very helpful while teaching concepts of Human Physiology, Nutritional Biochemistry, Metabolomics and Nutrigenomics. These are also used to convey complexities of food allergens, antigen-antibody interactions and generation of antibody diversity during the teaching of Nutrition and Immunity.

5. Model Making is also used especially for understanding and building a perception of the students for the food pyramid, balanced diet, etc.

6. Laboratory Practical are an integral part of every course included in the PG programme in Nutrition Biology. This is also a daily affair for PG students

7.Anthropometric measurements and nutritional deficiency Problem Solving and is encouraged during the laboratory work.

8. Group Activity as well as discussions with the laboratory instructor/ among the students themselves/ Mentor is also encouraged during laboratory work.

9. Project Work is included in the programme where students work individually or in groups to design experiments to solve/answer a problem suggested by the Mentor or identified by the students in consultation with the Mentor. The students are mentored regularly during the duration the project is in progress.

10. Presentations/Seminars by the Students are regularly done. The students are mentored in presentation of data, interpretation of data and articulation with the students/teachers/Research Scholars during their presentation.

11. Presentations by Experts in different specialties of nutritional science are arranged to broaden the horizons of the students.

12. Interaction with subject matter experts (SMEs) is also encouraged during/after presentations to satisfy/ignite curiosities of the students related to developments in the different areas of Nutrition Biology.

13. Visits to Industries/Laboratories/hospitals/social outreach activities related to Food and nutritional sciences like fermentation, food, diagnostics, diet planning, nutritional education and awareness among public, etc. are organized to acquaint the students with real-life working environments of the professional nutritionist with a view to broaden their perspective of the subject of Nutrition Biology.

Blended Learning

As per UGC guidelines 40% of the courses of Nutrition Biology in each semester offered to students in blended mode. Blended Learning is learning that is facilitated by the effective combination of different modes of delivery, models of teaching and styles of learning and applying them in an interactively meaningful learning through a virtual environment. E-Learning is the use of technology to enable students to learn anytime and anywhere. E-Learning can include training, the delivery of just-in-time information and guidance from experts. Video lectures recorded in segments, case studies, reading material, homework, and quizzes are designed in advance and made available for online streaming or download. Students are expected to watch the videos, read the assigned material, and do homework before attending class, online or face-to-face, for discussions with the teacher/instructor or a teaching assistant.

Assessment and Evaluation

It is important that the students of the PG Nutrition Biology program achieve the desired results in terms of the learning outcomes to be professionally sound and competitive in a global society. Achieving the desired learning outcomes is also imperative in terms of job employment leading to a happy and prosperous individual and thereby a happy and prosperous society or nation. The assessment tasks are pivotal to get authentic feedback for the teaching learning process and for mid-course corrections and further improvements in future. The assessment tasks are carried out at various stages of the duration of the programme like regular class assessments, internal assessments, Term-End-Examination/Semester examinations, viva-voce, etc. The assessment tasks are listed below:

1. **Multiple Choice Questions (MCQ)** are one of the predominant form of assessment tasks. This task is used during all kinds of term and semester examinations.

2. **Short-AnswerQuestions** during term and semester examinations are used to assess the ability of the student to convey his thoughts in a coherent way where prioritization of the information in terms of their significance is tested.

3. **Surprise Quizzes** are regularly used during continuous assessment while the teaching learning process is continuing which prepares the student to quickly recall information or quickly analyze a problem and come up with proper solutions.

4. **Visual/Pictorial Quizzes** are used to sharpen the comprehension of the students after looking at all the components of a system.

5. **Impromptu Opinions** on nutrient deficiency, nutritional biomarkers, metabolic databases are sought from students during regular teaching learning which help them to think quickly in a given context. This helps build their ability to come up with solutions to problems which the students might not have confronted previously.

6. **Problem Solving Tasks** are generally given during the laboratory work.

7. **Data Interpretation** is also another assessment task which is used to develop analytical skills of the students. This assessment is used during laboratory work as well as during conduction of project work.

8. **Analytical Skills** are assessed during work related to several experiments like digestive enzyme kinetics, growth of bacteria, mutation frequencies.

9. **Paper/ Project presentations/seminars** are used to assess the articulation skills of the student. These are carried out both during the duration of the teaching learning processes as well as during Term-End-Examinations/Semester.

10. **Report Writing** is used to assess the keenness of the students for details related to nutritional sciences while visiting adopted villages/laboratories / industries as students invariably are required to submit a report after such visits.

11. **Assignment Writing** is used to assess the writing abilities of the students during holidays.

12. **Viva-voce** during the laboratory working hours is used to assess the overall practical/experimental knowledge and intelligence of the students.

Keywords

1. Anthropometric measurements, Nutritional science, clinical biochemistry, diet planning, clinical nutrition, nutritional biomarkers, food microbiology, food fermentation, Food Safety, nutritional education and nutrigenomics
2. LOCF
3. NEP-2020
4. Blended Learning
5. Face to face (F to F) Learning
6. Programme Outcomes
7. Programme Specific Outcomes
8. Course-level Learning Outcomes
9. Postgraduate Attributes
10. Learning Outcome Index
11. Formative Assessment and Evaluation
12. Comprehensive and Continuous Evaluation

Appendices

1. Curricular Reforms— Extracts from National Education Policy-2020

References

2. National Education Policy-2020. https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf
3. The draft subject specific LOCF templates available on UGC website. https://www.ugc.ac.in/ugc_notices.aspx?id=MjY5OQ==
4. Draft Blended Mode of Teaching and Learning: Concept Note available on UGC website. https://www.ugc.ac.in/pdfnews/6100340_Concept-Note-Blended-Mode-of-Teaching-and-Learning.pdf