BANGALORE UNIVERSITY

Course Structure and Curriculum for

Clinical Nutrition and Dietetics – Core Discipline
B.Sc. (Basic) (Hons.) & Integrated M.Sc.

Nutrition and Dietetics (Major)
B.Sc. (Basic) (Hons.) & Integrated M.Sc.

Food Science and Nutrition Major)
B.Sc. (Basic) (Hons.) & Integrated M.Sc.

CHOICE BASED CREDIT SYSTEM (CBCS)

I – X SEMESTERS

Framed According to the National Educational Policy (NEP 2020)

To implement from the Academic Year 2021-2022

PROCEEDINGS OF THE EXPERT COMMITTEE MEETING FOR B.Sc., CLINICAL NUTRITION AND DIETETICS, NUTRITION AND DIETETICS, FOOD SCIENCE AND NUTRITION UNDER NEP HELD ON 24TH SEPTEMBER 2021 AT BOARD ROOM AT PADMASHREE INSTITUTE OF MANAGEMENT AND SCIENCES

Chairman, welcomed the expert committee members for the 1st meeting of 21-22 Chairperson, Expert Committee presented the highlights of the course and also asked the members to deliberate on the courses and content.

Resolutions

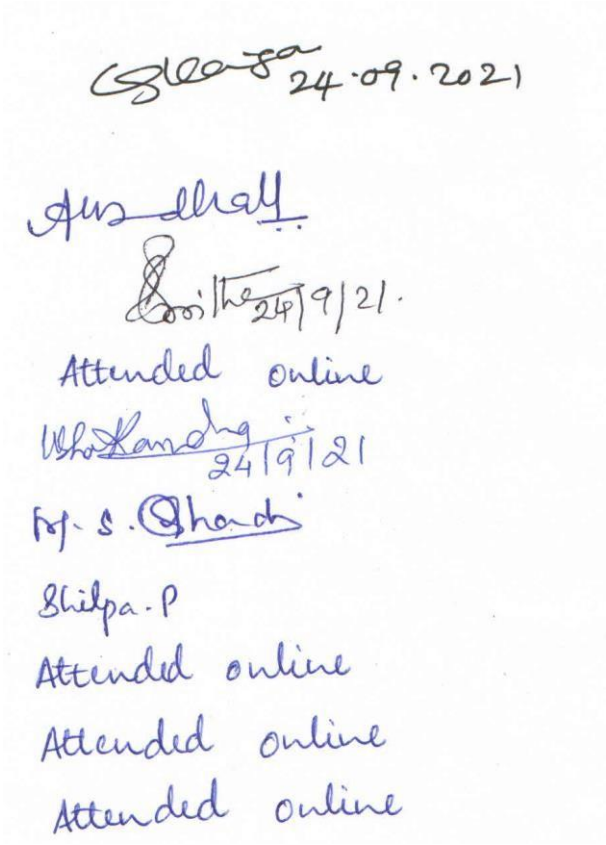
1. The detailed syllabus was framed as per the formats received from KHEC and NEP 2020.
2. The Syllabus framed by the committee for has been thoroughly deliberated andaccepted after corrections.
3. The subjects of study (Theory and Practical), no. of credits, board course structure, entry and exit options, scheme of examination and evaluation The members also suggested to add recent editions of text books and reference books.
4. The course curriculum will be effective from 2021-22 academic year

The meeting concluded with Chairperson thanking all the members for their support and co-operation.

Chairman: Prof. C.S. Karigar,
Dept. of Biochemistry,
Bangalore University, Bengaluru

Members:

1. Dr. Anuradha. M
2. Dr. Savitha. J
3. Dr. Kiran S. Vasist
4. Dr. Usha Ravindra
5. Dr. Saradha Devi M S
6. Dr. Shilpa P
7. Dr. B. Y. Satish Kumar
8. Dr. J. Rajeshwari
9. Dr. Adarsha Gowda



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BANGALORE UNIVERSITY

Syllabus for

Clinical Nutrition and Dietetics
B.Sc. (Basic) (Hons.) & Integrated M.Sc.

CHOICE BASED CREDIT SYSTEM (CBCS)

I – X SEMESTERS

Framed According to the National Educational Policy (NEP 2020)

To implement from the Academic Year 2021-2022

Syllabus for B.Sc., Basic/Hons/Integrated M.Sc. in
Clinical Nutrition and Dietetics

Name of the Degree Program: **B.Sc., Basic/Hons/Integrated P.G**
Discipline Core: **Clinical Nutrition and Dietetics**
Total Credits for the Program: **226**
Starting year of implementation: **2021**

B.Sc., Basic/Hons - Progressive Certificate, Diploma, bachelor's degree or bachelor's degree with Honors Provided at the End of Each Year of Exit of the Four-year Undergraduate Program/ Five-year Integrated Master's Degree Program.

Introduction:

The National Education Policy 2020 focusses on transforming and development of Indian Education system, by providing quality education to all. The objective of a B.Sc. (Honors) program in Clinical Nutrition and Dietetics is to produce competent professionals who deeply understand the essence of nutrition which allows them to personalize information rather than follow every guideline issued for an entire population. Clinical Nutrition takes students on a fascinating journey beginning with curiosity and ending with a solid knowledge base and a healthy dose of skepticism. This program emphasizes the key areas of knowledge that must be understood and the key points of critical thought that must accompany the acquisition of this knowledge. It covers nutritional support, ethics and other aspects on scientific bases. The course emphasizes the role of nutrition as a major modifiable factor in community health and the preventive, promotive and curative role of diet in health. Electives provide add on knowledge which assist in their professional endeavor.

1. Graduate Attributes in B.Sc. (Hons.) CLINICAL NUTRITION AND DIETETICS

After completing Honor's Programme in Clinical Nutrition and Dietetics the following attributes will be fulfilled:

- Equip with latest knowledge in the respective science.
- Create competitive nutritionists in various fields like Exercise, sports nutrition and food service institutions.

- Socially committed nutritional educators in various institutions.
- Gain knowledge on hospital management
- Train on innovative recipe development considering the science of food
- Develop feasible solutions against major nutrition related health issues in the country.
- Gain a deeper understanding of critical conditions and treatment routines
- Familiarize with advancements in the field of diet therapy
- Understand the wider horizons of nutrition as a part of palliative care
- Understand the nutrients in terms of changes during digestion, absorption etc. Familiarize with biochemical aspects in clinical context
- Develop an understanding of biochemical analysis
- Equip and inculcate an interest in research in the field of nutrition.
- Proficiency in lifestyle disease management.
- Develop confidence to handle classes in community through project
- Give opportunity for job experience through hospital internships
- Acquaint with knowledge on emergency life support.
- Independent to access, analyze and plan nutritional management for disease, physiological conditions and special conditions
- Inculcate interest in food service and quality control
- Open a window towards food microbiology
- Train the students the importance of good nutrition in combating the ill effects of metabolic alterations
- Develop deep knowledge about the role of therapeutic nutrition in the diseased conditions of vulnerable groups

AIMS AND OBJECTIVES OF UG PROGRAM IN CLINICAL NUTRITION AND DIETETICS:

The course “Clinical Nutrition and Dietetics” aims at developing basic understanding about nutrition, physiology, its effect on human health and newer advances in therapeutic nutrition. This course encompasses physiology, therapeutic dietetics, community nutrition and discusses relationship between metabolites and human health. Moreover, the course is focused on the advances in the most emerging area of applied science. The knowledge of nutrition in public health, sports, fitness, and importance of nutrition in different disease conditions, which empowers students' knowledge and skills to utilize nutrients as a powerful tool for physical, mental, and social wellbeing. The course also teaches students’ to be entrepreneurs, quality control fellows, at different places of food and nutrition service centers institution.

Meanwhile, students are expected to learn the skill component of his / her choice for 03 years along with other subjects as Generic Electives in the first six semesters in a holistic approach so that students eventually will be able to:

- Understand human physiological process and importance of nutrients in metabolism.
- Demonstrate an understanding of core knowledge in Clinical Nutrition and Dietetics.
- Learn about the assessing nutritional status in community and different health conditions.
- acquire knowledge on how nutrients interact with different drugs and their effect on physiological conditions
- Learn about importance of nutrition in different stages of life, critical care, fitness, exercise.

Name of the Degree Program: B.Sc. Basic., B.Sc. Hons. M.Sc., Clinical and Dietetics
Discipline Core: Clinical Nutrition and Dietetics
Total Credits for the Program: 224
Starting year of implementation: 2021-22

Program Outcomes (PO): By the end of the program the students will be able to -

PO	Program Outcomes
PO1	Understand the basic concepts of food science and nutrition and role of food and nutrients in growth, development, disease prevention and management.
PO2	Explain functions of macro and micronutrients, deficiencies, disorders and identify foods rich in specific nutrients.
PO3	Understand the complex processes of human physiology, metabolism, and human biochemistry with reference to energy and nutrition requirements.
PO4	Competent to implement food safety regulations and create awareness about sanitation, safety, hygiene for individuals, families, and communities.
PO5	Understand food and nutrition security and create awareness to public and communities.
PO6	Evaluate and assess the nutrient requirements of infants, children, and adults.
PO7	Critically analyze nutritional status of different age groups, and design diet plan as per the nutritional requirements.
PO8	Understand the importance of nutrition in lifestyle disorders and derive plan accordingly.
PO9	Apply technical skills, knowledge of nutrition, and decision-making skills, assessing capabilities in evaluating the nutritional status of individuals and communities and their response to nutrition intervention
PO10	Provide nutrition awareness and counseling to individuals, groups, and communities.
PO11	Competence in the skills of Nutritional assessment, Diet planning and Food service management in health-care systems, communities, and institutions
PO12	Shall be able to understand the principles of fitness and nutrition, during various stages of life cycle such as childhood, adolescence and old age and assess and evaluate their dietary and exercise habits.
PO13	Data collection and interpretation in nutrition surveys and critical analysis to resolve complex societal problems
PO14	Maintain ethical, legal, and professional practice standards during nutritional counselling or consultancy and to take leadership roles in fields of health, food research laboratories, dietetics, special nutritional needs, and nutritional counseling.
PO15	Practice and implement state of art nutrition care or consultancy in health food industry, critical care nutrition segments, clinical setups, nutraceutical industry, sports and fitness centers, therapeutic nutrition product manufacturing set ups, geriatric care units, meal/food distribution centers, women and child development organizations, Food auditing set ups, Food testing labs and Food corporations.

Course Content - Certificate course, B.Sc., (Basic) B.Sc., (Hons) and M.Sc.

Semester	Course code.	Course Category	Theory/ Practical	Credits	Paper Title	Marks	
						S. A	I.A
1.	CNDT 1.1	DSC- 1	Theory	3	Fundamentals of Nutrition	60	40
	CNDP 1.1		Practical	2	Fundamentals of Nutrition	30	20
	CNDT 1.2	DSC- 2	Theory	3	Essentials of Macronutrients	60	40
	CNDP 1.2		Practical	2	Essentials of Macronutrients	30	20
	CNDT 1.3	DSC- 3	Theory	3	Food Sanitation and Hygiene	60	40
	CNDT 1.4	OE - 1	Theory	3	Fundamentals of Food and Health/Health lifestyle and Nutrition	60	40
2.	CNDT 2.1	DSC - 4	Theory	3	Human Physiology	60	40
	CNDP 2.1		Practical	2	Human Physiology	30	20
	CNDT 2.2	DSC- 5	Theory	3	Essentials of Micronutrients	60	40
	CNDP 2.2		Practical	2	Essentials of Micronutrients	30	20
	CNDT 2.3	DSC- 6	Theory	3	Food Safety and Security	60	40
	CNDT 2.4	OE- 2	Theory	3	Food safety and hygiene /Food adulteration	60	40
3.	CNDT 3.1	DSC- 7	Theory	3	Life Cycle nutrition	60	40
	CNDP 3.1		Practical	2	Life Cycle nutrition	30	20
	CNDT 3.2	DSC- 8	Theory	3	Dietetics I	60	40
	CNDT 3.2		Practical	2	Dietetics I	30	20
	CNDT 3.3	DSC- 9	Theory	3	Nutritional biochemistry	60	40
	CNDT 3.4	OE- 3	Theory	3	Nutritional assessment/Traditional foods in health	60	40
4.	CNDT 4.1	DSC- 10	Theory	3	Dietetics II	60	40
	CNDP 4.1		Practical	2	Dietetics II	30	20
	CNDT 4.2	DSC- 11	Theory	3	Community Nutrition	60	40
	CNDP 4.2		Practical	2	Community Nutrition	30	20
	CNDT 4.3	DSC- 12	Theory	3	Nutrition in Physical Fitness	60	40
	CNDT 4.4	OE- 4	Theory	3	Nutrition in weight management/Diet in lifestyle disorders	60	40

5	CNDT 5.1	DSC- 13	Theory	3	Dietetics III	60	40
	CNDP 5.1		Practical	2	Dietetics III	30	20
	CNDT 5.2	DSC- 14	Theory	3	Food Science	60	40
	CNDP 5.2		Practical	2	Food Science	30	20
	CNDT 5.3	DSC- 15	Theory	3	Functional Foods	60	40
	CNDT 5.5	DSE- 1	Theory	3	Food microbiology	60	40
	CNDT 5.4	VOC - 1	Theory	3	Food entrepreneurship	60	40
6.	CNDT 6.1	DSC- 16	Theory	3	Dietetics IV	60	40
	CNDP 6.1		Practical	2	Dietetics IV	30	20
	CNDT 6.2	DSC- 17	Theory	3	Institutional Food Service Management	60	40
	CNDP 6.2		Practical	2	Institutional Food Service Management	30	20
	CNDT 6.3	DSC- 18	Theory	3	Nutrition education and Counselling	60	40
	CNDT 6.4	DSE- 2	Theory	3	Diabetes management	60	40
	CNDT 6.5	VOC - 2	Theory	3	Clinical case studies	60	40
Exit Option with Bachelor of Science in Clinical Nutrition and Dietetics							
7.	CNDT 7.1	DSC- 19	Theory	3	Human nutrition I	60	40
	CNDP 7.1		Practical	2	Human nutrition I	30	20
	CNDT 7.2	DSC- 20	Theory	3	Medical Nutrition Therapy I	60	40
	CNDP 7.2		Practical	2	Medical Nutrition Therapy I	30	20
	CNDT 7.3		Internship	3	Internship	60	40
	CNDT 7.4	DSE- 3	Theory	3	Foods in Indian Tradition	60	40
	CNDT 7.5	VOC - 3	Theory	3	Nutritional communication	60	40
	CNDT 7.6		Theory	3	Research Methodology	60	40
8.	CNDT 8.1	DSC- 21	Theory	3	Human Nutrition- II	60	40
	CNDT 8.2	DSC- 22	Theory	3	Nutrition in critical care	60	40
	CNDT 8.3	DSE- 4	Theory	3	Food additives and adulterants	60	40
	CNDT 8.4	VOC- 4	Theory	3	Therapeutic Food Product development	60	40
	CNDT 8.5		Research Project/ Theory – 2	6	Research Project	120	80

					Advanced Dietetics	60	40
					Advanced Food Science	60	40
Award of Bachelor of Science in Clinical Nutrition and Dietetics with Honors							
9.	CNDT 9.1	DSC- 23	Theory	3	Medical nutrition therapy II	60	40
	CNDP 9.1		Practical	2	Medical nutrition therapy II	60	40
	CNDT 9.2	DSC- 24	Theory	3	Public Health nutrition	60	40
	CNDP 9.2		Practical	2	Public Health nutrition	30	20
	CNDT 9.3	Field Study	Field study	2	Field study	30	20
	CNDT 9.4	DSE- 5	Theory	3	Nutritional Psychology	30	20
	CNDT 9.5	VOC - 5	Vocational	3	Nutrition for women	60	40
	CNDT 9.6		Theory	3	Nutraceuticals and Dietary Supplements	60	40
10.	CNDT 10.1	DSC -25	Theory	4	Sports Nutrition	60	40
	CNDT 10.1	DSC- 26	Theory	3	Nutrition in major Emergencies	60	40
	CNDT 10.3	DSE- 6	Theory	3	Paediatric and Geriatric nutrition	60	40
	CNDP 10.4	VOC- 6	Practical	2	Nutritional management in Lifestyle disorders	30	20
	CND 10.5	Dissertation /Research Project	Dissertation /Research Project	6	Dissertation/Research Project	120	80
Award of Post Graduate degree in Clinical Nutrition and Dietetics							

Assessment:

Weightage for assessments (in percentage)

Type of Course	**Formative Assessment / IA**	**Summative Assessment**
Theory	**40**	**60**
Practical	**20**	**30**
Projects	**40**	**60**
Experiential Learning (Internships etc.)	**40**	**60**

IC. Model Program Structure for the Undergraduate Programs in Universities and Colleges in Karnataka

Bachelor of Science (Basic/Hons) with Clinical Nutrition and Dietetics as core subject

Semester	Discipline Core (DSC) (Credits)(L+T+P)	Discipline Elective (DSE)/Open Elective (OE)(Credits)(L+T+P)	Ability Enhancement compulsory Courses (ACC), Language (Credits) (L+T+P)		Skill Enhancement Courses (SEC)			Total Credits
					Skill based (Credits) (L+T+P)	Value based (Credits) (L+T+P)		
I	CND C1- Fundamentals of Nutrition (3+2) CND C2- Essentials of Macronutrients (3+2) CND C3- Food Sanitation, Hygiene (3)	OE-1(3) Fundamentals of Food and Health/Health lifestyle and Nutrition	L1- 1(3), L2- 1(3) (3+1+0 each)		SEC-1: Nutrition and Health Communication (2) (1+0+2)	Physical education- Yoga (1) (0+0+2)	Health & wellness (1) (0+0+2)	26
II	CND C4- Human Physiology (3+2) CND C5- Essentials of Micronutrients (3+2) CND C6- Food Safety and Food Security (3)	OE-2(3) Food safety and Hygiene /Food Adulteration	L1-2(3), L2- 2(3) (3+1+0 each)	Environmental studies (2)		Physical education- Sports (1) (0+0+2)	NCC/NSS/R&R(S& G)/ Cultural (1) (0+0+2)	26
Exit option with Certificate in Clinical Nutrition and Dietetics (52 credits)								

III	CND C7- Life Cycle nutrition (3+2) CND C8- Dietetics – I (3+2) CND C9- Nutritional biochemistry (3)	OE-3 (3) Nutritional Assessment/Traditional Foods in Health	L1-3(3), L2-3(3) (3+1+0 each)		SEC-2: Fitness Nutrition (2) (1+0+2)	Physical education-Sports (1) (0+0+2)	NCC/NSS/R&R(S&G)/ Cultural (1) (0+0+2)	26
IV	CND C10- Dietetics II (3+2) CND C11- Community Nutrition (3+2) CND C12- Nutrition in Physical Fitness (3)	OE-4 (3) Nutrition in Weight Management / Diet in Lifestyle Disorders	L1-3(3), L2- 3(3) (3+1+0 each)	Constitution of India (2)		Physical education-Sports (1) (0+0+2)	NCC/NSS/R&R(S&G)/ Cultural (1) (0+0+2)	26
Exit option with Diploma in Clinical Nutrition and Dietetics (100 credits)								
V	CND C13- Dietetics III (3+2) CND C14- Food Science (3+2) CND C15- Functional Foods (3)	CND E- 1- Drug Nutrient Interaction (3) Vocational – 1 (3) Food entrepreneurship (2)			SEC- 3: Nutrition and Diet Counselling (2) (1+0+2)	Physical education-Sports (1) (0+0+2)	NCC/NSS/R&R(S&G)/ Cultural (1) (0+0+2)	23
VI	CND C16- Dietetics IV (3+2) CND- C17- Institutional Food Service Management (3+2) CND C18- Nutrition education and Counselling (3)	CND E-2 Dietary Supplements and Nutraceuticals (3) Vocational – 2 (3) Diabetes Educator (2)			SEC- 4: Food Service management in hospital setup (2) (1+0+2)	Physical education-Sports (1) (0+0+2)	NCC/NSS/R&R(S&G)/ Cultural (1) (0+0+2)	23
Exit Option with Bachelor of Science in Clinical Nutrition and Dietetics (144 credits)								
VII	CNDC19-Human nutrition I (3+2)	CND E-3 Nutrigenomics (3)						21

	CNDC20- Medical Nutrition Therapy I(3+2), Internship (2)	Vocational 3 - Sports Nutrition (3) Research Methodology (3)				
VIII	CND C21- Human Nutrition II (3+2) CND C22- Medical Nutrition Therapy II (3)	CND E-4 Food Intolerance & Allergies (3) Vocational 4 – Therapeutic food product development (3) Research Project (6)				20
	Award of Bachelor of Science Honors, B.Sc. (Hons) degree in Clinical Nutrition and Dietetics (185 credits)					
IX	CND C23- Nutrition in Critical Care I (3+2) CND C24- Public Health Nutrition (3+2) Internship (2)	CND E-5 Nutrition Psychology (3) Vocational 5- Nutritional assessment in hospitals (3) Field study (3)				21
X	CND C25- Sports Nutrition (3+2) CND C26- Nutrition in Emergencies (3)	CND E-6 Nutritional Assessment in Lifestyle disorders (3) Vocational 6 – Pediatric and Geriatric nutrition (3) Hospital internship (6)				20
Award of Master of Science in Clinical Nutrition and Dietetics (226 credits)						

*In lieu of the research project, two additional elective papers /Internship may be offered

Curriculum Structure for Clinical Nutrition and Dietetics
BSc (Basic), (Hons.) and PG

Total Credits for the Program: 224 **Starting year of implementation: 2021-22**
Name of the Degree Program: B. Sc
Discipline/Subject: Clinical Nutrition and Dietetics

Program Articulation Matrix:
This matrix lists only the core courses. Core courses are essential to earn the degree in that discipline/subject. They include courses such as theory, laboratory, project, internships etc. Elective courses may be listed separately

Sem.	Title /Name of the course	Program outcomes that the course addresses	Pre-requisite course(s)	Pedagogy##	Assessment$
1	Fundamentals of Nutrition	PO1	PUC/ 10+2 with Chemistry or Biology as one optional	Seminar presentation Quiz	Seminar report MCQ marks
	Essentials of Macronutrients	PO1, PO2		Seminar presentation Planning innovative recipes, Low-cost innovative recipes	Seminar report Marks for recipes
	Food Sanitation, Hygiene	PO4		Field study in community Visits Awareness programs	Reports for Field study Reports for Visits Reports for Awareness programs
2	Human Physiology	PO3		Seminar and Poster presentation Model making	Reports for Seminar presentation

					Reports for Poster presentation
	Essentials of Micronutrients	PO2		Seminar presentation, Quiz Low-cost innovative recipes	Seminar report Marks for recipes
	Food Safety and Security	PO4, PO5		Visits to fair price shops Visits to institutes, Debate Awareness programs	Report for visits Report for Awareness programs
3	Life Cycle Nutrition	PO1, PO7		Diet planning, Survey, Case study	Report for survey
	Dietetics I	PO8		Case study, Visits to hospitals dietary department, Nutrition club	Reports for visits Nutrition club activities
	Nutritional Biochemistry	PO3		Exhibitions, Model making Poster presentation	Report for Poster presentation Report for participating in Exhibitions
4	Dietetics II	PO8, PO9		Visits to hospitals, Visits to fitness centres, Debate	Reports for visits
	Community Nutrition	PO7, PO9		Visits to aganwadis schools, PHCs Assessment of nutritional status	Report
	Nutrition in Physical Fitness	PO12		Visits to fitness centres, sports club and Seminar presentation	Reports for visits Seminar report
5	Dietetics III	PO9		Visits to hospitals, Diet planning for different disease case studies Debate	Reports for visits
	Food Science	PO14		Food fest, Innovative recipes Visits to food research laboratories	Report for visits
	Functional Foods	PO14, PO15		Food product development using nutraceuticals, Visits to dietary supplements, Manufacturing unit	Reports for visit

6	Dietetics IV	PO11, PO12		Diet planning, Questionnaire preparations for Counselling based on case studies	Reports for case studies
	Institutional Food Service Management	PO13, PO14		Visits to dietary department, Visits to food catering units	Reports for visits
	Nutrition education and Counselling	PO13, PO15		Questionnaire preparations for Counselling based on case studies Survey on nutritional status	Reports for case studies Survey report
7	Human Nutrition I	PO5, PO2, PO6		Diet planning for different age groups, Survey on dietary pattern	Reports for survey
	Medical Nutrition Therapy I	PO13, PO15		Planning of therapeutic diets Case studies	Reports for Case studies
8	Human Nutrition II	PO6, PO7		Seminar presentation Visits to hospitals, Dietary department	Seminar Report Report for visits
	Medical Nutrition Therapy II	PO13 PO14		Planning of therapeutic diets Case studies, Visit to intensive care unit in hospitals	Reports for Case studies
9	Nutrition in Critical Care I	PO13		Planning diets for Critical Care Assessment of nutritional status for case studies in Critical Care	Reports on nutritional status for case studies
	Public Health Nutrition	PO9, PO5, PO11		Visits to aganwadis, PHCs, schools in rural areas. Assessment of nutritional status in children and women. Awareness programs – posters, charts, etc.,	Reports for visits
10	Sports Nutrition	PO14, PO15		Visits to sports academies, Visits to fitness centers, Planning diets for athletes	Report for visits
	Nutrition in major emergencies	PO1, PO14		Visits to disaster management institute, Planning nutritious low-cost recipes	Reports for visits

Pedagogy for student engagement is predominantly lectures. However, other pedagogies enhancing better student engagement to be recommended for each course. The list includes active learning/ course projects/ problem or project-based learning/ case studies/ self-study like seminar, term paper or MOOC

$ Every course needs to include assessment for higher order thinking skills (Applying/ Analyzing/ Evaluating/ Creating). However, this column may contain alternate assessment methods that help formative assessment (i.e., assessment for learning).

CLINICAL NUTRITION AND DIETETICS

SEMESTER 1

Course Title: FUNDAMENTALS OF NUTRITION (DSE 1)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s): PUC/ 10+2 (with chemistry or biology as one optional)

Course Outcomes (COs): At the end of the course the student should be able to:

1. To understand the guidelines of diet requirements
2. To learn about different methods and principle of cooking
3. To understand the role of macro nutrients in human nutrition
4. To understand their physiological functions, requirements, and sources of macro nutrients
5. To acquire knowledge on food sanitation and hygiene
6. To understand food laws and food regulations

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
To understand food laws and food regulations	✓														
To understand the guidelines of diet requirements	✓														
To learn about different methods and principle of cooking	✓														
To understand the role of macro nutrients in human nutrition	✓	✓													
To understand their physiological functions, requirements, and sources of macro nutrients	✓	✓													
To acquire knowledge on food sanitation and hygiene				✓											

Note: Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark = √ in the intersection cell if a course outcome addresses a particular program outcome.

B.Sc., CLINICAL NUTRITION AND DIETETICS

SEMESTER 1

Course Title: FUNDAMENTALS OF NUTRITION (DSC-1)

Course Title: FUNDAMENTALS OF NUTRITION (DSC- 1)	
Total Contact Hours: 45	Course Credits: 3+2
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**45 Hours**
Unit –1 INTRODUCTION	**15 Hours**
Understanding terminologies: Food, nutrition, health, nutrients, nutritional status, malnutrition-under nutrition over nutrition and optimum nutrition, diet, diet therapy, therapeutic nutrition, kilocalorie, joule, diet diversity, body mass index, daily values, nutrient density. Methods of determining human nutrient need. **Food and nutrient requirements:** Guidelines and Recommendations, development of National Nutritional Requirements, translation of nutritional requirements into Dietary Guidelines. food group system, functions of food Physiological, Psychological and Social factors affecting food intake and food habits, Recommended Dietary allowance (RDA), General Principles of Deriving RDA, Use of Recommended Dietary Allowances (RDAs), Limitations of RDAs, Balanced diet, use of Food exchange list. Food pyramid, my plate, basic of menu planning for family.	
Unit – 2 ENERGY	**15 Hours**

Definition, units of energy, energy value of food. Components of energy requirement, factors affecting energy requirements, methods of measuring energy expenditure. RMR, Physical Activity Level (PAL), BMR, factors affecting B.M.R, determination of BMR by calculation (Harris Benedict). Energy needs of the body (reference man and reference woman), Energy requirement during work, thermic effect of food, SDA. Human body composition – Methods of assessment (direct and indirect), Changes in body composition during life cycle. Factors affecting body composition: body weight and physical activity	
Unit – 3 FOOD PREPARATION AND HEALTH	**15 Hours**
Selection of foods, preliminary preparation of food, principles of cooking, methods of cooking - Boiling, Steaming, Pressure cooking, Microwave oven, Frying (shallow, deep fat), Smoking point of oil, Combination method, methods of cooking: advantages and disadvantages. Effect of cooking on nutritive value, methods of enhancing nutritive value Nutrition and Health- Inter-relationship between food, nutrition, and health. Food choices – nutrients and nourishment, cognitive and environmental influences. Nutrient and food guides for health promotion. Balanced diet- definitions and its Importance	

Practical – 2 Credits

FUNDAMENTALS OF NUTRITION – PRACTICAL 60 Hours

1. Identification of foods under four food groups.
2. Calculation of Glycaemic index in foods
3. Weights and measures of common foods - (Raw and Cooked weight)
4. Cooking methods - Preparing a recipe by Boiling & steaming
5. Cooking methods - Preparing a recipe by Pressure cooking and Microwave
6. Cooking methods - Preparing a recipe by Frying (shallow, deep fat), Smoking point of oil and combination method
7. Calculation of energy requirement for an adult man and a woman and children
8. Anthropometric Measurement - Height, weight, skinfold thickness, Mid - upper arm circumference.
9. Comparison and interpretation of the nutritional assessment data and its significance - body Mass Index (BMI), fat mass, Waist - Hip Ratio (WHR).
10. Estimation of food and nutrient intake - 24 hours dietary recall, food frequency
11. Proximate analysis of foods.

References:

1. Mudambi S R and Rajagopal M V, *Fundamentals of Foods, nutrition & Diet therapy*, New Age International Publishers, 6th Edition. 2020
2. Bamji, M.S, *Textbook of Human Nutrition,* Oxford & IBH Publishing Co Pvt. Ltd,4th Edition. 2019
3. Srilakshmi B, *Dietetics*, New Age International Publishers, 8th Edition. 2019
4. Swaminathan, M, Handbook of Food and Nutrition, The Bangalore Press, 5th Edition. 2018
5. Sunetra Roday, *Food Science and Nutrition,* Oxford university Press, 3rd Edition. 2018
6. Srilakshmi B, *Nutrition Science,* New Age International Publishers, 6th Edition. 2017
7. Shubhangaini A Joshi, *Nutrition and Dietetics*, McGraw-Hill, 4th Edition. 2017
8. Williams, *Basic nutrition and Diet therapy*, Elsevier India, 1st South Asia Edition. 2016
9. Carolyn D. Berdanier; Johanna T. Dwyer; David Heber , *Handbook of Nutrition and Food,* 3rd Edition.2014
10. Gibney M.J, *Nutrition and Metabolism,* Wiley- Blackwell, 2003
11. Emma. S. Weigley, *Robinson's Basic Nutrition and Diet Therapy*, Pearson publication, 1st Edition. 1996

B.Sc., CLINICAL NUTRITION AND DIETETICS

SEMESTER 1

Title of the Course: ESSENTIALS OF MACRO NUTRIENTS (DSC- 2)

Course Title: ESSENTIALS OF MACRO NUTRIENTS (DSC- 2)	
Total Contact Hours: 45	Course Credits: 3+2
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s): PUC/ 10+2 (with chemistry or biology as one optional)

Course Outcomes (COs): At the end of the course the student should be able to:

1. Understand significance of Macro nutrients in the diet
2. Understand their physiological functions, requirements, and sources of macro nutrients
3. Assessment of Macronutrients
4. To learn about the relationship between nutrients and health

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Understand significance of Macro nutrients in the diet	✓	✓				✓									
Understand their physiological functions, requirements, and sources of macro nutrients	✓	✓				✓									
Assessment of Macronutrients	✓	✓				✓									
To learn about the relationship between nutrients and health	✓	✓				✓									

B.Sc., CLINICAL NUTRITION AND DIETETICS

SEMESTER 1

Title of the Course: ESSENTIALS OF MACRO NUTRIENTS

Course Title: ESSENTIALS OF MACRO NUTRIENTS (DSC- 2)	
Total Contact Hours: 45	Course Credits: 3+2
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**45 Hours**
Unit –1 CARBOHYDRATES	**15 Hours**
Composition, classification, digestion, absorption and metabolism, Functions, Sources and Requirements, excess and deficiencies. Dietary fiber – definition, classification, sources, role of fiber in Nutrition. Resistant starch, fructo-oligosaccharides, other oligosaccharides: Chemical composition and physiological significance. Glycemic Index and glycemic load. Review of nutritional significance of carbohydrates and changing trends in dietary intake of different types of carbohydrates and their implications.	
Unit – 2 PROTEINS	**15 Hours**
Composition, classification of proteins and amino-acids, functions, digestion, absorption and metabolism, Requirements and Sources, Effect of deficiency. Assessment of Protein quality. BV, PER, NPU and chemical score.	
Unit – 3 LIPIDS	**15 Hours**
Classification, functions, digestion, absorption and metabolism, Sources and Requirements - SFA, MUFA, PUFA: functions and deficiency, Role of n-3 and n-6 fatty acids, Trans Fatty Acids, dietary guidelines (International and National) for visible and invisible fats in diets.	

Practical – 2 Credits

1. Planning and preparation of energy dense recipes
2. Planning and preparation of low energy recipes
3. Planning and Preparation of low Glycemic index recipes, Calculation of Glycemic index and Glycemic load
4. Planning and preparation of high & low fiber recipes
5. Planning and preparation of protein dense recipes
6. Planning and preparation of low protein recipes
7. Planning and preparation of n-3 and n-6 rich recipes
8. Qualitative analysis of carbohydrates
9. Qualitative analysis of Amino acids
10. Estimation of carbohydrate by DNS method
11. Estimation of protein by Lowry's method

References:

1. Mudambi S R and Rajagopal M V, *Fundamentals of Foods, nutrition & Diet therapy,* New Age International Publishers, 6th Edition. 2020
2. Bamji, M.S, *Textbook of Human Nutrition,* Oxford & IBH Publishing Co Pvt. Ltd,4th Edition. 2019
3. Srilakshmi B, *Dietetics*, New Age International Publishers, 8th Edition. 2019
4. Swaminathan, M, *Handbook of Food and Nutrition*, The Bangalore Press, 5th Edition. 2018
5. Srilakshmi B, *Nutrition Science*, New Age International Publishers, 6th Edition. 2017
6. Longvah T Anathan R, Bhaskarachary K, and Venkaiah k, *Indian food composition table*, NIN.ICMR, 2nd Edition. 2017
7. Gibney M.J, *Nutrition and Metabolism*, Wiley- Blackwell, 2003
8. Carolyn D. Berdanier, *Advanced Nutrition, Macronutrients,* CRC press, 2nd Edition.2000
9. Emma. S. Weigley, *Robinson's Basic Nutrition and Diet Therapy*, Pearson publication, 1st Edition. 1996

B.Sc., CLINICAL NUTRITION AND DIETETICS

SEMESTER 1

Title of the Course: FOOD SANITATION AND HYGYEINE (DSC-3)

Course Title: FOOD SANITATION AND HYGYEINE (DSC-3)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s): PUC/ 10+2 (with chemistry or biology as one optional)

Course Outcomes (COs): At the end of the course the student should be able to:

1. Understand importance of food hygiene
2. Understand the procedure for cleaning and sanitation
3. Demonstrate proper personal hygiene procedure for food handlers
4. Importance of food safety training in the workplace

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Understand the importance of food hygiene	✓														
Understand the procedure for cleaning and sanitation	✓														
Demonstrate proper personal hygiene procedure for food handlers				✓											
Importance of food safety training in the workplace				✓	✓										

B.Sc., CLINICAL NUTRITION AND DIETETICS

SEMESTER 1

Title of the Course: FOOD SANITATION & HYGIENE (DSC-3)

Course Title: FOOD SANITATION AND HYGYEINE (DSC-3)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**45 Hours**
Unit –1 INTRODUCTION	**15 Hours**
Terminologies – Sanitation, hygiene, food safety, food sanitation, contamination, food spoilage, danger zone. Significance of sanitation in food catering units, hospital kitchens, food handlers. FSSAI: Safe food handling and hygiene practices - guidelines. Introduction - Serving safe food, food borne illnesses, preventing food borne illnesses, key practices for ensuring food sanitation. Personal hygiene - importance, sanitary habits, and practices, use of protective clothing during food preparation in large establishments.	
Unit – 2 PURCHASE AND HYGIENE	**15 Hours**
Purchasing and Storage - Choosing a supplier, Inspection Procedures, Receiving and Inspecting Specific Food, Storage - General Storage Guidelines, Types of Storage, storing specific food, storage techniques - dry food storage, refrigerated storage, freezer storage. Hygiene in Service - Hygiene procedures in food preparation, holding and display food for service, serving food safely, off-site services, hot holding of foods, Safe use of left - over food, hygiene in food service, protective display of food. Storage and disposal of waste – Classification of waste, methods of disposal.	
Unit – 3 CLEANING AND SANITATION	**15 Hours**

Cleaning and Sanitation - Sanitation Standards for Equipment, installing and maintaining kitchen equipment, Cleaning and Sanitizing - Cleaning vs. Sanitizing, machine dishwashing, manual dishwashing, sanitizing food contact surfaces, cleaning the Premises, storing utensils, tableware, and equipment, using cleaning agents, developing a cleaning Program. Pest control methods and its importance.	

References

1. Roday. S, *Food Hygiene and Sanitation*, McGraw-Hill, 2nd Edition. 2017
2. Lawley, R., Curtis L. and Davis, J, *The Food Safety Hazard Guidebook*, RSC publishing, 2015
3. Y. H. Hui, *Plant sanitation for Food processing and Food service*, CRC Press, 2nd Edition.2015.
4. Pierre-Jean Raugel, *Rapid Food Analysis and Hygiene Monitoring*, Springer, 2012
5. Mario Stanga, *Sanitation: Cleaning and Disinfection in the Food Industry*, Wiley, 2010.
6. Norman G. Marriott, *Principles of sanitation*, Springer, 5th Edition. 2010.
7. H. L. M. Lelieveld et.al., *Hygiene in Food Processing: Principles and Practice*s, Woodhead Publishing series, 2003.
8. Y. H. Hui, L. Bernard Bruinsma, J. Richard Gorham, Wai-Kit Nip, Phillip S. Tong, Phil Ventresca, *Food Plant Sanitation*, CRC Press, 2002.
9. De Vries, *Food Safety and Toxicity*, CRC Press, 1996
10. Richard Hayes, *Food Microbiology and Hygiene*, Springer, 2nd Edition. 1995

B.Sc., CLINICAL NUTRITION AND DIETETICS

SEMESTER 1

Title of the Course: FUNDAMENTALS OF FOOD & HEALTH (OE-1)

Course Title: FUNDAMENTALS OF FOOD AND HEALTH (OE-1)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Outcomes (COs):

1. Gain knowledge on key nutrients and their implications on health
2. Familiarize with the concept of health and issues of public health concern
3. Understand the effect of novel and processed foods on general health and well being

Course Articulation Matrix:

Course Outcomes (COs)/ Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Gain knowledge on key nutrients and their implications on health	✓	✓										
Understand the effect of novel and processed foods on general health and well being	✓	✓										
Familiarize with the concept of health and issues of public health concern	✓	✓										

B.Sc., CLINICAL NUTRITION AND DIETETICS

SEMESTER 1

Title of the Course: FUNDAMENTALS OF FOOD & HEALTH(OE-1)

Course Title: FUNDAMENTALS OF FOOD AND HEALTH (OE-1)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**45 Hours**
Unit – 1 OVERVIEW OF FOOD & MACRONUTRIENTS	**15 hours**
Overview of Food & Nutrients, Food choice and factors influencing food choice Classification of nutrients – macronutrients and micronutrients. Energy, Carbohydrates, Protein and Fats Classification, Functions and Sources Impact of macronutrients on health – Deficiency and Excess.	
Unit - 2 MICRONUTRIENTS & WATER	**15 hours**
Micronutrients - Classification, Functions and Sources in detail, Impact of micronutrients on health – Deficiency and Excess, Water –Types, Role, Distribution of water in Body, Body fluids and electrolytes. Regulation of Water and Electrolyte balance and its imbalance	
Unit – 3 COMPONENTS OF HEALTH	**15 hours**
Health – Definition, Components, Factors influencing health, Dietary guidelines Issues of public concern, Malnutrition, Anemia, Vitamin A deficiency, Obesity, Diabetes and Hypertension. Functional foods – Probiotics, prebiotics and phytochemicals, Health supplements, processed foods, organic foods, Nutrition label – understanding and importance	

References:

1. Mudambi S R and Rajagopal M V, *Fundamentals of Foods, nutrition & Diet therapy*, New Age International Publishers, 6th Edition. 2020
2. Bamji, M.S, *Textbook of Human Nutrition*, Oxford & IBH Publishing Co Pvt. Ltd,4th Edition. 2019
3. Srilakshmi B, *Dietetics*, New Age International Publishers, 8th Edition. 2019
4. Swaminathan, M, Handbook of Food and Nutrition, The Bangalore Press, 5th Edition. 2018
5. Srilakshmi B, *Nutrition Science*, New Age International Publishers, 6th Edition. 2017
6. Longvah T Anathan R, Bhaskarachary K, and Venkaiah k, *Indian food composition table*, NIN.ICMR, 2nd Edition. 2017
7. Gibney M.J, *Nutrition and Metabolism*, Wiley- Blackwell, 2003
8. Carolyn D. Berdanier, *Advanced Nutrition, Macronutrients*, CRC press, 2nd Edition.2000
9. Emma. S. Weigley, *Robinson's Basic Nutrition and Diet Therapy*, Pearson publication, 1st Edition. 1996

B.Sc., CLINICAL NUTRITION ND DIETETICS

SEMESTER 1

Title of the Course: Healthy lifestyles and Nutrition (OE- 1)

Course Title: Healthy lifestyles and Nutrition (OE- 1)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 03Hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s): Students who have passed Pre-University Board of Examination or Equivalent board with science subjects are eligible for the undergraduate degree B.Sc., in Food Science and Nutrition.

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Gain knowledge on healthy life styles
2. Understand the relationship between different nutrients and their importance
3. Understand the importance of Nutrition in Lifestyle disorders

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Gain knowledge on Healthy Life styles	✓	✓										
Understand the relationship between different nutrients and their importance	✓											
Understand the importance of Nutrition in Lifestyle disorders						✓		✓				

B.Sc., CLINICAL NUTRITION ND DIETETICS

SEMESTER 1

Title of the Course: HEALTHY LIFE STYLE AND NUTRITION (OE-1)

Course Title: Healthy lifestyles and Nutrition (OE- 1)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 03Hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**45 Hours**
Unit – 1 INTRODUCTION TO FOOD AND NUTRITION	**15 Hours**
History of nutrition, Relationship of food and health, Factors influencing food intake & food habits: Physiologic, Factors that determine food intake, Environmental & behavioral factors influencing food acceptance Energy and macronutrients – Carbohydrates, Protein, Fat - functions, sources deficiency disorders and recommended intakes. Micronutrients: Minerals – calcium, Iron, Iodine, and other elements, Vitamins – Fat Soluble & Water Soluble.	
Unit – 2 NUTRITION FOR LIFE CYCLE	**15 Hours**
Nutritional assessment - direct and indirect methods, Nutritional requirements for pregnancy and lactation, Nutritional requirements for growing children, Nutritional requirements for adult and elderly.	
Unit – 3 PLANNING OF DIET	**15 Hours**
Basic principles of planning diet, Dietary guides and balanced diets**.** Principles of planning a normal diet: characteristics of a normal diet, meeting nutrient requirements of individuals and family. Use of Dietary guidelines for Indians. Objectives of diet therapy- Regular diet and rationale for modifications in energy and other nutrients, texture, fluid, soft diets etc. Nutrition for health and fitness- Role of nutrition in fitness, Nutritional guidelines for health and fitness, Nutritional supplements, Importance and benefits of physical activity.	

References:

1. Mudambi S R and Rajagopal M V, *Fundamentals of Foods, nutrition & Diet therapy*, New Age International Publishers, 6th Edition. 2020
2. Manay & Shadakshara Swamy, *Food facts & principles*, New Age International Publication, 2020
3. Swaminathan, M, Handbook of Food and Nutrition, The Bangalore Press, 5th Edition. 2018
4. Srilakshmi B, *Nutrition Science*, New Age International Publishers, 6th Edition. 2017
5. Chadha R and Mathur P eds. *Nutrition: A Lifecycle Approach*, Orient Blackswan, New Delhi. 2015
6. Carolyn D. Berdanier; Johanna T. Dwyer; David Heber , *Handbook of Nutrition and Food*, 3rd Edition.2014
7. Barbara A. Bowmaw and Robert M. Russell, *Nutrition*, ILSI press, 9th Edition. 2008.
8. C. Gopalan, B.V. Ramasastri and S.G. Balasubramaniam, *Nutritive value of Indian foods*, NIN, ICMR, 2007.
9. Gibney M.J, *Nutrition and Metabolism*, Wiley- Blackwell, 2003

B.Sc., CLINICAL NUTRITION AND DIETETICS

SEMESTER 2

Title of the course: HUMAN PHYSIOLOGY (DSC – 4)

Course Title: HUMAN PHYSIOLOGY (DSC – 4)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s): PUC/ 10+2 (with chemistry or biology as one optional)

Course Outcomes (COs):

At the end of the course the student should be able to:

1. To gain elementary knowledge of functions of organ systems in the human body.
2. To learn about the physiological functions, sources, requirements, micronutrients and its deficiencies
3. To understand the concept of water balance and the function of electrolytes in human nutrition
4. To understand the major nutritional problems in populations
5. To study the different programs and interventions for improving nutritional status.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
To gain elementary knowledge of functions of organ systems in the human body			✓												
To learn about the physiological functions, sources, requirements, micronutrients and its deficiencies		✓													
To understand the concept of water balance and the function of electrolytes in human nutrition		✓													
To understand the major nutritional problems in populations				✓	✓										
To study the different programs and interventions for improving nutritional status				✓	✓										

B.Sc., CLINICAL NUTRITION AND DIETETICS

SEMESTER 2

Title of the Course: HUMAN PHYSIOLOGY (DSC-4)

Course Title: HUMAN PHYSIOLOGY (DSC – 4)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**45 Hours**
UNIT 1- BASIC CELLS AND TISSUES	**13 Hours**
Structure and Function of Cell, Physiological properties of protoplasm. Levels of cellular organization and function – cell organelles and tissues - Structure and functions of epithelial, connective, muscular and nervous tissue, organs and systems – Brief review, Cell membrane transport across cell, membrane and intercellular communication, cell multiplication Introduction of biological membranes to understand molecular transport, transport of large molecules, receptor mediated endocytosis, exocytosis. Molecular aspects of transport; Passive diffusion, facilitated diffusion, active transport. active transport - sodium potassium pump.	
Unit – 2 - ORGAN SYSTEM I	**16 Hours**
Digestive System - Digestive system: Physiology and functions - Digestive glands: salivary, gastric, liver, pancreas. Digestion of nutrients- Proteins, fats, carbohydrates. Hunger and thirst mechanism. Motility and hormones of GIT. Regulation of food intake – role of hunger and satiety centers, effect of nutrients. **Circulatory System -** Blood: Composition and homeostasis. Formation and functions of plasma proteins, erythropoiesis. Blood groups & histocompatibility. Composition & functions of CSF and Lymph. Structure & functions of heart.	

Respiratory system - Outlined structure of respiratory system, Primary function of respiratory system, Mechanism of respiration, Transport of gases and artificial respiration. Role of lungs in the exchange of gases, Transport of oxygen and CO_2. **Excretory System -** Structure and functions of Kidney, nephron, glomerular filtration, tubular absorption and secretion. Urine formation. **Nervous System:** Review of structure and function of neuron - conduction of nerve impulse, synapses, and role of neurotransmitters, Organization of central and Peripheral nervous system.	
Unit – 3 ORGAN SYSTEM II	**16 Hours**
Skeletal & Muscular System - Ultra structure of skeletal muscle and bone. Muscular system: Muscle type, structure: Muscle proteins – contractile and non-contractile. Energetics of muscle contraction, Muscular dystrophies. **Reproductive System and Endocrine System -**Male reproductive system – Structure and functions. Female reproductive system – Structure and functions. Menstrual cycle, Puberty, Menopause. Fertilization, Development of fertilized ovum (Brief account) Placenta and its functions – Parturition. Endocrinology- Functions of hormones of the pituitary, Steroid hormones their functions and mechanism of action. **Immune System -** Organs and cells of Immune system, Primary and secondary Lymphoid organs. Immunity– Definition, Types. Antigens - Chemical nature of antigens, epitope. Immunoglobulins -Types, structures and Functions. Hypersensitivity reactions- definition and types.	

PRACTICAL: 2 Credits **60 Hours**

1. Microscopic study of tissues- Epithelial, connective, and muscular tissues
2. Preparation of blood film and staining with Leishman's staining
3. Smear preparation of human blood for RBC and WBC count
4. Estimation of hemoglobin by Sahli- Hellige (Colorimetric) hematin method
5. Determination of blood groups and Rh factor
6. Determination of bleeding time by Duke's method
7. Determination of Blood clotting time by Wright's method
8. Clinical examination of urine

a) Physical examination: volume colour, odour, appearance, pH.

b) Test for abnormal constituents of urine: Sugar, blood, albumin, Bile salts and ketone bodies.

9. Pulse, B.P and respiratory rate at rest and after exercises
10. Estimation of Blood Urea

References:

1. Lehninger, *Principles of Biochemistry*, W.H. Freeman and Co Ltd, 8th Edition. 2021
2. CC. Chatterjee, *Human Physiology*, CBS publishers, 13th edition. 2020
3. H.S.Ravikumar Patil et.al., A textbook of Human Physiology, Wiley, 2020
4. Guyton and Hall, Textbook of Medical Physiology, Elsevier, 14th Edition. 2020
5. K Sambulingam, *Essentials of Medical physiology*, Jaypee Publishers 3rd edition. 2019
6. Barrett et.al., *Gannong's Review of Medical Physiology*, Mcgraw Hill, 26th Edition, 2019
7. Cindy L. Stanfield, *Principles of Human Physiology*, Pearson publishers,6th Edition. 2017
8. Copper, Geoffery, M, *The Cell- A Molecular Approach,* Oxford University Press, 6th Edition.2013
9. Gary G Mathews, *Cellular Physiology of Nerve and Muscle*, Wiley Balckwell, 4th Edition.2002
10. Thomas Devlin, *Textbook of Biochemistry with Clinical correlations*, John Wiley and Sons, 1999
11. A.J. Vander, et.al., *Human Physiology: The mechanisms of Body functions*, McGraw-Hill, 5th Edition. 1990

B.Sc., CLINICAL NUTRITION AND DIETETICS

SEMESTER 2

Title of the Course: ESSENTIALS OF MICRONUTRIENTS (DSC – 5)

Course Title: ESSENTIALS OF MICRONUTRIENTS (DSC – 5)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s): PUC/ 10+2 (with chemistry or biology as one optional)

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Understand the significance of micronutrients
2. Know the role of water and electrolytes in the body
3. Understand the functions and importance of Vitamins and Minerals

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Understand the significance of micronutrients			✓												
Know the role of water and electrolytes in the body		✓													
Understand the functions and importance of Vitamins and Minerals	✓	✓													

B.Sc., CLINICAL NUTRITION AND DIETETICS

SEMESTER 2

Title of the Course: ESSENTIALS OF MICRONUTRIENTS (DSC-5)

Course Title: ESSENTIALS OF MICRONUTRIENTS (DSC – 5)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**45 Hours**
Unit –1 VITAMINS	**15 Hours**
Definition and classification, Fat soluble vitamins - Physiological functions, Sources, Requirements, Deficiency and Hypervitaminosis of Vitamin A, D, E and K. Water Soluble vitamins – Physiological functions, Sources, Requirements and Deficiency of B Complex Vitamins- Thiamine, Riboflavin, Niacin, Pyridoxine, Folic Acid, Pantothenic Acid, Cyanocobalamin and Vitamin C**.** Interaction with other nutrients and its effects.	
Unit – 2 MINERALS	**15 Hours**
Definition, Classification, Distribution in the body, Functions, Sources and requirement and Effects of Deficiency of Calcium, Phosphorus, Magnesium, Sodium, Potassium, Manganese, Selenium, Iron, Zinc, Iodine, Molybdenum, Cobalt and Fluorine, Trace Elements - Distribution in the body, Functions, Sources and requirement and Effects of Deficiency of Vanadium, Silicon, Boron, Nickel, Lithium, Lead, Cadmium, Sulphur.	
Unit – 3 WATER AND ELECTROLYTES	**15 Hours**
Water – Molecular structure, Ionic Product of water, Importance, distribution in the body, functions of water and sources, effects on biomolecules, Effect of non-polar compounds on water, water intake and loss. Dehydration, edema. Electrolytes - Types, sources, composition of body fluids, Regulation of electrolyte content and maintenance of pH, maintenance of fluid and electrolyte balance and imbalance, Renin- Angiotensin system, Clinical Investigation of Sodium, Potassium Chloride	

Practical: 2 Credits

1. Planning and preparation of Vitamin A rich recipes
2. Planning and preparation of Vitamin C rich recipes
3. Planning and preparation of Vitamin B complex rich recipes
4. Planning and preparation of Calcium rich recipes
5. Planning and preparation of Iron rich recipes
6. Planning and preparation of Folate rich recipes
7. Estimation of Iron in food sources
8. Estimation of Calcium in milk
9. Estimation of Vitamin C in food sources
10. Estimation of Vitamin A in food samples
11. Estimation of total mineral content in a food sample using muffle furnace

References:

1. Mudambi S R and Rajagopal M V, *Fundamentals of Foods, nutrition & Diet therapy,* New Age International Publishers, 6th Edition. 2020
2. Bamji, M.S, *Textbook of Human Nutrition,* Oxford & IBH Publis.,4th Edition. 2019
3. Srilakshmi B, *Dietetics,* New Age International Publishers, 8th Edition. 2019
4. Swaminathan, M, *Handbook of Food and Nutrition*, The Bangalore Press, 5th Edition. 2018
5. Srilakshmi B, *Nutrition Science,* New Age International Publishers, 6th Edition. 2017
6. Longvah T Anathan R, Bhaskarachary K, and Venkaiah k, *Indian food composition table,* NIN.ICMR, 2nd Edition. 2017
7. Gibney M.J, *Nutrition and Metabolism,* Wiley- Blackwell, 2003
8. Michael Zimmermann, *Burgerstein's Handbook of Nutrition*, Thieme. 9th Edition. 2001
9. Carolyn D. Berdanier, *Advance Nutrition Micronutrients (Modern Nutrition),* CRC Press. 1st Edition. 1997
10. Emma. S. Weigley, *Robinson's Basic Nutrition and Diet Therapy*, Pearson publication, 1st Edition. 1996

B.Sc., CLINICAL NUTRITION AND DIETETICS

SEMESTER 2

Title of the Course: FOOD SAFETY AND SECURITY (DSC-6)

Course Title: FOOD SAFETY AND SECURITY (DSC-6)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s): PUC/ 10+2 (with chemistry or biology as one optional)

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Understand food laws, regulations and policies
2. Describe major challenges in Nutrition rich and deprived society
3. Relate major nutritional challenges to social practices such as food access and changing diet in modern food systems

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Understand food laws, regulations and policies			✓	✓											
Describe major challenges in Nutrition rich and deprived society		✓								✓					
Relate major nutritional challenges to social practice		✓											✓		

B.Sc., CLINICAL NUTRITION AND DIETETICS

SEMESTER 2

Title of the Course: FOOD SAFETY AND SECURITY (DSC-6)

Course Title: FOOD SAFETY AND SECURITY (DSC-6)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**45 Hours**
Unit –1 FOOD SAFETY	**15 Hours**
Definition of food safety and food spoilage, factors affecting food safety and food spoilage: GMP, GAP, SSOP, GHP, food adulteration - definition, types of adulteration in various foods- intentional, incidental, and metallic contaminants Food Laws and Regulations National Legislation - Essential Commodities Act, Standard of Weight and Measures Act, ISI, Mark of BIS, Agmark, BIS. GRAS and permissible limits for chemical preservatives and legal aspects for γ -irradiations. Recent concerns in food safety: New and Emerging Pathogens. Genetically modified foods / Transgenics / Organic foods. Newer approaches to food safety. PFA, FPO, Food Safety and Standards Bill 2005, International Laws and Agreements - FAO, WHO, Codex Alimentarious, WTO, JECFA, APEDA, ISO 22000 series, Hazard Analysis Critical Control Point (HACCP): principles of HAACP, applications of HACCP Current Food Safety Standards in India, Current Food Safety regulations 2001, Food Safety and Standards Authority of India, objectives of developing food safety standards, enforcement of structure and procedure, role of food analyst, safety analysis, action by designated officer and report of food analyst.	
Unit – 2 FOOD AND NUTRITION SECURITY	**15 Hours**
Definition, Food production, access, distribution, availability, losses, consumption, Food distribution strategies and storage of food. Socio-cultural aspects and Dietary Patterns: Their implications for Nutrition and Health. Nutritional Status - Determinants of nutritional status of individual and populations, Nutrition and Non-nutritional indicators -Socio-cultural, Biologic, Environmental, Economic.	

Major Nutritional Problems – An overview etiology, prevalence, clinical manifestations, preventive and therapeutic measures for: Macro and micronutrient deficiencies.	
Unit – 3 NUTRITION AND HEALTH POLICIES	**15 Hours**
Plan of action and programs, Approaches and Strategies for improving nutritional status and health, Programmatic options- their advantages and demerits. feasibility, political support, available resources (human, financial, infrastructural). Case studies of selected strategies and programs: their rationale and context. How to select interventions from a range of possible options: Health-based interventions, Food-based interventions including fortification and genetic improvement of foods, supplementary feeding, nutrition education for behavior change. Health economics and economics of malnutrition- Its impact on productivity and national development, Cost-Benefit, Cost effectiveness, Cost efficiency	

References:

1. *Release of Fact sheets for National Family Health Survey (NFHS)-5,* Ministry of Health and Family Welfare, GOI, 2019-2020. https://main.mohfw.gov.in/newshighlights-26
2. Prabodh Halde, Sanjeev Kumar Sharma, *Objective Food Science and Safety standards,* Jain Brothers; 2nd edition. 2019
3. Bamji, M.S, *Textbook of Human Nutrition,* Oxford & IBH Publishing Co Pvt. Ltd,4th Edition. 2019
4. William H. & Carol Anne, *Food Safety for the 21st Century: Managing HACCP and Food Safety Throughout the Global Supply Chain,* Wiley; 2nd edition.2018

5. Bill Pritchard et.al., *Routledge Handbook of Food and Nutrition Security*, Routledge, 2018
6. G. Satyavani Sridhar Seetharaman, *Food and Nutritional Security: Role of Food Assistance*, Write and print publications, 2018
7. Arpitha Verma, *Women's Health and Nutrition: Role of State and Voluntary Organizations*, Rawat, 2017
8. Swaminathan M.S., *Remember your Humanity- Pathway to sustainable Food security*, NIPA, 2012
9. Panda, *Sustainable Food and Nutrition security in National Economy*, Agrobios (India), 2010
10. Murray, C. and Lopez, A, *Global Burden of Disease and Injury*, Harvard University Press, 1996
11. Achaya, K.T., *Interfaces between agriculture nutrition and food science*, The United Nations University, 1985.

B.Sc., CLINICAL NUTRITION AND DIETETICS

SEMESTER 2

Title of the Course: FOOD SAFETY AND HYGIENE (OE- 2)

Course Title: **FOOD SAFETY AND HYGIENE (OE- 2)**	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Outcomes (COs):

1. Gain knowledge on food safety and their implications on health
2. Familiarize with the concept of food safety issues on public health
3. Understand the standards, laws and regulations regarding food safety

Course Articulation Matrix:

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Gain knowledge on food safety and their implications on health	✓											
Familiarize with the concept of food safety issues on public health	✓					✓						
Understand the standards, laws and regulations regarding food safety						✓						

B.Sc., CLINICAL NUTRITION AND DIETETICS

SEMESTER 2

Title of the Course: FOOD SAFETY AND HYGIENE (OE-2)

Course Title: FOOD SAFETY AND HYGIENE (OE- 2)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**45 Hours**
Unit – 1 INTRODUCTION TO FOOD SAFETY	**15 hours**
Concept and meaning of Food Safety, food adulteration, food hazards Food laws and regulations – National (FSSAI) and international (FAO) food laws, newer approaches to food safety. PFA, FPO, Food Safety and Standards Bill 2005, International Laws and Agreements - FAO, WHO, Codex Alimentarious, Governing bodies, Exposure, estimation, toxicological requirements and risk analysis. Safety aspects of water and beverages, Safety assessment of food contaminants and pesticide residues.	
Unit – 2 FOOD SAFETY AND FOOD HYGIENE	**15 hours**
Food contaminants- Physical, Chemical and Biological contaminants, reduce microbial contamination and control growth, Eliminate source of contaminants Sanitation: Definition, principle and purposes. Food hygiene law and the importance of food safety. Food Safety Hazards. Temperature control, food deliveries, refrigeration, low and high-risk foods, use by dates and best before dates, and stock rotation (FIFO). Cross-Contamination Hand hygiene, further hygiene considerations, protective clothing, reporting illness and first aid.	
Unit – 3 FOOD PROTECTION	**15 hours**

Food protection: General Principles, methods of food protection and food preservation - Thermal transfer methods, Chemical methods, Biocontrol methods, Irradiation methods, Foodborne Illness – Food Borne infections and Intoxications. Risk Factors, Food worker Education and training.	

References:

1. Alok Kumar, *Fundamentals of Food Hygiene Safety and Quality*, Dreamtech press, 2019
2. Ram Lakhan Singh and Sukanta Mondal, *Food Safety and Health*, Academic Press, 2019
3. Prabodh Halde, Sanjeev Kumar Sharma, *Objective Food Science and Safety standards,* Jain Brothers; 2nd edition. 2019
4. William H. & Carol Anne, *Food Safety for the 21st Century: Managing HACCP and Food Safety Throughout the Global Supply Chain,* Wiley; 2nd Edition.2018
5. Sunetra Roday, *Food Hygiene and Sanitation With case studies*, Tata McGraw, 2nd Edition, Hill.2017
6. Paul L. Knechtges, *Food Safety-Theory and Practice*, Jones & Bartlett Learning, 2012
7. David McSwane et.al., *Essentials of Food safety and Sanitation*, Pearson's, 4th Edition, 2004

B. Sc., CLINICAL NUTRITION AND DIETETICS

SEMESTER 2

Title of the Course: FOOD ADULTERATION (OE- 2)

Course Title: FOOD ADULTERATION (OE- 2)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Outcomes (COs):

1. Gain knowledge on common food adulterants and its toxic effects
2. Familiarize with the techniques of identifying Food adulterants
3. Understand the standards, laws and regulations regarding Food Adulteration

Course Articulation Matrix:

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Gain knowledge on food safety and their implications on health				✓	✓							
Familiarize with the concept of food safety issues on public health				✓	✓							
Understand the standards, laws and regulations regarding food safety				✓	✓							

B. Sc., CLINICAL NUTRITION AND DIETETICS

SEMESTER 2

Title of the Course: FOOD ADULTERATION (OE- 2)

Course Title: FOOD ADULTERATION (OE- 2)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**45 Hours**
Unit – 1 COMMON FOOD ADULTERANTS	**15 hours**
Adulteration – Definition – Types of adulterants in different food, Adulteration through Food Additives – Intentional and incidental. Health hazards and risks. Historical Food legislation in India; Central food laboratory, Municipal laboratories. National Food laws- PFA specification for food products. Salient features of Food Safety & Standards Act, 2006, Structure of FSSAI, ISO 22000, GMP, GHP, ISO 9001 (Food Safety Management System), Prevention of food adulteration Act	
Unit – 2 FOOD LAWS AND STANDARDS	**15 hours**
Consumer protection: Role of agencies such as AGMARK, ISI and Quality Control Laboratories in protecting consumer rights. International food laws- Codex Alimentarius, FDA, USDA, FAO and WHO. Other International regulatory bodies like EFSA –European food safety authority Food standards of Australia and New Zealand, Saudi Arabia food regulations	
Unit – 3 ANALYSIS OF FOOD ADULTERANTS	**15 hours**
Food Adulteration tests for common foods- Spices, Cereals and pulses, milk and milk products, Coffee, tea, Ghee, Oil and fats, sugar and sugar products. Identification of New adulterants in different foods, Toxic effects of food adulterants. Food additives; colouring matter, preservatives, poisonous metals, antioxidants and emulsifying and stabilizing agents, insecticides	

References:

1. Bare Act, *Prevention of Food Adulteration Act, 1954 along with Rules,* Universal Law Publishing, 2016
2. Shyam Narayan Jha & Pranay, *Rapid Detection of Food Adulterants and Contaminants - Theory and Practice,* 2016
3. Sumeet Malik, Handbook of Food Adulteration and Safety Laws, Eastern Book company, 2012
4. Edwin Morris Bruce, *Detection of common Food Adulterants,* Nebu Press, 2011
5. N. Raghuramulu et.al., *Manual of Laboratory Techniques*, NIN, 2nd Edition.2003
6. A.Y. Sathe, A First Course in Food Analysis, New Age international, 1999

Skill Enhancement course (SEC) in Clinical Nutrition and Dietetics

Semester I – B.Sc. Skill based credits L (1) +T (0) +P (2)

COURSE TITLE: NUTRITION AND HEALTH COMMUNICATION

Theory (1) credit:

Outcomes:

By the end of this course, students should be able to demonstrate strong written, verbaland nonverbal communication skills.

Students should further have a strong understanding of communication and behaviour change theory, and should be able to apply this knowledge to nutrition program planningand evaluation.

Modules

Communication skills:

Definitions of Communication, functions of Communication, types & levels of Communication, Barriers in Communication. Folk Media, Press, Radio, Cinema, Television, New Media- internet - its roles and values in society. E- Health and informationcommunication technologies - writing blogs, Content creation on Health and Nutrition fora website, Use of mobile technology to spread awareness Nutrition and Health Status of the Community, learning and working with the Community,Factors Influencing Community Health and Nutrition. Themes and Messages in Nutritionand Health Education, past and present nutrition programmes, Nutrition Education Programmes-Planning, Implementation and Evaluation, Organizing Successful Nutrition and Health Programmes: Selected Process Models

Professional Skills:

Planning and organising skills, decision-making, problem-solving skills, analyticalthinking, critical thinking, team management, risk assessment.

Interpersonal skills:

Writing skills, reading skills, oral communication, delivery of quality work on time, conflict-resolution techniques, interpretation of research data, trouble shoot and resolvingproblems.

Digital skills:

Information Technology Skills, Apply Basic Computer Skills (MS Office, Excel, Power point, Internet)at Workplace. Lab Management Information System in a laboratory and Production plant.

Practical (1) Credit:

Different Nutrition and health education communication processes.

Planning health and nutrition education program for children, women, adolescent girls.

Evaluation of nutrition and health education programs implemented by Government.

Community activity planning– Interpersonal and group.

Preparing visual aids – presentations, posters, charts, information booklets etc.

Case studies of selected strategies and programs: their rationale and context

Planning Health-based interventions

Planning Food-based interventions including fortification and supplementary feeding.

References

Littlejohn, Steven, *Theories of Human Communication.* 11th edition, Wadsworth PublishingCompany, 2016.

Molenda H., Smaldino, R. *Instructional Media and Technologies for Learning*. Merill PrenticeHall, 2009.

Schrank J. *Understanding Mass Media,* National Textbook Company. 1996.

Maibach e., Parott, R.L. *Designing Health Messages – Approaches from Communication Theoryand Public Health Practice*. Sage, 1995.

Padaki Vijay. *Development Intervention and Program Evaluation: Concepts and cases*. Sage.1995.

Mehta D, *Mass Communication and Journalism in India,* Allied Publishers, 1994.

Mott, R. *Sound Effects for Radio and Television*. Boston & London. Focal Press, 1990.

Atkin, G. *Sound Technics for Video and Television*. Focal Press, 1990.

Huber, DM. *Audio Production Techniques for Video*. McMillan, 1987.

Mcquail D. *Introduction to Mass Communication Theory*, 3rd edition, Sage Publications, 1984.

BANGALORE UNIVERSITY

Syllabus for

Nutrition and Dietetics (Major)
B.Sc. (Basic) (Hons.) & Integrated M.Sc.

CHOICE BASED CREDIT SYSTEM (CBCS)

I – X SEMESTERS

Framed According to the National Educational Policy (NEP 2020)

To implement from the Academic Year 2021-2022

Syllabus for B.Sc., Basic/Hons in
Nutrition and Dietetics (IIA model) as Major

Name of the Degree Program: **B.Sc., Basic/Hons**
Discipline Core: **Nutrition and Dietetics**
Total Credits for the Program: **226**
Starting year of implementation: **2021**

B.Sc., Basic/Hons - Progressive Certificate, Diploma, bachelor's degree or bachelor's degree with Honors Provided at the end of each Year of exit of the four-year Undergraduate Program/ Five-year Integrated Master's Degree Program.

Introduction:

The B.Sc., (Basic/Honors) program in Nutrition and Dietetics intends to create competent professionals with in-depth understanding of various aspects offered under this program. The program offers a broad range of courses spanning across areas of community nutrition, food science, dietetics, and nutrition counseling. The four-year program aims at conceptual understanding of the key elements of nutrition and dietetics. Students would be trained in areas such as nutritional assessment, diet planning, food product development, health communication, clinical nutrition, nutrition education and behavior modification. The program would also introduce students to research methodology and statistics which would be pivotal in developing reasoning, logic, problem solving and scientific temper. The students would be further exposed to continuous hands-on training through regular practical and internship experience. This would enable creative and critical thinking among the students. The comprehensive program would enable students to keep themselves updated through internship, practical and projects.

The subject expert committee designed the Course Learning Outcome (CO) to help the learners to understand the main objectives of studying the courses by keeping in mind of the Program outcomes (PO) of the graduate degree with honors in Nutrition and Dietetics or a graduate degree with Nutrition and Dietetics as a major subject.

As the field of Nutrition and Dietetics is vast, dynamic and an evolving area of specialization. This requires students to learn and be abreast with recent advances and evidence- based guidelines in the field of food and nutrition. Hence the subject expert committee suggests introduction of elective

papers (for both Discipline electives and Open Electives) along with Discipline Core Courses. The BoS in Nutrition and Dietetics of universities may include additional electives based on the expertise of their staff and needs of the students. Student can select elective paper as per her/his needs and interest. The skills and attributes acquired during the program would open doors to job opportunities in areas of food science, nutrition, health promotion, and disease management, also paves way for research and higher education for interested students.

By the end of the program the students will be able to: -

PO 1	**Disciplinary Knowledge**: Understand the role and importance of food and nutrition for the welfare of the community and acquire the skills in planning diet, health and diseases
PO 2	**Communication Skills:** Learn and apply evidence-based guidelines in the field of dietetics, nutrition counselling, nutrition research laboratory, community
PO 3	**Critical thinking:** Understand the structure and functions of the different organs systems in relation to nutrition
PO 4	**Interpersonal and Problem Solving**: Design solutions and novel food products to meet the specified nutrient needs with appropriate consideration for the public health and safety.
PO 5	**Critical thinking, Communication and problem solving**: Comprehend, communicate effectively, plan, design and implement programs in the field of nutrition and dietetics
PO 6	**Decision making, Analytical and Research skills:** Understand and demonstrate the knowledge of food science, food science and quality control in societal and environmental contexts
PO 7	**Moral and ethical awareness/reasoning and Research skills:** Apply ethical principles and commit to professional ethics and responsibilities in the field of nutrition, sports, food industry and health care sectors.
PO 8	**Interpersonal and Business skills:** Understand the applications of nutraceuticals and functional foods in the product development from conceptualization to evaluation of the quality of the food product
PO 9	**Analytical and Research skills:** Comprehend the knowledge and role of food additives in food industry in relation to its analytical techniques
PO 10	**Critical thinking, Analysis and Research skills:** Understand and apply the concept of nutrients and nutritional science in the evaluation of health and disease
PO 11	**Goal Setting and Problem-solving skills**: Enable students to pursue higher education and research

Weightage for assessments (in percentage):

Type of Course	Formative Assessment / IA	Summative Assessment
Theory	**40**	**60**
Practical	**20**	**30**
Projects	**40**	**60**
Experiential Learning (Internships etc.)	**40**	**60**

Content of Courses for B.Sc. Degree/Honours in Nutrition and Dietetics

Model II A

Semester	Course Code.	Category of course	Theory/ Practical	Credits	Paper Titles	Marks	
						S. A	I.A
I	NDT1	DSC	Theory	4	Fundamentals of nutrition	60	40
	NDP1	DSC	Practical	2	Fundamentals of nutrition	30	20
	NDOE-1	OE-1	Theory	3	Fundamentals of food and health / Health lifestyle and nutrition	60	40
	ND1 L1 ND1 L2	L1 L2	Theory	3+3	Language 1 Language 2	60 +60	40+40
	NDSEC1	SEC	Theory	2	Digital Fluency	60	40
	NDVB1	VB	Theory	2	Physical education for Health & Wellness	60	40
II	NDT2	DSC	Theory	4	Principles of Food Science and Preservation	60	40
	NDP2	DSC	Practical	2	Principles of Food Science and Preservation	30	20
	NDOE-2	OE-2	Theory	3	Food safety and Hygiene/ Food Adulteration	60	40
	ND2 L1 ND2 L2		Theory	3+3	Language 1 Language 2	60 +60	40+40
	NDAEC 1	AEC	Theory	2	Environmental Studies	60	40
	NDVB2	VB	Theory	2	Physical education - NCC/NSS/R&R(S&G)/ Cultural	60	40
Exit Option with Certificate in Nutrition and Dietetics (52 Credits)							
III	NDT3	DSC	Theory	4	Nutrition through life span	60	40
	NDP3	DSC	Practical	2	Nutrition through life span	30	20

	NDOE3	OE	Theory	3	Nutritional Assessment/ Traditional Foods and Health	60	40
	ND3 L1 ND3 L2	L1 L2	Theory	3+3	Language 1 Language 2	60+60	40+40
	NDSEC2	SEC	Theory	2	Artificial Intelligence	60	40
	NDVB3	VB	Theory	2	Physical education - NCC/NSS/R&R(S&G)/ Cultural	60	40
IV	NDT4	D1SC	Theory	4	Food Microbiology, Sanitation and Hygiene	60	40
	NDP4	DSC	Practical	2	Food Microbiology, Sanitation and Hygiene	30	20
	NDOE4	OE	Theory	3	Nutrition in weight management/ Diet in life style disorder	60	40
	ND4 L1 ND4 L2	L1 L2	Theory	3+3	Language 1 Language 2	60+60	40+40
	NDAEC 2	AEC	Theory	2	Constitution of India	60	40
	NDVB4	VB	Theory	2	Physical education - NCC/NSS/R&R(S&G)/ Cultural	60	40
Exit Option with Diploma in Nutrition and Dietetics (100 Credits)							
V	NDT5	DSC	Theory	3	Clinical Nutrition & Dietetics – 1	60	40
	NDP5	DSC	Practical	2	Clinical Nutrition & Dietetics – 1	30	20
	NDT6	DSC	Theory	3	Intermediary metabolism	60	40
	NDP6	DSC	Practical	2	Intermediary metabolism	30	20
	NDE1	DSE-1/ Vocational 1	Theory	3	Food Product Development & Sensory analysis	60	40
	NDSEC3	SEC	Theory	2	Cyber security	60	40
VI	NDT7	DSC	Theory	3	Clinical Nutrition & Dietetics – II	60	40
	NDP7	DSC	Practical	2	Clinical Nutrition & Dietetics – II	30	20

	NDT8	DSC	Theory	3	Community Nutrition & Public Health	60	40
	NDP8	DSC	Practical	2	Community Nutrition & Public Health	30	20
	NDE2	DSE-2/ Vocational 1	NDE1	3	Food Analysis	60	40
	NDSEC4	SEC	Theory	2	Professional Communication	60	40
	NDI1	Internship	Internship	2	Internship	60	40
Exit Option with Bachelor's in science Degree in Nutrition and Dietetics (144 Credits)							
VII	NDT9	DSC	Theory	3	Advanced Nutrition –I	60	40
	NDP9	DSC	Practical	2	Advanced Nutrition –I	30	20
	NDT10	DSC	Theory	3	Advanced Food Science	60	40
	NDP10	DSC	Practical	2	Advanced Food Science	30	20
	NDT11	DSC	Theory	3	Applied Physiology	60	40
	NDE3	DSE-3	Theory	3	Statistics for Nutrition Research / food and Drug interaction	60	40
	NDE4	DSE-4	Theory	3	Food Processing & Preservation / Functional food quality	60	40
	NDT12		Theory	3	Research Methodology	60	40
VIII	NDT13	DSC	Theory	3	Advances in Medical Nutrition Therapy	60	40
	NDP13	DSC	Practical	2	Advances in Medical Nutrition Therapy	30	20
	NDT14	DSC	Theory	3	Advanced Nutrition-II	60	40
	NDT15	DSC	Theory	3	Exercise physiology and nutrition	60	40
	NDE4	DSE-4	Theory	3	Nutrition counselling / Nutrition care process	60	40
	NDT16		Research Project/	6	Research Project	120	80
Exit Option with Bachelor in Science Honours in Nutrition and Dietetics (185 Credits)							

IX	NDT17	DSC	Theory	3	Nutraceuticals and Functional Foods	60	40
	NDP17	DSC	Practical	2	Nutraceuticals and Functional Foods	30	20
	NDT18	DSC	Theory	3	Nutrition in critical care	60	40
	NDP18	DSC	Practical	2	Nutrition in critical care	30	20
	NDT19	DSC	Theory	3	Food safety & quality assurance	60	40
	NDP19	DSC	Practical	2	Food safety & quality assurance	30	20
	NDT20	DSC	Theory	3	Nutrition Psychology	60	40
	NDE-5	DSE-5	Theory	3	Nutrition in emergencies / Food sanitation &hygiene	60	40
	NDE-6	DSE-6	Theory	3	Food Additives/ Nutritional Biochemistry	60	40
X	NDT21	DSC	Theory	3	Sports Nutrition	60	40
	NDP21	DSC	Practical	2	Sports Nutrition	30	20
	NDT22	DSC	Theory	3	Program Planning and Nutrition	60	40
	NDT23	DSC	Theory	3	Nutrition Education in Community	60	40
	NDT24	DSE	Theory	3	Geriatric Nutrition/ Pediatric Nutrition	60	40
	NDT25	Project	Dissertation	6	Dissertation/ Research project	120	80
Award with Master in Science in Nutrition and Dietetics (265 Credits)							

*In lieu of the research Project, two additional elective papers/ Internship may be offered

Abbreviation ND – Nutrition and Dietetics; DSC – Discipline Core; DSE –Discipline Specific Elective; T – Theory/ P – Practical; VOC-Vocational; OE- Open Elective; E-Elective ;

CURRICULUM STRUCTURE FOR UNDERGRADUATE DEGREE PROGRAM

Name of the Degree Program: B.Sc. (Honors)

Discipline / Subject: Nutrition and Dietetics

Starting Year of Implementation: 2021-22

PROGRAM ARTICULATION MATRIX

Sem.	Course No	Program outcomes that the course addresses	Pre-Requisite Course (s)	Pedagogy	Assessment
I	DSC 1 Fundamentals of nutrition	PO1 PO2	PUC/12th Science students	➢ MOOC ➢ Seminar ➢ Assignments ➢ Group ➢ Discussion ➢ Case Studies ➢ Lecture ➢ ICT ➢ Content Review ➢ Audio -Video Materials ➢ Demonstration ➢ Field Visits ➢ Hands On Training ➢ Observation ➢ On The Field Training ➢ Review ➢ Research ➢ Article ➢ Presentations ➢ Nutrition Education Tools And Module Development ➢ Seminars	Formative and Summative Assessment
	OE 1 Fundamentals of food and health / Health lifestyle and nutrition	PO1 PO2			Formative and Summative Assessment
II	DSC- 2 Principles of Food Science and Preservation	PO1 PO4 PO6			Formative and Summative Assessment
	OE- 1 Food safety and Hygiene/ Food Adulteration	PO1 PO4 PO6			Formative and Summative Assessment

B.Sc., NUTRITION AND DIETETICS

SEMESTER 1

Title of the Course: FUNDAMENTALS OF NUTRITION (DSC 1)

Course Title: FUNDAMENTALS OF NUTRITION (DSC 1)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s): PUC/ 10+2 (with chemistry or biology as one optional)

Course Outcomes (COs): At the end of the course the student should be able to:

1. To understand the guidelines of diet requirements
2. To learn about different methods and principle of cooking
3. To understand the role of macro nutrients in human nutrition
4. To understand their physiological functions, requirements, and sources of macro nutrients
5. To acquire knowledge on food sanitation and hygiene
6. To understand food laws and food regulations

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
To understand food laws and food regulations	✓														
To understand the guidelines of diet requirements	✓														
To learn about different methods and principle of cooking	✓														
To understand the role of macro nutrients in human nutrition	✓	✓													
To understand their physiological functions, requirements, and sources of macro nutrients	✓	✓													
To acquire knowledge on food sanitation and hygiene				✓											

Note: Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark = √ in the intersection cell if a course outcome addresses a particular program outcome.

B.Sc., NUTRITION AND DIETETICS

SEMESTER 1

Course Title: FUNDAMENTALS OF NUTRITION (DSC-1)

Course Title: FUNDAMENTALS OF NUTRITION (DSC- 1)	
Total Contact Hours: 45	Course Credits: 4+2
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Syllabus	**56 Hours**
Unit –1 INTRODUCTION	**14 Hours**
Understanding terminologies: Food, nutrition, health, nutrients, nutritional status, malnutrition-under nutrition over nutrition and optimum nutrition, diet, diet therapy, therapeutic nutrition, kilocalorie, joule, diet diversity, body mass index, daily values, nutrient density. Methods of determining human nutrient need **Food and nutrient requirements:** Guidelines and Recommendations, development of National Nutritional Requirements, translation of nutritional requirements into Dietary Guidelines. food group system, functions of food Physiological, Psychological and Social factors affecting food intake and food habits, Recommended Dietary allowance (RDA), General Principles of Deriving RDA, Use of Recommended Dietary Allowances (RDAs), Limitations of RDAs, Balanced diet, use of Food exchange list. Food pyramid, my plate, basic of menu planning for family.	
Unit – 2 ENERGY	**14 Hours**

Definition, units of energy, energy value of food. Components of energy requirement, factors affecting energy requirements, methods of measuring energy expenditure. RMR, Physical Activity Level (PAL), BMR, factors affecting B.M.R, determination of BMR by calculation (Harris Benedict). Energy needs of the body (reference man and reference woman), Energy requirement during work, thermic effect of food, SDA. Human body composition – Methods of assessment (direct and indirect), Changes in body composition during life cycle. Factors affecting body composition: body weight and physical activity.	
Unit – 3 NUTRITIONAL MANAGEMENT	**14 Hours**
Nutrition and Health- Inter-relationship between food, nutrition, and health. Food choices – nutrients and nourishment, cognitive and environmental influences. Nutrient and food guides for health promotion. Balanced diet- definitions and its importance Definition, importance of balanced diet, RDA for various nutrients - age, gender, physiological state, food group system, factors affecting meal planning. Nutritional deficiency diseases - Causes, symptoms, treatment, Protein Energy Malnutrition (PEM), Vitamin A Deficiency (VAD), Iron Deficiency Anemia (IDA), Iodine Deficiency Disorders (IDD), Zinc Deficiency, Fluorosis. National Nutrition Policy and Program - Integrated Child Development Services (ICDS) Scheme, Mid-day Meal Program (MDMP), National programs for prevention of Anemia, Vitamin A deficiency, Iodine Deficiency Disorders. National and International agencies in uplifting the nutritional status -WHO, UNICEF, CARE, ICMR, ICAR, CSIR, CFTRI. Various nutrition related welfare program, ICDS, SLP, MOM, and others (in brief).	
Unit – 4: MACRO NUTRIENTS AND MICRONUTRIENTS	**14 HOURS**
Protein -Classification, functions, Digestion& absorption (in brief), RDA, sources and deficiencies. Carbohydrate - Classification, functions, Digestion & absorption (in brief), RDA, sources and deficiencies. Fat-Classification, functions, Digestion & absorption (in brief), RDA, sources and deficiencies. Dietary fiber- types and functions. Fat-soluble Vitamins (A, D, E & K)- Function, RDA, sources and deficiency and excess. Water soluble vitamins: Thiamin, Riboflavin, Niacin, B12, Folic acid, Biotin and Vitamin C: functions, RDA, food sources, deficiencies and excess. Macro minerals- Calcium, Phosphorus and magnesium, Sodium, Potassium, Chlorine: Functions, absorption, RDA, sources and deficiencies. Micro Minerals- Iron, Zinc, Fluorine and Iodine: function, absorption, RDA, sources and deficiency.	

Practical – 2 Credits

FUNDAMENTALS OF NUTRITION – PRACTICAL

1. Identification of foods under four food groups.
2. Calculation of Glycaemic index in foods
3. Weights and measures of common foods - (Raw and Cooked weight)
4. Cooking methods - Preparing a recipe by Boiling & steaming
5. Cooking methods - Preparing a recipe by Pressure cooking and Microwave
6. Cooking methods - Preparing a recipe by Frying (shallow, deep fat), Smoking point of oil and combination method
7. Calculation of energy requirement for an adult man and a woman and children
8. Anthropometric Measurement - Height, weight, skinfold thickness, Mid - upper arm circumference.
9. Comparison and interpretation of the nutritional assessment data and its significance - body Mass Index (BMI), fat mass, Waist - Hip Ratio (WHR).
10. Estimation of food and nutrient intake - 24 hours dietary recall, food frequency
11. Proximate analysis of foods

References:

1. Mudambi S R and Rajagopal M V, *Fundamentals of Foods, nutrition & Diet therapy*, New Age International Publishers, 6th Edition. 2020
2. Bamji, M.S, *Textbook of Human Nutrition,* Oxford & IBH Publishing Co Pvt. Ltd,4th Edition. 2019
3. Srilakshmi B, *Dietetics*, New Age International Publishers, 8th Edition. 2019
4. Swaminathan, M, Handbook of Food and Nutrition, The Bangalore Press, 5th Edition. 2018
5. Sunetra Roday, *Food Science and Nutrition,* Oxford university Press, 3rd Edition. 2018
6. Srilakshmi B, *Nutrition Science*, New Age International Publishers, 6th Edition. 2017
7. Shubhangaini A Joshi, *Nutrition and Dietetics*, McGraw-Hill, 4th Edition. 2017
8. Williams, *Basic nutrition and Diet therapy*, Elsevier India, 1st South Asia Edition. 2016
9. Carolyn D. Berdanier; Johanna T. Dwyer; David Heber , *Handbook of Nutrition and Food,* 3rd Edition.2014
10. Gibney M.J, *Nutrition and Metabolism*, Wiley- Blackwell, 2003
11. Emma. S. Weigley, *Robinson's Basic Nutrition and Diet Therapy*, Pearson publication, 1st Edition. 1996

B.Sc., NUTRITION AND DIETETICS

SEMESTER 1

Title of the Course: FUNDAMENTALS OF FOOD & HEALTH (OE-1A)

Course Title: FUNDAMENTALS OF FOOD AND HEALTH (OE-1A)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Outcomes (COs):

1. Gain knowledge on key nutrients and their implications on health
2. Familiarize with the concept of health and issues of public health concern
3. Understand the effect of novel and processed foods on general health and well being

Course Articulation Matrix:

Course Outcomes (COs)/ Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Gain knowledge on key nutrients and their implications on health	✓	✓										
Understand the effect of novel and processed foods on general health and well being	✓	✓										
Familiarize with the concept of health and issues of public health concern	✓	✓										

B.Sc., NUTRITION AND DIETETICS

SEMESTER 1

Title of the Course: FUNDAMENTALS OF FOOD & HEALTH (OE-1 A)

Course Title: FUNDAMENTALS OF FOOD AND HEALTH (OE-1A)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**45 Hours**
Unit – 1 OVERVIEW OF FOOD & MACRONUTRIENTS	**15 hours**
Overview of Food & Nutrients, Food choice and factors influencing food choice Classification of nutrients – macronutrients and micronutrients. Energy, Carbohydrates, Protein and Fats Classification, Functions and Sources Impact of macronutrients on health – Deficiency and Excess.	
Unit - 2 MICRONUTRIENTS & WATER	**15 hours**
Micronutrients - Classification, Functions and Sources in detail, Impact of micronutrients on health – Deficiency and Excess, Water –Types, Role, Distribution of water in Body, Body fluids and electrolytes. Regulation of Water and Electrolyte balance and its imbalance	
Unit – 3 COMPONENTS OF HEALTH	**15 hours**
Health – Definition, Components, Factors influencing health, Dietary guidelines Issues of public concern, Malnutrition, Anemia, Vitamin A deficiency, Obesity, Diabetes and Hypertension. Functional foods – Probiotics, prebiotics and phytochemicals, Health supplements, processed foods, organic foods, Nutrition label – understanding and importance	

References:

1. Mudambi S R and Rajagopal M V, *Fundamentals of Foods, nutrition & Diet therapy*, New Age International Publishers, 6th Edition. 2020
2. Bamji, M.S, *Textbook of Human Nutrition*, Oxford & IBH Publishing Co Pvt. Ltd,4th Edition. 2019
3. Srilakshmi B, *Dietetics*, New Age International Publishers, 8th Edition. 2019
4. Swaminathan, M, Handbook of Food and Nutrition, The Bangalore Press, 5th Edition. 2018
5. Srilakshmi B, *Nutrition Science*, New Age International Publishers, 6th Edition. 2017
6. Longvah T Anathan R, Bhaskarachary K, and Venkaiah k, *Indian food composition table*, NIN.ICMR, 2nd Edition. 2017
7. Gibney M.J, *Nutrition and Metabolism*, Wiley- Blackwell, 2003
8. Carolyn D. Berdanier, *Advanced Nutrition, Macronutrients*, CRC press, 2nd Edition.2000
9. Emma. S. Weigley, *Robinson's Basic Nutrition and Diet Therapy*, Pearson publication, 1st Edition. 1996

B.Sc., NUTRITION ND DIETETICS

SEMESTER 1

Title of the Course: Healthy lifestyles and Nutrition (OE- 1 B)

Course Title: Healthy lifestyles and Nutrition (OE- 1 B)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 03Hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s): Students who have passed Pre-University Board of Examination or Equivalent board with science subjects are eligible for the undergraduate degree B.Sc., in Food Science and Nutrition.

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Gain knowledge on healthy life styles
2. Understand the relationship between different nutrients and their importance
3. Understand the importance of Nutrition in Lifestyle disorders

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Gain knowledge on Healthy Lifestyles	✓	✓										
Understand the relationship between different nutrients and their importance	✓											
Understand the importance of Nutrition in Lifestyle disorders						✓		✓				

B.Sc., NUTRITION ND DIETETICS

SEMESTER 1

TITLE OF THE COURSE: HEALTHY LIFESTYLE AND NUTRITION (OE-1B)

Course Title: Healthy lifestyles and Nutrition (OE- 1B)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 03Hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**45 Hours**
Unit – 1 INTRODUCTION TO FOOD AND NUTRITION	**15 Hours**
History of nutrition, Relationship of food and health, Factors influencing food intake & food habits: Physiologic, Factors that determine food intake, Environmental & behavioral factors influencing food acceptance Energy and macronutrients – Carbohydrates, Protein, Fat - functions, sources deficiency disorders and recommended intakes. Micronutrients: Minerals – calcium, Iron, Iodine, and other elements, Vitamins – Fat Soluble & Water Soluble.	
Unit – 2 NUTRITION FOR LIFE CYCLE	**15 Hours**
Nutritional assessment - direct and indirect methods, Nutritional requirements for pregnancy and lactation, Nutritional requirements for growing children, Nutritional requirements for adult and elderly.	
Unit – 3 PLANNING OF DIET	**15 Hours**
Basic principles of planning diet, Dietary guides and balanced diets**.** Principles of planning a normal diet: characteristics of a normal diet, meeting nutrient requirements of individuals and family. Use of Dietary guidelines for Indians. Objectives of diet therapy- Regular diet and rationale for modifications in energy and other nutrients, texture, fluid, soft diets etc. Nutrition for health and fitness- Role of nutrition in fitness, Nutritional guidelines for health and fitness, Nutritional supplements, Importance and benefits of physical activity.	

References:

1. Mudambi S R and Rajagopal M V, *Fundamentals of Foods, nutrition & Diet therapy*, New Age International Publishers, 6th Edition. 2020
2. Manay & Shadakshara Swamy, *Food facts & principles*, New Age International Publication, 2020
3. Swaminathan, M, Handbook of Food and Nutrition, The Bangalore Press, 5th Edition. 2018
4. Srilakshmi B, *Nutrition Science*, New Age International Publishers, 6th Edition. 2017
5. Chadha R and Mathur P eds. *Nutrition: A Lifecycle Approach,* Orient Blackswan, New Delhi. 2015
6. Carolyn D. Berdanier; Johanna T. Dwyer; David Heber , *Handbook of Nutrition and Food*, 3rd Edition.2014
7. Barbara A. Bowmaw and Robert M. Russell, *Nutrition*, ILSI press, 9th Edition. 2008.
8. C. Gopalan, B.V. Ramasastri and S.G. Balasubramaniam, *Nutritive value of Indian foods*, NIN, ICMR, 2007.
9. Gibney M.J, *Nutrition and Metabolism*, Wiley- Blackwell, 2003

B.Sc., NUTRITION AND DIETETICS
SEMESTER 2

Title of the Course: PRINCIPLES OF FOOD SCIENCE & PRESERVATION (DSC- 2)

Course Title: Principles of Food Science & Preservation (DSC- 2)	
Total Contact Hours: 56	Course Credits: 4
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s): PUC/ 10+2 (with chemistry or biology as one optional)

Course Outcomes (COs):

1. Apply basic nutrition knowledge in making foods choices and obtaining an adequate diet
2. Learn to distinguish and relate the characteristics and properties of foods
3. Apply the knowledge gained on characteristics and properties of foods during cooking
4. Develop appropriate food preparation and processing methods to ensure quality standards

Course Articulation Matrix:

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Learn to distinguish and relate the characteristics and properties of foods	✓					✓						
Apply the knowledge gained on characteristics and properties of foods during cooking.			✓									
Develop appropriate food preparation and processing methods to ensure quality standards			✓		✓							

B.Sc., NUTRITION AND DIETETICS
SEMESTER 2

Title of the Course: Principles of Food Science & Preservation (DSC- 2)

Course Title: Principles of Food Science & Preservation (DSC- 2)	
Total Contact Hours: 56	Course Credits: 4
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**56 Hours**
Unit – 1 INTRODUCTION TO FOOD SCIENCE	**14 Hours**
Definition of Food, Food Science, Functions of Food, Food groups basic, Properties of food- Solution, Vapor pressure, viscosity, specific gravity. Colloids, sols, gels, foam- Emulsion formation- Bound and free water, pH Value, osmosis and osmotic pressure, Boiling, melting and freezing points. Acids and Bases in foods. Sensory Evaluation- Subjective and objective.	
Unit – 2 CEREAL AND PULSES	**14 Hours**
Cereals and Millets : Structure, composition, Nutritive value milling of rice and wheat, Gluten, factors affect the gluten formation, gelatinization, Dextrinisation, Retrogradation. Pulses: Structures, composition and Nutritive value, use in different preparations, Germination, decortication, fermentation, Parching and puffing, pulse protein concentrates, Pulse cookery.	
Unit – 3 EGG, OIL SEEDS AND MILK PRODUCTS	**14 Hours**
Eggs: Nutritive value, Structure, composition, grade, quality selection, storage, Effect of heat on proteins, Egg products Fats and oils- composition and nutritive value-Commonly used fats and oils, role of fat in cookery	

Milk and Milk products - Composition and Nutritive value of milk, properties of milk, Milk cookery, effect of heat on milk, milk products -Non fermented and fermented products- Role of milk in cookery.	
Unit – 4 PRINCIPLES OF FOOD PRESERVATION	**14 Hours**
Principles of food preservation and their application, Practice of Cleaning and Sanitation, Food dehydration and concentration, Use of high temperature and Canning in Food Preservation, Use of Low temperature in Food Preservation, Use of Drying, Irradiation, Modified Atmosphere and Chemical preservatives, Food irradiation and microwave heating. Latest trends in food preservation Techniques	

Practical: 2 Credits

List of Experiments to be conducted

1. Weights & measures, standardization of common food preparation.
2. Sensory evaluation
3. Starch cookery I-microscopic observation of different starches gel formation and gelatinization.
4. Starch cookery II- Rice and Wheat preparation, factors influencing dough development, gluten formation.
5. Leavened products, milk cookery-casein formation, curd setting.
6. Fermented products and pulse cookery.
7. Egg, fat and oil cookery.
8. Assessment of Egg quality
9. Sugar and Jaggery- Syrup formation, crystallization and caramelization.
10. Estimation of acidity of milk

References:

1. N. Shakuntala Manay, M Shadaksharaswamy, *Foods Facts and Principles*, New age international Publishers**,** 4th Edition, 2020
2. Rick Perker, Miriah Pace, *Introduction to Food Science and Food Systems,* Cengage Publishers, 2nd Edition. 2019
3. Swaminathan, M, Handbook of Food and Nutrition, The Bangalore Press, 5th Edition. 2018
4. Sunetra Roday, *Food Science and Nutrition,* Oxford university Press, 3rd Edition. 2018
5. Srilakshmi B, *Food Science*, New Age International Publishers, 6th Edition. 2015
6. Vijaya khader, *Textbook of Food Science and Technology*, ICAR Publishers, 2013
7. B.Poornima ,*Fundamentals of Food Science, Technology, Processing and Preservation* , Centrum Press 2012
8. Norman.N.Potter, Joseph H Hotchkiss , *Food Science* , . CBS publisher's 5th Edition. 2007

B.Sc., NUTRITION AND DIETETICS

SEMESTER 2

Title of the Course: FOOD SAFETY AND HYGIENE (OE- 2A)

Course Title: **FOOD SAFETY AND HYGIENE (OE- 2A)**	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Outcomes (COs):

1. Gain knowledge on food safety and their implications on health
2. Familiarize with the concept of food safety issues on public health
3. Understand the standards, laws and regulations regarding food safety

Course Articulation Matrix:

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Gain knowledge on food safety and their implications on health	✓											
Familiarize with the concept of food safety issues on public health	✓					✓						
Understand the standards, laws and regulations regarding food safety						✓						

B.Sc., NUTRITION AND DIETETICS

SEMESTER 2

Title of the Course: FOOD SAFETY AND HYGIENE (OE-2A)

Course Title: FOOD SAFETY AND HYGIENE (OE- 2A)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 30	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**45 Hours**
Unit – 1 INTRODUCTION TO FOOD SAFETY	**15 hours**
Concept and meaning of Food Safety, food adulteration, food hazards Food laws and regulations – National (FSSAI) and international (FAO) food laws, newer approaches to food safety. PFA, FPO, Food Safety and Standards Bill 2005, International Laws and Agreements - FAO, WHO, Codex Alimentarious, Governing bodies, Exposure, estimation, toxicological requirements and risk analysis. Safety aspects of water and beverages, Safety assessment of food contaminants and pesticide residues.	
Unit – 2 FOOD SAFETY AND FOOD HYGIENE	**15 hours**
Food contaminants- Physical, Chemical and Biological contaminants, reduce microbial contamination and control growth, Eliminate source of contaminants Sanitation: Definition, principle, and purposes. Food hygiene law and the importance of food safety. Food Safety Hazards. Temperature control, food deliveries, refrigeration, low and high-risk foods, use by dates and best before dates, and stock rotation (FIFO). Cross-Contamination Hand hygiene, further hygiene considerations, protective clothing, reporting illness and first aid.	
Unit – 3 FOOD PROTECTION	**15 hours**
Food protection: General Principles, methods of food protection and food preservation - Thermal transfer methods, Chemical methods, Biocontrol methods, Irradiation methods, Foodborne Illness – Food Borne infections and Intoxications. Risk Factors, Food worker Education and training.	

References:

1. Alok Kumar, *Fundamentals of Food Hygiene Safety and Quality*, Dreamtech press, 2019
2. Ram Lakhan Singh and Sukanta Mondal, *Food Safety and Health*, Academic Press, 2019
3. Prabodh Halde, Sanjeev Kumar Sharma, *Objective Food Science and Safety standards*, Jain Brothers; 2nd edition. 2019
4. William H. & Carol Anne, *Food Safety for the 21st Century: Managing HACCP and Food Safety Throughout the Global Supply Chain*, Wiley; 2nd Edition.2018
5. Sunetra Roday, *Food Hygiene and Sanitation With case studies*, Tata McGraw, 2nd Edition, Hill.2017
6. Paul L. Knechtges, *Food Safety-Theory and Practice*, Jones & Bartlett Learning, 2012
7. David McSwane et.al., *Essentials of Food safety and Sanitation*, Pearson's, 4th Edition, 2004

B. Sc., NUTRITION AND DIETETICS

SEMESTER 2

Title of the Course: FOOD ADULTERATION (OE- 2B)

Course Title: FOOD ADULTERATION (OE- 2B)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Outcomes (COs):

1. Gain knowledge on common food adulterants and its toxic effects
2. Familiarize with the techniques of identifying Food adulterants
3. Understand the standards, laws, and regulations regarding Food Adulteration

Course Articulation Matrix:

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Gain knowledge on food safety and their implications on health				✓	✓							
Familiarize with the concept of food safety issues on public health				✓	✓							
Understand the standards, laws and regulations regarding food safety				✓	✓							

B.Sc., NUTRITION AND DIETETICS

SEMESTER 2

Title of the Course: FOOD ADULTERATION (OE-2B)

Course Title: FOOD ADULTERATION (OE- 2B)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**45 Hours**
Unit – 1 COMMON FOOD ADULTERANTS	**15 hours**
Adulteration – Definition – Types of adulterants in different food, Adulteration through Food Additives – Intentional and incidental. Health hazards and risks. Historical Food legislation in India; Central food laboratory, Municipal laboratories. National Food laws- PFA specification for food products. Salient features of Food Safety & Standards Act, 2006, Structure of FSSAI, ISO 22000, GMP, GHP, ISO 9001 (Food Safety Management System), Prevention of food adulteration Act	
Unit – 2 FOOD LAWS AND STANDARDS	**15 hours**
Consumer protection: Role of agencies such as AGMARK, ISI and Quality Control Laboratories in protecting consumer rights. International food laws- Codex Alimentarius, FDA, USDA, FAO and WHO. Other International regulatory bodies like EFSA –European food safety authority Food standards of Australia and New Zealand, Saudi Arabia food regulations	
Unit – 3 ANALYSIS OF FOOD ADULTERANTS	**15 hours**
Food Adulteration tests for common foods- Spices, Cereals and pulses, milk and milk products, Coffee, tea, Ghee, Oil and fats, sugar and sugar products. Identification of New adulterants in different foods, Toxic effects of food adulterants. Food additives; colouring matter, preservatives, poisonous metals, antioxidants and emulsifying and stabilizing agents, insecticides.	

References:

1. Bare Act, *Prevention of Food Adulteration Act, 1954 along with Rules,* Universal Law Publishing, 2016
2. Shyam Narayan Jha & Pranay, *Rapid Detection of Food Adulterants and Contaminants - Theory and Practice*, 2016
3. Sumeet Malik, Handbook of Food Adulteration and Safety Laws, Eastern Book company, 2012
4. Edwin Morris Bruce, *Detection of common Food Adulterants*, Nebu Press, 2011
5. N. Raghuramulu et.al., *Manual of Laboratory Techniques*, NIN, 2nd Edition.2003
6. A.Y. Sathe, A First Course in Food Analysis, New Age international, 1999

BANGALORE UNIVERSITY

Syllabus for

Food Science and Nutrition (Major)
B.Sc. (Basic) (Hons.) & Integrated M.Sc.

CHOICE BASED CREDIT SYSTEM (CBCS)

I – X SEMESTERS

Framed According to the National Educational Policy (NEP 2020)

To implement from the Academic Year 2021-2022

Syllabus for B.Sc., Basic/Hons M.Sc. in

Food Science and Nutrition (IIA model)

Name of the Degree Program: **B.Sc., Basic/Hons**

Discipline Core: **Food Science and Nutrition**

Total Credits for the Program: **228**

Starting year of implementation: **2021**

B.Sc., Basic/Hons - Progressive Certificate, Diploma, bachelor's degree or bachelor's degree with Honors Provided at the End of Each Year of Exit of the Four-year Undergraduate Program / Five-year Integrated Master's Degree Program.

Introduction:

The National Education Policy 2020 focusses on transforming and development of Indian Education system, by providing quality education to all. The objective of a B.Sc., (Honors) program in Food Science and Nutrition emphasizes on the fundamentals of Food and Nutrition. As Food science is a far-reaching discipline that applies the pure science subjects of chemistry, biology and nutrition to the study of the nature, properties, and composition of foods, nutritional constituents, commodities, food quality and deterioration, food preservation, product development, basics of Human physiology, nutrition during lifetime, food hygiene and sanitation, food service management, quality control in food industries and food service institutions and functional foods as part of the syllabi. The program endeavors to provide students with broad-based knowledge and training in Food Science and Nutrition to provide a solid background of basic concepts as well as exposing them to the exciting advancements in the field. They are competent to explore the field of Food and Nutrition widening their scope in areas of Food Industry, Nutritionist, Disease specific Therapist and much more.

The program aims to skill the students with knowledge of the field to gain profitable scopes in matters of career. The goal of the syllabus is to make the study of Food Science and Nutrition, interesting and encouraging to the students for higher studies including research and also to cater to the needs of quality trained manpower with necessary professional skills in the food industry as well as health sector and to educate the workforce in the field of food science and nutrition. Electives provide add on knowledge which assist in their professional endeavor

AIM AND OBJECTIVES

Provide and equip students with understanding of food Science and nutrition with evidence-based approach

- Equip students with knowledge and understanding of modern aspects of nutritional science and novel food usage

- Train on innovative recipe development applying the science of food
- Serve in core food industry, which leverages diverse food science domains including food biotechnology, product development, safety & quality control.
- Harness the skills required to be an efficient entrepreneur
- Perform in applied nutrition fields including public health and diet therapy
- Build competent professionals in the field of food industry, health care sector to address societal & national needs
- Enable students to confidently pursue higher studies and research
- Gain an understanding to enable independency to access, analyze and plan nutritional management for disease and critical condition
- Develop feasible solutions against major nutrition related health issues in country
- Develop confidence to implement nutrition education program in community
- Open a window in the field of food microbiology, quality control
- Create competitive nutritionists in various fields – hospitals, health care sectors, sports nutrition and food service institutions.

Program Outcomes:

By the end of the program the students will be able to:

PO 1	**Disciplinary Knowledge**: Understand the role and importance of food and nutrition for the welfare of the community and acquire the skills in planning diet, health and diseases
PO 2	**Communication Skills:** Learn and apply evidence-based guidelines in the field of dietetics, nutrition counselling, nutrition research laboratory, community
PO 3	**Critical thinking:** Understand the structure and functions of the different organs systems in relation to nutrition
PO 4	**Interpersonal and Problem Solving**: Design solutions and novel food products to meet the specified nutrient needs with appropriate consideration for the public health and safety.
PO 5	**Critical thinking, Communication and problem solving**: Comprehend, communicate effectively, plan, design and implement programs in the field of nutrition and dietetics

PO 6	**Decision making, Analytical and Research skills:** Understand and demonstrate the knowledge of food science, food science and quality control in societal and environmental contexts
PO 7	**Moral and ethical awareness/reasoning and Research skills:** Apply ethical principles and commit to professional ethics and responsibilities in the field of nutrition, sports, food industry and health care sectors.
PO 8	**Interpersonal and Business skills:** Understand the applications of nutraceuticals and functional foods in the product development from conceptualization to evaluation of the quality of the food product
PO 9	**Analytical and Research skills:** Comprehend the knowledge and role of food additives in food industry in relation to its analytical techniques
PO 10	**Critical thinking, Analysis and Research skills:** Understand and apply the concept of nutrients and nutritional science in the evaluation of health and disease
PO 11	**Goal Setting and Problem-solving skills**: Enable students to pursue higher education and research

Weightage for assessments (in percentage):

Type of Course	**Formative Assessment / IA**	**Summative Assessment**
Theory	**40**	**60**
Practical	**20**	**30**
Projects	**40**	**60**
Experiential Learning (Internships etc.)	**40**	**60**

Contents of Courses for B.Sc., (Hons.) in Food Science and Nutrition as Major Subject

Model II A

Semester	Course No.	Theory/ Practical	Credits	Paper Title	Marks	
					S.A.	I.A.
I	FSNT1	Theory	4	Human Physiology	60	40
	FSNP1	Practical	2	Human Physiology	30	20
	FSNOE1	Theory- OE-1	3	Fundamentals of Food and Health/ Health lifestyle and Nutrition	60	40
	FSN1 L1 &L2	Theory	3+3	Language 1 Language 2	60+60	40+40
	FSNSEC1	Theory	2	Digital Fluency	60	40
	FSNVB1	Theory	2	Physical education for Health & Wellness	60	40
II	FSNT2	Theory	4	Fundamentals of Human Nutrition	60	40
	FSNP2	Practical	2	Human Nutrition	30	20
	FSNOE2	Theory OE-2	3	Food safety and Hygiene /Food Adulteration	60	40
	FSN2 L1 &L2	Theory	3+3	Language 1 Language 2	60+60	40+40
	FSNAEC1	Theory	2	Environmental Studies	60	40
	FSNVB2	Theory	2	Physical education - NCC/NSS/R&R(S&G)/ Cultural	60	40
Exit Option with Certificate in Food Science and Nutrition (50 Credits)						
III	FSNT3	Theory	4	Food Science	60	40
	FSNP3	Practical	2	Food Science	30	20
	FSNOE3	Theory OE-3	3	Nutritional Assessment/Traditional Foods in Health	60	40

	FSN3 L1 &L2	Theory	3+3	Language 1 Language 2	60+60	40+40
	FSNSEC2	Theory	2	Artificial Intelligence	60	40
	FSNVB3	Theory	2	Physical education - NCC/NSS/R&R(S&G)/ Cultural	60	40
IV	FSNT4	Theory	4	Community Nutrition	60	40
	FSNP4	Practical	2	Community Nutrition	30	20
	FSNOE4	Theory OE-4	3	Nutrition in Weight Management / Diet in Lifestyle Disorders	60	40
	FSN4 L1 &L2	Theory	3+3	Language 1 Language 2	60+60	40+40
	FSNAEC2	Theory	2	Constitution of India	60	40
	FSNVB4	Theory	2	Physical education - NCC/NSS/R&R(S&G)/ Cultural	60	40
Exit Option with Diploma (100 Credits)						
V	FSNT5	Theory	3	Food Preservation	60	40
	FSNP5	Practical	2	Food Preservation	30	20
	FSNT6	Theory	3	Food Microbiology	60	40
	FSNP6	Practical	2	Food Microbiology	30	20
	FSNE1	Theory-DSE-1/Vocational 1	3	A) Nutrition and Food Security B) Drug and Nutrient Interaction	60	40
	FSNSEC3	Theory	2	Cyber security	60	40
VI	FSNT7	Theory	3	Food Product Development	60	40
	FSNP7	Practical	2	Food Product Development	30	20
	FSNT8	Theory	3	Elementary Dietetics	60	40
	FSNP8	Practical	2	Elementary Dietetics	30	20
	FSNE2	Theory DSE-2/ Vocational 2	3	A) Sensory Evaluation B) Nutrition and AYUSH	60	40

	FSNSEC4	Theory	2	Professional Communication	60	40
	FSNI1	Internship	2	Internship	60	40
Exit Option with Bachelor of Science, B.Sc., Degree (144 Credits)						
VII	FSNT9	Theory	3	Food Quality Control	60	40
	FSNP9	Practical	2	Food Quality Control	30	20
	FSNT10	Theory	3	Nutrition During Emergencies	60	40
	FSNP10	Practical	2	Nutrition During Emergencies	30	20
	FSNT11	Theory	4	Food Biotechnology	60	40
	FSNE3	Theory DSE-3	3	Inborn Errors of Metabolism	60	40
	FSNE4	Theory DSE-4	3	Food entrepreneurship	60	40
	FSNT12	Theory	3	Research Methodology	60	40
VIII	FSNT13	Theory	3	Public Health Nutrition	60	40
	FSNP13	Practical	2	Public Health Nutrition	30	20
	FSNT14	Theory	3	Food Additives	60	40
	FSNT20	Theory	3	Nutraceuticals and Functional Foods	60	40
	FSNE4	Theory- DSE-4	3	A) Sports Nutrition B) Entrepreneurship and Restaurant Startup C)Food Hygiene and sanitation	60	40
	FSNT16		6 (3+3)	Research Project OR Any two of the electives A) Functional Properties of Food B) Storage and Handling of Food C) Enzymes in Food Industry	140 60 60	60 40 40
Award of Bachelor of Science Honors, B.Sc., (Hons.) Degree in Food Science and Nutrition 9 (186)						
XI	FSNT17	Theory	3	Food Packaging	60	40

	FSNP17	Practical	2	Food Packaging	30	20
	FSNT18	Theory	3	Medical Nutrition Therapy -1	60	40
	FSNP18	Practical	2	Medical Nutrition Therapy -1	30	10
	FSNT19	Theory	3	Food Processing Techniques	60	40
	FSNP19	Practical	2	Food Processing Techniques	30	20
	FSNT20	Theory	3	Diet Counseling	60	40
	FSNE-5	Theory DSE-5	3	Food Chemistry	60	40
	FSNE-6	Theory DSE-6	3	Functional Foods and Nutraceuticals	60	40
X	FSNT21	Theory	3	Medical Nutrition Therapy – 2	60	40
	FSNP21	Practical	2	Medical Nutrition Therapy – 2	30	20
	FSNT22	Theory	4	Institutional Food Service Management	60	40
	FSNT23	Theory	3	Health and Nutrition Education	60	40
	FSNT24	Theory	3	Nutrition in Critical Care	60	40
	FSNT25	Project	6	Research Project Or Any 2 DSE (A) (B)Or Internship	140	60
Award of M.Sc. degree in Food Science and Nutrition (228 credits)						

*In lieu of the research Project, two additional elective papers/ Internship may be offered

Curriculum Structure for the Undergraduate Degree Program

B.Sc., Food Science and Nutrition

Name of the Degree Program: B.Sc.,

Discipline/Subject: Food Science & Nutrition

Total Credits for the Program: 228

Starting year of implementation: 2021-22

Program Articulation Matrix:

This Matrix lists only the core courses. Core courses are essential to earn the degree in that discipline/subject. They include courses such as theory, laboratory, project, internships etc. Elective courses may be listed separately

Sem	Title / Name Of the course	Program outcomes that the course addresses (not more than 3 per course)	Pre-requisite course (s)	Pedagogy	Assessment
1	**DSC-I** **A1 (4+2)** Human Physiology	PO- 2 PO- 4	PUC/ 12th Science Stream	• Lectures • Demonstrations • Discussion	Formative and Summative Assessment
	OE-1 **3 Credits** Fundamentals of Food and Health / Health lifestyle and Nutrition	PO- 7		• Lectures • Demonstration • Discussion	Formative and Summative Assessment
2	**DSC-2** **A2 (4+2)** Fundamentals of Human Nutrition	PO- 2 PO- 5		• Lectures • Demonstration • Discussion	Formative and Summative Assessment
	OE-2 **3 Credits** Food Safety & Hygiene/Food Adulteration	PO- 2 PO- 5			

B.Sc., FOOD SCIENCE & NUTRITION

SEMESTER 1

Title of the course: HUMAN PHYSIOLOGY (DSC – 1)

Course Title: HUMAN PHYSIOLOGY (DSC – 1)	
Total Contact Hours: 56	Course Credits: 4
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s): PUC/ 10+2 (with chemistry or biology as one optional)

Course Outcomes (COs):

At the end of the course the student should be able to:

1. To gain elementary knowledge of functions of organ systems in the human body.
2. To learn about the physiological functions, sources, requirements, micronutrients and its deficiencies
3. To understand the concept of water balance and the function of electrolytes in human nutrition
4. To understand the major nutritional problems in populations
5. To study the different programs and interventions for improving nutritional status.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
To gain elementary knowledge of functions of organ systems in the human body			✓												
To learn about the physiological functions, sources, requirements, micronutrients and its deficiencies		✓													
To understand the concept of water balance and the function of electrolytes in human nutrition		✓													
To understand the major nutritional problems in populations				✓	✓										
To study the different programs and interventions for improving nutritional status				✓	✓										

B.Sc., FOOD SCIENCE & NUTRITION

SEMESTER 1

Title of the Course: HUMAN PHYSIOLOGY (DSC-1)

Course Title: HUMAN PHYSIOLOGY (DSC – 1)	
Total Contact Hours: 56	Course Credits: 4
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**56 Hours**
UNIT 1- BASIC CELLS AND TISSUES	**14 Hours**
Structure and Function of Cell, Physiological properties of protoplasm. Levels of cellular organization and function – cell organelles and tissues - Structure and functions of epithelial, connective, muscular and nervous tissue, organs and systems – Brief review, Cell membrane transport across cell, membrane and intercellular communication, cell multiplication Introduction of biological membranes to understand molecular transport, transport of large molecules, receptor mediated endocytosis, exocytosis. Molecular aspects of transport; Passive diffusion, facilitated diffusion, active transport. active transport - sodium potassium pump.	
Unit – 2 - ORGAN SYSTEMS I	**14 Hours**
Digestive System - Digestive system: Physiology and functions - Digestive glands: salivary, gastric, liver, pancreas. Digestion of nutrients- Proteins, fats, carbohydrates. Hunger and thirst mechanism. Motility and hormones of GIT. Regulation of food intake – role of hunger and satiety centers, effect of nutrients. **Circulatory System -** Blood: Composition and homeostasis. Formation and functions of plasma proteins, erythropoiesis. Blood groups & histocompatibility. Composition & functions of CSF and Lymph. Structure & functions of heart.	

Unit – 3 ORGAN SYSTEMS II	14 Hours
Respiratory system - Outlined structure of respiratory system, Primary function of respiratory system, Mechanism of respiration, Transport of gases and artificial respiration. Role of lungs in the exchange of gases, Transport of oxygen and CO_2. **Excretory System -** Structure and functions of Kidney, nephron, glomerular filtration, tubular absorption and secretion. Urine formation. **Nervous System:** Review of structure and function of neuron - conduction of nerve impulse, synapses, and role of neurotransmitters, Organization of central and Peripheral nervous system.	
Unit – 4 ORGAN SYSTEM III	**14 Hours**
Skeletal & Muscular System - Ultra structure of skeletal muscle and bone. Muscular system: Muscle type, structure: Muscle proteins – contractile and non-contractile. Energetics of muscle contraction, Muscular dystrophies. **Reproductive System and Endocrine System -**Male reproductive system – Structure and functions. Female reproductive system – Structure and functions. Menstrual cycle, Puberty, Menopause. Fertilization, Development of fertilized ovum (Brief account) Placenta and its functions – Parturition. Endocrinology- Functions of hormones of the pituitary, Steroid hormones their functions and mechanism of action. **Immune System -** Organs and cells of Immune system, Primary and secondary Lymphoid organs. Immunity– Definition, Types. Antigens - Chemical nature of antigens, epitope. Immunoglobulins -Types, structures and Functions. Hypersensitivity reactions- definition and types.	

PRACTICAL: 2 Credits

1. Microscopic study of tissues- Epithelial, connective, and muscular tissues
2. Preparation of blood film and staining with Leishman's staining
3. Smear preparation of human blood for RBC and WBC count
4. Estimation of hemoglobin by Sahli- Hellige (Colorimetric) hematin method
5. Determination of blood groups and Rh factor
6. Determination of bleeding time by Duke's method
7. Determination of Blood clotting time by Wright's method
8. Clinical examination of urine

a) Physical examination: volume colour, odour, appearance, pH.

b) Test for abnormal constituents of urine: Sugar, blood, albumin, Bile salts and ketone bodies.

9. Pulse, B.P and respiratory rate at rest and after exercises
10. Estimation of Blood Urea

References:

1. Lehninger, *Principles of Biochemistry*, W.H. Freeman and Co Ltd, 8th Edition. 2021
2. CC. Chatterjee, *Human Physiology*, CBS publishers, 13th edition. 2020
3. H.S.Ravikumar Patil et.al., A textbook of Human Physiology, Wiley, 2020
4. Guyton and Hall, Textbook of Medical Physiology, Elsevier, 14th Edition. 2020
5. K Sambulingam, *Essentials of Medical physiology*, Jaypee Publishers 3rd edition. 2019
6. Barrett et.al., *Gannong's Review of Medical Physiology*, Mcgraw Hill, 26th Edition, 2019
7. Cindy L. Stanfield, *Principles of Human Physiology*, Pearson publishers,6th Edition. 2017
8. Copper, Geoffery, M, *The Cell- A Molecular Approach*, Oxford University Press, 6th Edition.2013
9. Gary G Mathews, *Cellular Physiology of Nerve and Muscle*, Wiley Balckwell, 4th Edition.2002
10. Thomas Devlin, *Textbook of Biochemistry with Clinical correlations*, John Wiley and Sons, 1999
11. A.J. Vander, et.al., *Human Physiology: The mechanisms of Body functions*, McGraw-Hill, 5th Edition. 1990

B.Sc., FOOD SCIENCE AND NUTRITION

SEMESTER 1

Title of the Course: FUNDAMENTALS OF FOOD & HEALTH (OE-1A)

Course Title: FUNDAMENTALS OF FOOD AND HEALTH (OE-1A)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Outcomes (COs):

1. Gain knowledge on key nutrients and their implications on health
2. Familiarize with the concept of health and issues of public health concern
3. Understand the effect of novel and processed foods on general health and well being

Course Articulation Matrix:

Course Outcomes (COs)/ Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Gain knowledge on key nutrients and their implications on health	✓	✓										
Understand the effect of novel and processed foods on general health and well being	✓	✓										
Familiarize with the concept of health and issues of public health concern	✓	✓										

B.Sc., FOOD SCIENCE AND NUTRITION

SEMESTER 1

Title of the Course: FUNDAMENTALS OF FOOD AND HEALTH (OE-1 A)

Course Title: FUNDAMENTALS OF FOOD AND HEALTH (OE-1A)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**45 Hours**
Unit – 1 OVERVIEW OF FOOD & MACRONUTRIENTS	**15 hours**
Overview of Food & Nutrients, Food choice and factors influencing food choice Classification of nutrients – macronutrients and micronutrients. Energy, Carbohydrates, Protein and Fats Classification, Functions and Sources Impact of macronutrients on health – Deficiency and Excess.	
Unit - 2 MICRONUTRIENTS & WATER	**15 hours**
Micronutrients - Classification, Functions and Sources in detail, Impact of micronutrients on health – Deficiency and Excess, Water –Types, Role, Distribution of water in Body, Body fluids and electrolytes. Regulation of Water and Electrolyte balance and its imbalance	
Unit – 3 COMPONENTS OF HEALTH	**15 hours**
Health – Definition, Components, Factors influencing health, Dietary guidelines Issues of public concern, Malnutrition, Anemia, Vitamin A deficiency, Obesity, Diabetes and Hypertension. Functional foods – Probiotics, prebiotics and phytochemicals, Health supplements, processed foods, organic foods, Nutrition label – understanding and importance	

References:

1. Mudambi S R and Rajagopal M V, *Fundamentals of Foods, nutrition & Diet therapy,* New Age International Publishers, 6th Edition. 2020
2. Bamji, M.S, *Textbook of Human Nutrition,* Oxford & IBH Publishing Co Pvt. Ltd,4th Edition. 2019
3. Srilakshmi B, *Dietetics*, New Age International Publishers, 8th Edition. 2019
4. Swaminathan, M, Handbook of Food and Nutrition, The Bangalore Press, 5th Edition. 2018
5. Srilakshmi B, *Nutrition Science,* New Age International Publishers, 6th Edition. 2017
6. Longvah T Anathan R, Bhaskarachary K, and Venkaiah k, *Indian food composition table*, NIN.ICMR, 2nd Edition. 2017
7. Gibney M.J, *Nutrition and Metabolism*, Wiley- Blackwell, 2003
8. Carolyn D. Berdanier, *Advanced Nutrition, Macronutrients,* CRC press, 2nd Edition.2000
9. Emma. S. Weigley, *Robinson's Basic Nutrition and Diet Therapy*, Pearson publication, 1st Edition. 1996

B.Sc., FOOD SCIENCE AND NUTRITION

SEMESTER 1

Title of the Course: Healthy lifestyle and Nutrition (OE- 1 B)

Course Title: Healthy lifestyles and Nutrition (OE- 1B)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 03Hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s): Students who have passed Pre-University Board of Examination or Equivalent board with science subjects are eligible for the undergraduate degree B.Sc., in Food Science and Nutrition.

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Gain knowledge on healthy life styles
2. Understand the relationship between different nutrients and their importance
3. Understand the importance of Nutrition in Lifestyle disorders

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Gain knowledge on Healthy Life styles	✓	✓										
Understand the relationship between different nutrients and their importance	✓											
Understand the importance of Nutrition in Lifestyle disorders						✓		✓				

B.Sc., FOOD SCIENCE AND NUTRITION

SEMESTER 1

Title of the Course: HEALTHY LIFESTYLE AND NUTRITION (OE-1 B)

Course Title: Healthy lifestyle and Nutrition (OE- 1B)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 03Hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**45 Hours**
Unit – 1 INTRODUCTION TO FOOD AND NUTRITION	**15 Hours**
History of nutrition, Relationship of food and health, Factors influencing food intake & food habits: Physiologic, Factors that determine food intake, Environmental & behavioral factors influencing food acceptance Energy and macronutrients – Carbohydrates, Protein, Fat - functions, sources deficiency disorders and recommended intakes. Micronutrients: Minerals – calcium, Iron, Iodine, and other elements, Vitamins – Fat Soluble & Water Soluble.	
Unit – 2 NUTRITION FOR LIFE CYCLE	**15 Hours**
Nutritional assessment - direct and indirect methods, Nutritional requirements for pregnancy and lactation, Nutritional requirements for growing children, Nutritional requirements for adult and elderly.	
Unit – 3 PLANNING OF DIET	**15 Hours**
Basic principles of planning diet, Dietary guides and balanced diets**.** Principles of planning a normal diet: characteristics of a normal diet, meeting nutrient requirements of individuals and family. Use of Dietary guidelines for Indians. Objectives of diet therapy- Regular diet and rationale for modifications in energy and other nutrients, texture, fluid, soft diets etc. Nutrition for health and fitness- Role of nutrition in fitness, Nutritional guidelines for health and fitness, Nutritional supplements, Importance and benefits of physical activity.	

References:

1. Mudambi S R and Rajagopal M V, *Fundamentals of Foods, nutrition & Diet therapy,* New Age International Publishers, 6th Edition. 2020
2. Manay & Shadakshara Swamy, *Food facts & principles*, New Age International Publication, 2020
3. Swaminathan, M, Handbook of Food and Nutrition, The Bangalore Press, 5th Edition. 2018
4. Srilakshmi B, *Nutrition Science*, New Age International Publishers, 6th Edition. 2017
5. Chadha R and Mathur P eds. *Nutrition: A Lifecycle Approach*, Orient Blackswan, New Delhi. 2015
6. Carolyn D. Berdanier; Johanna T. Dwyer; David Heber , *Handbook of Nutrition and Food,* 3rd Edition.2014
7. Barbara A. Bowmaw and Robert M. Russell, *Nutrition*, ILSI press, 9th Edition. 2008.
8. C. Gopalan, B.V. Ramasastri and S.G. Balasubramaniam, *Nutritive value of Indian foods*, NIN, ICMR, 2007.
9. Gibney M.J, *Nutrition and Metabolism*, Wiley- Blackwell, 2003

B.Sc., FOOD SCIENCE & NUTRITION

SEMESTER 2

Title of the Course: FUNDAMENTALS OF HUMAN NUTRITION (DSC-A2)

Course Title: FUNDAMENTALS OF HUMAN NUTRITION (DSC-A2)`	
Total Contact Hours: 56	Course Credits: 4
Formative Assessment Marks: 40	Duration of ESA/Exam: 03 Hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Pre-requisite(s): Students who have passed Pre-University Board of Examination or Equivalent board with science subjects are eligible for the undergraduate degree B.Sc., in Food Science and Nutrition.

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Knowledge in aspects of nutrition & functions of food in healthy life sustenance
2. Understand function of nutrients, dietary sources, consequences of deficiency and excess
3. Understand the food composition and concept of energy balance
4. Knowledge and understanding role of water in diet

Course Articulation Matrix: Mapping of Course Outcomes (COs) with

Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Knowledge in aspects of nutrition & functions of food in healthy life sustenance	✓											
Understand function of nutrients, dietary sources, consequences of deficiency and excess	✓											
Understand the food composition and concept of energy balance					✓							
Knowledge and understanding role of water in diet									✓			

B.Sc., FOOD SCIENCE & NUTRITION

SEMESTER 2

Title of the Course: FUNDAMENTALS OF HUMAN NUTRITION (DSC-A2)

Course: FUNDAMENTALS OF HUMAN NUTRITION (DSC-A2)	
Total Contact Hours: 56	Course Credits:4
Formative Assessment Marks: 40	Duration of ESA/Exam: 03Hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**56 Hours**
Unit – 1 DEFINITION OF FOOD, NUTRITION, HEALTH	**14 Hours**
Introduction: Food, nutrition and health – definitions, classification of foods -functional and nutritional classification. Methods of cooking - moist, dry and microwave - principles, merits and demerits. Importance and scope of food & nutrition – relation to health. Objectives in the study of nutrition Energy –Definition, forms of energy, energy needs of the body (Reference man and woman) units of measurement, energy balance, physiological fuel vales of energy, determination of energy value of foods. BMR – definition, Determination and factors affecting, Factors affecting energy requirements, diet induced thermogenesis (SDA). Water: Functions, requirements, sources. maintenance of electrolyte balance. Recent trends in food and nutrition.	
Unit – 2 MACRO NUTRIENTS	**14 Hours**
Protein -Classification, properties, functions, Digestion& absorption (in brief), RDA, classification of amino acids, sources and deficiencies and prevention, protein quality of foods – supplementary value of protein. Carbohydrate - Classification, properties, functions, Digestion & absorption (in brief), RDA, sources and deficiencies. Fat-Classification, properties, functions, Digestion & absorption (in brief), RDA, sources and deficiencies. Dietary fiber- types and functions, advantages and dis advantages of dietary fiber and RDA. Effect of processing on protein, carbohydrate and fat (in brief)	
Unit – 3 MICRONUTRIENT – VITAMINS AND MINERALS	**14 Hours**

Fat-soluble Vitamins (A, D, E & K)- Function, RDA, sources and deficiency and excess. Water soluble vitamins: thiamine, riboflavin , niacin, pyridoxine, folic acid, cyanacobalamin (B 12), biotin, pantothenic acid ascorbic acid – functions, food sources, deficiency, excess and RDA. Macro minerals- Calcium, Phosphorus and magnesium, Sodium, Potassium, Chlorine: Functions, absorption, RDA, sources and deficiencies. Micro Minerals- Iron, Zinc, Fluorine, Iodine and selenium: function, absorption, RDA, sources and deficiency. Factors hindering the absorption of macro and micro minerals.	
Unit – 4 NUTRITIONAL MANAGEMENT	**14 Hours**
Definition, importance and composition of balanced diet, RDA for various nutrients - age, gender, physiological state, food group system, definition of menu planning, factors affecting meal planning. Nutritional deficiency diseases -Causes, symptoms, treatment, Protein Energy Malnutrition (PEM), Vitamin A Deficiency (VAD), Iron Deficiency Anemia (IDA), Iodine Deficiency Disorders (IDD), Zinc Deficiency, Fluorosis. National Nutrition Policy and Program - Integrated Child Development Services (ICDS) Scheme, Mid-day Meal Program (MDMP), Public Distribution System (PDS), National programs for prevention of Anemia, Vitamin A deficiency, Iodine Deficiency Disorders. National and International agencies in uplifting the nutritional status -WHO, UNICEF, CARE, ICMR, ICAR, CSIR, CFTRI. Various nutrition related welfare program, ICDS, SLP, MOM, and others (in brief). Long term and short-term strategies- fortification, supplementation and dietary diversification to overcome malnutrition including hygiene and sanitation.	

References

1. Mudambi S R and Rajagopal M V, *Fundamentals of Foods, nutrition & Diet therapy*, New Age International Publishers, 6th Edition. 2020
2. Manay & Shadakshara Swamy, *Food facts & principles*, New Age International Publication, 2020
3. Swaminathan, M, Handbook of Food and Nutrition, The Bangalore Press, 5th Edition. 2018
4. Srilakshmi B, *Nutrition Science*, New Age International Publishers, 6th Edition. 2017
5. Chadha R and Mathur P eds. *Nutrition: A Lifecycle Approach*, Orient Blackswan, New Delhi. 2015
6. Carolyn D. Berdanier; Johanna T. Dwyer; David Heber , *Handbook of Nutrition and Food*, 3rd Edition.2014
7. Barbara A. Bowmaw and Robert M. Russell, *Nutrition*, ILSI press, 9th Edition. 2008.
8. C. Gopalan, B.V. Ramasastri and S.G. Balasubramaniam, *Nutritive value of Indian foods*, NIN, ICMR, 2007.
9. Gibney M.J, *Nutrition and Metabolism*, Wiley- Blackwell, 2003
10. Harbans lal, 2012, Food and Nutrition 2nd Edition, CBS Publishers and distributors Pvt. Ltd, New Delhi.
11. Javier se˜norans, f. Javier se˜norans, elena ib´a˜nez, and alejandro cifuentes, 2003, new trends in food processing, *critical reviews in food science and nutrition*, 43(5):507–526 .

12. Sharma d. C and devanshi sharma, 2015, first edition., nutritional biochemistry, cbs publishers and distributors.
13. Srilakshmi .b. 2015. Nutrition science. New age international pvt. Ltd. New Delhi.
14. Sunetra roday, 2016, food science and nutrition, oxford university press, New delhi, 2nd edition.

E- References :

1. www.cellinteractive.com
2. www.nutrition.org.uk
3. www.fnic.nal.usda.gov
4. www.myfooddiary.com

PRACTICAL: 2 Credits

1. Weights and measures –Household and standard measures used in food science laboratory.
2. Calculation of mean nutritive value of foods
3. Standardization of recipes.
4. Recommended Dietary Allowances/Nutritive values of foods.
5. Enhancing the nutrient value of food with protein
6. Enhancing the nutrient value of food with carbohydrate
7. Enhancing the nutrient value of food fat, and).
8. Enhancing the nutrient value of food vitamin A,
9. Enhancing the nutrient value of food vitamin C,
10. Enhancing the nutrient value of food calcium,
11. Enhancing the nutrient value of iron
12. Case studies of nutrient deficient adults and children

B.Sc., FOOD SCIENCE AND NUTRITION

SEMESTER 2

Title of the Course: FOOD SAFETY AND HYGIENE (OE-2 A)

Course Title: FOOD SAFETY AND HYGIENE (OE- 2 A)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**45 Hours**
Unit – 1 INTRODUCTION TO FOOD SAFETY	**15 hours**
Concept and meaning of Food Safety, food adulteration, food hazards Food laws and regulations – National (FSSAI) and international (FAO) food laws, newer approaches to food safety. PFA, FPO, Food Safety and Standards Bill 2005, International Laws and Agreements - FAO, WHO, Codex Alimentarius, Governing bodies, Exposure, estimation, toxicological requirements and risk analysis. Safety aspects of water and beverages, Safety assessment of food contaminants and pesticide residues.	
Unit – 2 FOOD SAFETY AND FOOD HYGIENE	**15 hours**
Food contaminants- Physical, Chemical and Biological contaminants, reduce microbial contamination and control growth, Eliminate source of contaminants Sanitation: Definition, principle and purposes. Food hygiene law and the importance of food safety. Food Safety Hazards. Temperature control, food deliveries, refrigeration, low and high-risk foods, use by dates and best before dates, and stock rotation (FIFO). Cross-Contamination Hand hygiene, further hygiene considerations, protective clothing, reporting illness and first aid.	
Unit – 3 FOOD PROTECTION	**15 hours**

Food protection: General Principles, methods of food protection and food preservation - Thermal transfer methods, Chemical methods, Biocontrol methods, Irradiation methods, Foodborne Illness – Food Borne infections and Intoxications. Risk Factors, Food worker Education and training.	

References:

1. Alok Kumar, *Fundamentals of Food Hygiene Safety and Quality*, Dreamtech press, 2019
2. Ram Lakhan Singh and Sukanta Mondal, *Food Safety and Health*, Academic Press, 2019
3. Prabodh Halde, Sanjeev Kumar Sharma, *Objective Food Science and Safety standards*, Jain Brothers; 2nd edition. 2019
4. William H. & Carol Anne, *Food Safety for the 21st Century: Managing HACCP and Food Safety Throughout the Global Supply Chain*, Wiley; 2nd Edition.2018
5. Sunetra Roday, *Food Hygiene and Sanitation With case studies*, Tata McGraw, 2nd Edition, Hill.2017
6. Paul L. Knechtges, *Food Safety-Theory and Practice*, Jones & Bartlett Learning, 2012
7. David McSwane et.al., *Essentials of Food safety and Sanitation*, Pearson's, 4th Edition, 2004

B. Sc., FOOD SCIENCE AND NUTRITION

SEMESTER 2

Title of the Course: FOOD ADULTERATION (OE- 2 B)

Course Title: FOOD ADULTERATION (OE- 2 B)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

Course Outcomes (COs):

1. Gain knowledge on common food adulterants and its toxic effects
2. Familiarize with the techniques of identifying Food adulterants
3. Understand the standards, laws and regulations regarding Food Adulteration

Course Articulation Matrix:

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Gain knowledge on food safety and their implications on health				✓	✓							
Familiarize with the concept of food safety issues on public health				✓	✓							
Understand the standards, laws and regulations regarding food safety				✓	✓							

B.Sc., FOOD SCIENCE AND NUTRITION

SEMESTER 2

Title of the Course: FOOD ADULTERATION (OE-2B)

Course Title: FOOD ADULTERATION (OE- 2B)	
Total Contact Hours: 45	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 3 hours
Model Syllabus Authors:	Summative Assessment Marks: 60

CONTENTS	**45 Hours**
Unit – 1 COMMON FOOD ADULTERANTS	**15 hours**
Adulteration – Definition – Types of adulterants in different food, Adulteration through Food Additives – Intentional and incidental. Health hazards and risks. Historical Food legislation in India; Central food laboratory, Municipal laboratories. National Food laws- PFA specification for food products. Salient features of Food Safety & Standards Act, 2006, Structure of FSSAI, ISO 22000, GMP, GHP, ISO 9001 (Food Safety Management System), Prevention of food adulteration Act	
Unit – 2 FOOD LAWS AND STANDARDS	**15 hours**
Consumer protection: Role of agencies such as AGMARK, ISI and Quality Control Laboratories in protecting consumer rights. International food laws- Codex Alimentarius, FDA, USDA, FAO and WHO. Other International regulatory bodies like EFSA –European food safety authority Food standards of Australia and New Zealand, Saudi Arabia food regulations	
Unit – 3 ANALYSIS OF FOOD ADULTERANTS	**15 hours**
Food Adulteration tests for common foods- Spices, Cereals and pulses, milk and milk products, Coffee, tea, Ghee, Oil and fats, sugar and sugar products. Identification of New adulterants in different foods, Toxic effects of food adulterants. Food additives; colouring matter, preservatives, poisonous metals, antioxidants and emulsifying and stabilizing agents, insecticides	

References:

1. Bare Act, *Prevention of Food Adulteration Act, 1954 along with Rules,* Universal Law Publishing, 2016
2. Shyam Narayan Jha & Pranay, *Rapid Detection of Food Adulterants and Contaminants - Theory and Practice,* 2016
3. Sumeet Malik, Handbook of Food Adulteration and Safety Laws, Eastern Book company, 2012
4. Edwin Morris Bruce, *Detection of common Food Adulterants*, Nebu Press, 2011
5. N. Raghuramulu et.al., *Manual of Laboratory Techniques*, NIN, 2nd Edition.2003
6. A.Y. Sathe, A First Course in Food Analysis, New Age international, 1999