UPES
UNIVERSITY OF TOMORROW

SCHOOL OF
HEALTH SCIENCES
AND TECHNOLOGY

B.Sc. Food Nutrition and Dietetics

Four-Year Program

Program Structure | 2023-2027

UPES Bidholi Campus, P.O. Bidholi via Prem Nagar, Dehradun, Uttarakhand-248007
Tel: +91 0135 2770137 | Website: www.upes.ac.in

School of Health Sciences and Technology

[B.Sc. Food Nutrition and Dietetics Four Year Program]

Programme Structure

2023-2027

UPES Campus, "Energy Acres"

P.O Bidholi via Prem Nagar, Bidholi

Dehradun, Uttarakhand-248001

Tel : + 91-135-2776053/54

Fax: + 91-135-2776090

URL: www.upes.ac.in

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1.0 Abbreviations

Cat - Category
L - Lecture
T - Tutorial
P - Practical
Cr - Credits
UC - University Core
PC - Program Core
PRJ - Project Work (including Seminars, Dissertation, and Internships)
PE - Program Elective (includes Specialization courses)
UE - University Elective (includes Signatory, Exploratory and Open Electives)
TC - Total Credits

2.0 Vision and Mission of the University:

Vision of UPES

To be an Institution of Global standing for developing professionally competent talent contributing to nation building.

Mission of UPES

- Develop industry-focused professionals with an international outlook.
- Foster effective outcome-based education system to continually improve teaching-learning and research.
- Inculcate integrative thought process among students to instill lifelong learning.
- Create global knowledge eco-system through training, research & development and consultancy.
- Practice and promote high standards of professional ethics and develop harmonious relationship with environment and society.

3.0 Vision and Mission of the School

Vision

Leadership in Health Sciences & Technology for improving Planetary, and Public Health

Mission

- To create thought leaders and change makers.
- To design appropriate, holistic and sustainable programs.
- To converge multi-disciplinary efforts to make a difference for people and the planet.

4.0 Programme Educational Objectives

PEO 1: Graduates will be accomplished healthcare professionals, innovators, or entrepreneurs actively involved in research, academics and technology development.

PEO 2: Graduates will function in their profession with ethics, social awareness and responsibility.

PEO 3: Graduates will engage with professionals in the field of allied health and environmental sciences for collaborations and knowledge exchange.

PEO 4: Graduates will be successful in pursuing higher studies in allied health science.

PEO 5: Graduates will pursue career paths in academia or research.

Program Outcomes (POs):

At the end of the program students should be able to:

PO1: Gain Knowledge of basic and applied aspects of Food, Nutrition and Dietetics.

PO2: Demonstrate basic laboratory skills in Food, Nutrition and Dietetics and understanding of advanced analytical tools to gather scientific evidence.

PO3: Ability to comprehend basic analytical problems, apply critical thinking skills and offer scientific solutions.

PO4: Demonstrate and execute time management during completion of academic exercises, assignments and research projects.

PO5: Demonstrate awareness of roles, responsibilities, and ethical standards as per academia and industry alignments.

PO6: Demonstrate leadership abilities, problem solving capability and decision making with high ethical standards.

PO7: Demonstrate good interpersonal communication skills.

PO8: Demonstrate eagerness for tackling critical societal issues concerning human and planetary health.

PO9: Recognize the need for and prepare to engage in life-long learning to adapt with technological changes.

Program Specific Outcomes (PSOs) for Food Nutrition and Dietetics Specialization

After completing the program, students will be able to:

PSO 1: Demonstrate a comprehensive understanding of health behavior, clinical judgment, and decision-making skills to assess and evaluate the nutritional status of individuals and communities.

PSO 2: Develop and provide customized diet plans based on the assessed nutritional needs of individuals and provide nutrition counselling emphasizing the importance of healthy eating habits, disease prevention, and overall well-being.

PSO 3: Exhibit technical competence, entrepreneurial traits, and food science and processing knowledge to establish and manage a nutrition-related enterprise, while designing and developing healthy and sustainable functional foods.

PSO 4: Identify and address community problems pertaining to food insecurity, malnutrition, and chronic diseases.

PSO 5: Apply knowledge of food, nutrition and dietetics to pursue a wide range of careers in higher academia and research, public health, environmental organizations, societal organizations, relevant industries and entrepreneurial activities.

6.0 Overview of Credit Allocation/ Credit Break up

Category-wise Credit distribution

Category	**Number of Credits**	**Credit Percentage (%)**
University Core (UC)	16	10
Programme Core (PC)	115	72
Programme Elective (PE)	14	9
University Elective (UE)	0	0
Projects (PRJ)	15	9
Mandatory Non-Credit Courses (MNC)	5 courses	Nil
Total	160	100

- University core subjects are those subjects that are mandatory to all similar programmes.
- Program Core courses in a curriculum are program specific. To be eligible for the degree, students must successfully finish each of the PC-listed courses.
- Program Elective courses provide the students the opportunity to study courses that are more complex and specialized, in their field of specialization.
- University electives are courses that a student can opt for from outside of his/ her programme, from across the university. This allows students to pursue their interests in other subjects as well. The number of credits that a student may take under University Elective is regulated.

7.0 Programme Structure

The term "Program Structure" refers to a list of courses (Core, Elective, and Open Elective) that make up an academic program, describing the syllabus, credits, hours of instruction,

assessment and examination systems, minimum number of credits necessary for program graduation, etc.

B.Sc. (Food, Nutrition and Dietetics) Programme (2023-2027)

SEMESTER I

Cat	Course Code	Course Title	L	T	P	TC
PC	HSCC1025	Human Anatomy and Physiology	3	1	2	6
PC	HSND1001	Principles of Nutrition	3	1	2	6
PC	HSND1002	Fundamentals of Food Science	3	1	2	6
UC		Living Conversations (SFL)	1	1	0	2
MNC	HSCC1024	Ability Enhancement / Co-curricular	0			0

SEMESTER II

Cat	Course Code	Course Title	L	T	P	TC
PC		Principles of Biochemistry	2	1	1.5	4.5
PC		Computer Application and Bioinformatics	2	1	1.5	4.5
PC		Fundamentals of Biostatistics	2	1	1.5	4.5
UC		Critical Thinking and Writing (SFL)	1	1	0	2
PE		Elective Course	2	1	1.5	4.5

SEMESTER III

Cat	Course Code	Course Title	L	T	P	TC
PC		Nutrition Through the Lifecycle	2	1	1.5	4.5
PC		Food Safety and Laws	2	1	1.5	4.5
PC		Institutional Food Service Management	3	1	1	5
UC		Environmental Science	3	1	0	4
UC		Leadership and Teamwork	1	1		2
MNC		Ability Enhancement/ Co-curricular	0			0

SEMESTER IV

Cat	Course Code	Course Title	L	T	P	TC
PC		Meal Planning	2	1	1.5	4.5
PC		Food Microbiology	2	1	1.5	4.5
PC		Biosafety and Aseptic Techniques				
UC		Working with Data	2	0	0	2
MNC		Ability Enhancement / Co-Curricular	0	0	0	0
PE		Elective Course	2	1	1.5	4.5

SEMESTER V

Cat	Course Code	Course Title	L	T	P	TC
PC		Diet Therapy	2	1	1.5	4.5
PC		Epidemiology and Global Health	2	1	1.5	4.5
PC		Immunology	2	1	1.5	4.5
PC		Bioinstrumentation	2	1	1.5	4.5
UC		Design Thinking	1	1	0	2
MNC		Ability Enhancement / Co-curricular	0	0	0	0
PRJ		Industrial Training / Survey / Project			4	Q*

SEMESTER VI

Cat	Course Code	Course Title	L	T	P	TC
PC		Diet Therapy-II	3	1	2	6
PC		Community Nutrition	3	1	2	6
PC		Sports Nutrition	3	1	2	6
UC		Start your Start up (SFL)	1	1	0	2
MNC		Ability Enhancement / Co-curricular	0	0	0	0
PRJ		Industrial Training / Survey / Project			4	Q*

SEMESTER VII

Cat	Course Code	Course Title	L	T	P	TC
PC		Public Health Nutrition	2	2	1	5
PC		Nutrition in Emergencies	2	2	1	5
PC		Research Methodology	3	1	1	5
PC		Good Laboratory and Manufacturing Practices	3	1	1	5

SEMESTER VIII

Cat	Course Code	Course Title	L	T	P	TC
PRJ		**Industrial Training / Start up** (For BSc Honours Students) **Research Project** (For BSc Honours Students with Research)	-	-	15	15
PE		Elective Course	3	2	-	5

*Q – Qualifying

Note:
Common courses highlighted in Red

8.0 List of Electives as per NEP

S.N.	Electives	Credits
1	Skill Enhancement/Vocational-I: **Living Conversations (SFL)**	2
2	Ability Enhancement/Co-curricular-I	Qualifying
3	Skill Enhancement/Vocational-II: **Critical Thinking and Writing**	2
4	Ability Enhancement/Co-curricular-II	Qualifying
5	Minor Elective (Exploratory Elective) either in Ist or IInd Semester	4.5
6	Skill Enhancement/Vocational-III: **Environmental Science**	4
7	Skill Enhancement/Vocational-IV: **Leadership and Teamwork**	2
8	Ability Enhancement/Co-curricular-III	Qualifying
9	Skill Enhancement/Vocational-V: **Working with Data**	2
10	Ability Enhancement/Co-curricular-IV	Qualifying
11	Skill Enhancement/Vocational-VI: **Design Thinking**	2

12	Industrial Training/Survey/Project	Qualifying
13	Ability Enhancement/Co-curricular-V	Qualifying
14	Skill Enhancement/Vocational-VII: **Start your Start Up (SFL)**	2
15	Ability Enhancement/Co-curricular-VI	Qualifying
16	Industrial Training/Survey/Project	Qualifying
17	Industrial Internship/Startup - BSc Honours students Research Project-BSc Honours with Research students	15
18	Minor elective	5

SEMESTER I

HSCC XXXX	Human Anatomy and Physiology	L-T-P-C: 3-1-2-6

COURSE OBJECTIVES:

- To cover human anatomy and lay out the physiology of various systems including cardiovascular, respiratory, reproductive, skeletal, nervous systems, special senses among others.
- To explore the amazing inner workings of the body, which is a complex collection of interacting systems that carry out the important functions that let you move, think, feel and live.

COURSE OUTCOMES

After completion of this course, the students will be able to

CO1. Explain the gross morphology, structural organization, and body systems.

CO2. Discuss and correlate body systems with various homeostatic mechanisms and their imbalances.

CO3. Identify and distinguish various types of cells, tissues and organs.

CO4. Perform various experiments related to various organ system.

CO5**.** Analyze the coordinated working pattern of different organs of each system.

Co-Relationship Matrix

Program Outcomes / **Course Outcomes**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	-	-	-	-	-	-	-	1	-	-	-
CO 2	3	-	-	-	-	-	-	-	1	-	-	-

CO 3	-	3	-	-	-	-	-	-	1	-	-	-
CO4	-	3	-	2	-	1	1	-	1	-	2	1
CO5	-	3	2	2	-	1	1	-	1	-	2	1
Average	3	3	2	2	-	1	1	-	1	-	2	1

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)
Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)
Syllabus

UNIT-I Introduction to Human Anatomy and Physiology (12 Hours)

Introduction to anatomy and physiology, Level of Organization (atomic, molecular), Cellular Level of Organization, Tissue Level of Organization, Cell Structure and functions, cell-cell communication, intracellular cell signalling including Adenyl cyclase, ATP, AMP, GMP, Tyrosine Kinase, Phosphorylase, cell-cell signalling, cell division, homeostasis, negative and positive feedback.
Integumentary System: Anatomy and functions of skin
Skeletal System: Axial skeleton system, appendicular skeleton system, neuromuscular junction, joins, muscle contraction.

UNIT- II Circulatory System and Special Senses (12 Hours)

Body fluids and blood: Body fluids, composition and functions of blood, hemopoiesis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood
Lymphatic system: Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system, Immune System and its classification.
Special Senses: Structure and functions of eye, ear, nose and tongue and their disorders.

UNIT-III Nervous and Cardiovascular System (12 Hours)

Nervous system: Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters. Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid. Structure and functions of brain, spinal cord.
Peripheral Nervous System: Classification of peripheral nervous system: structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves.
Cardiovascular System Heart: Anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and

heartbeat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart.

UNIT-IV Digestion, Respiration and Hormone Regulation (12 Hours)

Digestive system: Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine and large intestine, Energetics Formation and role of ATP, Creatinine Phosphate and BMR
Respiratory system: Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods
Endocrine system: Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland, thymus and their disorders

UNIT-V Genitourinary System and Introduction to genetics (12 Hours)

Urinary system: Anatomy of urinary tract with special reference to anatomy of kidney and nephrons, functions of kidney and urinary tract, physiology of urine formation, role of RAS in kidney and disorders of kidney.
Reproductive system: Anatomy of male and female reproductive system, Functions of male and female reproductive system
Introduction to genetics Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance

References

1. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
2. Ross and Wilson: Anatomy and physiology in Health and Illness, 11th Edition, Church Hill Livingstone, 2011.
3. West, J.B.: Best and Taylor's Physiological Basis of Medical Practice, 11th Edition,2007
4. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
5. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
6. Keel and Neil: Samson and Wright's Applied Physiology (12th edition), Oxford University Press. London.2004
7. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers' medical publishers, New Delhi.

Practical **60 Hours**

1. Study of compound microscope.
2. Microscopic study of epithelial and connective tissue
3. Microscopic study of muscular and nervous tissue
4. Identification of axial bones
5. Identification of appendicular bones
6. Introduction to hemocytometry.
7. Enumeration of white blood cell (WBC) count
8. Enumeration of total red blood corpuscles (RBC) count
9. Determination of bleeding time, clotting time
10. Estimation of hemoglobin content
11. Determination of blood group and erythrocyte sedimentation rate (ESR).
12. Determination of heart rate and pulse rate.
13. Recording of blood pressure.
14. Study of various organ system with the help of models
15. Determination of respiratory volumes with the help of spirometer.

Recommended Books

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MI USA
4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brothers medical publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brothers medical publishers, New Delhi

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme:

Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

HSCC XXXX	Principle of Nutrition	L-T-P-C: 3-1-2-6

Course Objectives

- To provide students with a comprehensive understanding of the fundamental principles of nutrition and their application to human health.
- To enable students to explore the roles of macronutrients, micronutrients, and other dietary components in maintaining optimal health and preventing nutrition-related diseases.
- To develop the skills necessary to make informed dietary choices and promote healthy eating behaviors.

Course Outcomes

After completion of this course, the students will be able to

CO1. Understand the basic principles of human nutrition and their relevance to overall health and well-being.

CO2. Describe the functions, food sources, and recommended intakes of macronutrients and micronutrients.

CO3. Evaluate the relationship between nutrition, growth, metabolism, and the prevention of diseases.

CO4. Apply knowledge of nutrition principles to design and assess healthy dietary patterns.

CO-PO Mapping

Program Outcomes / Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS 04	PS O5
CO 1	3		1						1	2			2	1	
CO 2	3		1				1		2	2			2		
CO 3		3	2		1				3	2	2	2		1	

CO 4		2	2	2	2	2	2		3		2	3	3	2	3
Average	1.5	1.25	1.5	0.5	0.75	0.5	0.75		2.25	1.5	1	1.25	1.75	1	0.75

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High)
"_" means there is no correlation

Syllabus **60 Hours**

UNIT I: Understanding Nutrition **(8 Hours)**

Overview of health and nutrition: definitions. Balanced diet, food groups, Nutritional status. Nutrients and their classification. Dietary guidelines and recommendations. Food labelling and nutrition claims.

UNIT II: Macronutrients **(20 Hours)**

Carbohydrates: Classification. Digestion, absorption and transport of carbohydrates, functions. Sources, RDA and nutrient requirement. Role of dietary fiber. Regulation of blood glucose concentration, glycemic response of carbohydrates, carbohydrate counting.

Proteins: Classification of amino acids. Metabolism: Digestion, absorption and transport of proteins, functions. Sources, RDA and nutrient requirement, protein turnover and synthesis, methods of assessing protein quality and requirements. Protein deficiency.

Lipids: Classification of fatty acids. Metabolism: Digestion, absorption, and transport of fatty acids function. Sources, RDA and nutrient requirement. Lipids and cardiovascular disease risk.

UNIT III: Energy Balance **(12 Hours)**

Energy balance equation: energy intake and expenditure. Components of energy expenditure: basal metabolic rate, physical activity, thermic effect of food. Energy balance and body weight regulation: factors influencing energy intake – appetite, satiety, and hunger.

UNIT IV: Vitamins **(10 Hours)**

Classification – Water soluble and fat-soluble vitamins, characteristics, functions, sources, RDA and nutrient requirements, deficiencies, and toxicity.

UNIT V: Minerals **(10 Hours)**

Classification of minerals and their characteristics. Major and Minor minerals: functions, bioavailability, sources, RDA and nutrient requirement, deficiency, toxicity.

Water and electrolytes: importance and balance.

Practical: **60 hours**

1. Nutrient analysis of food labels and determination of the nutrient content per serving. To interpret food labels for making informed dietary choices.
2. Nutrient and health claims analysis. Compare the nutrient composition of different food products within the same category.
3. Nutritional status assessment for adults: Measurement of weight, height, body circumference. Calculation of BMI and its interpretation
4. Calculation of BMR and energy requirements
5. Dietary protein evaluation and assessment of protein quality using amino acid score.
6. Estimation of moisture content in given food sample.
7. Estimation of total carbohydrates and free sugar in given food sample.
8. Estimation of crude protein in given food sample.
9. Estimation of fat content in given food sample.
10. Estimation of ash content in given food sample.
11. Estimation of respiratory quotient of food samples using bomb calorimeter.

Reference Books

1. Carol Byrd-Bredbenner, Jacqueline Berning, Danita Kelley, Jaclyn Abbot, Gaile Moe and Donna Beshgetoor. 2022. Wardlaw's Perspectives in Nutrition. 12th Ed. McGraw Hill International Edition.
2. Medeiros D M and Wildman R E C. 2019. Advanced Human Nutrition. Jones & Barlett Learning LLC.
3. Thompson J. and Manore M. 2018. Nutrition: An Applied Approach. 5th edition. Pearson

4. Sareen S. Gropper, Jack L.Smith, Timothy P. Carr. 2017. Advanced nutrition and human metabolism. 7th edition. Australia; Belmont, CA: Wadsworth Cengage Learning.
5. Nix, Staci. 2016. Williams' Basic Nutrition & Diet Therapy. 15th ED. Mosby-Elsevier.
6. Working group of the First Edition, NIN. 2011. Dietary guidelines for Indians: A manual. National Institute of Nutrition, Hyderabad.
7. A Report of the Expert Group, Indian Council of Medical Research, National Institute of Nutrition. 2020. Recommended dietary allowances and estimated average requirements nutrient requirements for Indians. National Institute of Nutrition, Hyderabad.
8. FAO, Food and Nutrition Technical Report Series. 2001. Human energy requirements: Report of a Joint FAO/WHO/UNU Expert Consultation.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme: Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment	**End Term Examination**	

Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

HSCC XX	Fundamentals of Food Science	LTPC: 3-1-2-6

Course Objectives

- To understand the interrelationship between Food, Nutrition and Health.
- To obtain knowledge of different food groups and their nutritive value.
- To develop skills in food preparation with the conservation of nutrients and palatability using cooking methods generally employed
- To understand in brief about the functions of food and various nutrients, their requirements, dietary sources.

Course Outcomes

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

CO1: Understand significance of different food groups in relation to health and nutritional status.

CO2: Describe different methods of cooking and ways to prevent nutrient losses.

CO3: Provide in depth knowledge pertaining to effect of cooking on nutrient profile.

CO 4: Evaluate the final product quality through sensory evaluation.

CO 5: Apply the knowledge of selecting various food groups to prepare a balanced diet.

CO-PO Mapping

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High) "_" means there is no correlation

Program Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5

Course Outcomes															
CO 1	3	2	-	1	1	1	1	1	1	-	3	2	2	1	**3**
CO 2	3	2	-	1	1	1	1	1	1	-	3	2	2	1	**3**
CO 3	3	2	-	1	1	1	1	1	1	-	3	2	2	1	**3**
CO4	3	2	-	1	1	1	1	1	1	-	3	2	2	1	**3**
CO5	3	2	-	1	1	1	1	1	1	-	3	2	2	1	**3**
Average	**3**	**2**	**-**	1	1	**1**	1	1	1		**3**	**2**	**2**	1	**3**

Syllabus **(60 Hours)**

UNIT I: Basics of Food Science **(12 Hours)**

Food groups: Basic food groups classification by ICMR. Functional food groups-energy yielding, body building and protective foods. Food Pyramid, My Plate. Study of different cooking methods and nutrient retention – Moist heat, Dry heat and Combination. Advantages and disadvantages associated with different methods of cooking.

UNIT II: Cereals and Pulses, Composition and Nutritive Value **(12 Hours)**

Cereals: Composition, Nutritive value and processing of wheat, rice, barley, rye, oats, millets and its products, convenient cereal products.

Pulses: Composition and nutritive value, Digestibility of pulses, Processing, Toxic constituents, Pulse cookery.

UNIT III: Animal Foods and Its Products **(12 Hours)**

Composition and Nutritive Value of Milk, Types of milk, properties of milk proteins – effect of heat, acid and phenolic compounds on milk.

Egg: Composition, Nutritive Value and structure of egg, Egg as a binding, foaming and emulsifying agent, Quality and Grading of Eggs.

Meat: Post-mortem changes in meat – rigor mortis, curing, ageing and tenderization, Changes during cooking of meat Poultry: Advantages of white meat

Fish: Classification, Characteristics of fresh fish, Spoilage, Nutritional importance of fish.

UNIT IV: Fruits, Vegetables and Sensory Evaluation (12 Hours)

Classification of Vegetables, Composition and Nutritive profile. Plant pigments: Water insoluble and Water-soluble pigments, Factors affecting plant pigments on cooking: acid, alkali, metals, heat, Flavor compounds: terpenoids, flavonoids, Sulphur compounds and other volatile flavor compounds, Enzymatic Browning and its prevention, Physio – Chemical changes in Fruits and Vegetables- Ripening, Respiration and Textural changes.

Sensory evaluation techniques: Difference tests: paired comparison test, duo-trio test, triangle test, Rating tests – Ranking, single sample, Two sample and Multiple sample difference Tests, Hedonic scaling, Numerical scoring, Composite scoring, Sensitivity tests and Descriptive tests

UNIT V: Fats and Oil, Sugar composition and nutritive value (12 Hours)

Fats and Oils - Types of oils, function of fats and oils, shortening effects of oil, smoking point of oil, factors affecting absorption of oil. Sugar cookery- Types of sugar, Stages of sugar cookery, crystallization and factors affecting crystallization.

Spices and Condiments- general function, role and usage in cookery.

Practical (**60 Hours)**

1. Prepare different types of recipes using all cooking methods.
2. Perform practical on gelatinization, retrogradation, and dextrinization.
3. Prepare fermented food products.
4. Comparative study of animal-based milk and plant-based milk available in the market and their nutritional value
5. Check the quality of eggs using different methods e.g., candling, and floating tests.
6. Effect of ingredients like sugar, salt, acids, and starch on the cooking of eggs.
7. Prepare recipes where eggs act as – a) binding agents b) emulsifying agent.
8. Evaluation of changes during cooking in plant-based meat and chicken
9. Study enzymatic browning in fruits and vegetables and methods of prevention.
10. Determine the effect of pH of different pigments present in fruits and vegetables.
11. Determination of pectin content in different fruits and vegetables using Alcohol Test
12. Calculate the changes in chlorophyll content of the cooked and uncooked spinach.
13. Determine the smoking points of different oil samples.
14. Perform sensory evaluation of different food samples via paired comparison test, duo trio test and triangles test.

Recommended Books/ Resources:

1. Norman N. Potter and Joseph H. Hotchkiss. 1998. Food Science, 5th edition. New York, Chapman & Hall, ISBN: 9781461372639, 9781461372639.
2. Shakunthala Manay, N and Shadakhraswamy, M. 2021. Food Facts and Principles. 4th ed. New Age International (P) Ltd.
3. Srilakshmi B. 2018. Food Science. 7th (multi-color) ed. New Age International (P) Ltd.
4. Mudambi SR, Rao SM and Rajagopal MV. 2018. Food Science. Revised 2nd ed. New Age International (P) Ltd.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme :

Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total

Weightage (%)	30	20	20	20	10	100

HSCC XXXX	**Living Conversations (SFL)**	**L-T-P-C:2-1-1.5-4.5**

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HSCC XXXX	**Ability Enhancement/Co-curricular**	**L-T-P-C:**

SEMESTER II

HSCC XXXX	Principles of Biochemistry	L-T-P-C:2-1-1.5-4.5

Course Objectives

- To expose students to thermodynamics basis, bioenergetics of reaction, the basic role of biomolecules and their chemical interactions inside the cell.
- To provides deeper insight into structures, properties and functions of major biomolecules and metabolic pathways in the living systems.

Course Outcomes

After completion of this course, the students will be able to

CO1: Understand thermodynamics basis of life, bioenergetics of a reaction and pathway and different intermolecular interactions in structural organization of proteins.

CO2: Describe the structure and functions of different chemical building blocks (carbohydrates, proteins and lipids) of life.

CO3: Identify and draw structures of various types of biomolecules (carbohydrate, lipids, and proteins).

CO4: Classify enzyme in different categories and explain what enzyme does, how enzyme works and primary biochemical pathways leading to synthesis and catabolism of major biomolecules.

CO5: Demonstrate skills to prepare the solutions, buffers and identify and analyse any biological molecules in the given sample.

CO-PO Mapping

Program Outcomes / Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	1	1	1	2	1	1	1	1	3	2	2	1	**2**
CO 2	3	2	1	1	1	2	1	1	1	1	3	2	2	1	**2**
CO 3	3	2	1	1	1	2	1	1	1	1	3	2	2	1	**2**
CO4	3	2	1	1	1	2	1	1	1	1	3	2	2	1	**2**
CO5	3	2	1	1	1	2	1	1	1	1	3	2	2	1	**2**
Average	**3**	**2**	**1**	1	1	**2**	1	1	1	1	**3**	**2**	**2**	1	**2**

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High)
"_" means there is no correlation

Syllabus **(45 Hours)**

UNIT I Introduction to biophysics **(12 Hours)**

Introduction and history of biophysics, main features of quantum theory, elementary particles and their interactions. Bioenergetics, endergonic and exergonic reactions, Laws of thermodynamics, entropy, enthalpy, Gibb's free energy, standard Gibb's free energy, ATP and different high energy compounds. Properties and role of water. Buffers - action, capacity, relationship between pH & pKa (Henderson -Hasselbalch equation) and its importance.

UNIT II Proteins & Enzymes **(11 Hours)**

Amino acids and peptides- classification, chemical and physical properties, Introduction to protein structure and function, secondary, tertiary and quaternary structure of proteins,

fibrous and globular proteins, protein folding and Anfinsen's experiment. Amino acid metabolism-Amino acid deamination and transamination, urea cycle. Introduction to enzymes, classification of enzymes, mechanism of action, Michaelis-Menten equation and significance of Km, Vmax and Kcat.

UNIT III Carbohydrates **(12 Hours)**

Monosaccharides-structure of aldoses and ketoses, open and ring structure of sugars, conformations of sugars, mutarotation, anomers, epimers and enantiomers. Disaccharides-maltose, lactose and sucrose. Polysaccharides-homo and heteropolysaccharides, structural and storage polysaccharides. Anabolism and catabolism, glycolysis citric acid cycle and gluconeogenesis.

UNIT IV Lipids **(10 Hours)**

Definition, biological functions, general formulae, nomenclature and properties of fatty acids, essential and non-essential fatty acids, classification of lipids, building blocks of lipids - fatty acids, glycerol, ceramide, saponification number and iodine number, suitability of triglycerides as storage lipids, saponification number and iodine number. Introduction to lipid micelles, monolayer and bilayer, transport of fatty acids.

Practical **(45 Hours)**

1. To prepare different solutions-based molarity, normality and percentage.
2. To prepare buffer solution and pH measurement
3. Qualitative test for carbohydrates
4. Qualitative test for amino acids.
5. Titration of Amino acid (Neutral) with a strong base and acid.
6. Quantitative estimation of protein by Bradford/Bicinchoninic acid method
7. Assay of salivary amylase.
8. Qualitative test for lipids.
9. Quantitative test for lipids- Salkowski/Lieberman-Burchard test.
10. Colorimetric estimation of urea/blood urea nitrogen (BUN).

Reference Books

1. Lehninger: Principles of Biochemistry (2017) 7th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN 13: 978-1464126116.
2. Textbook of Biochemistry with Clinical Correlations an Indian Adaptation (2022) 7th ed., Devlin, T.M., John Wiley & Sons, Inc., ISBN: 978-9354641558.

3. Biochemistry (2019) 9th ed., Berg, J.M., Tymoczko, J.L. and Stryer, L., W.H Freeman and Company (New York), ISBN 13: 978-1319114671.
4. Principles and Techniques of Biochemistry and Molecular Biology (2018) 8th ed., Wilson, K. and Walker, J. Cambridge University Press, ISBN 13: 978-1316614761.
5. Introduction to Practical Biochemistry, Sawhney, S.K. and Singh R. so Narosa Publishing House (New Delhi), ISBN-13: 978-8173193026.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme:

Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total

Weightage (%)	30	20	20	20	10	100

HSCC XXXX	**Computer Applications and Bioinformatics**	**L-T-P-C:2-1-1.5-4.5**

Course Objectives

Theory:

- The basic objective is to give students an introduction to the basic practical techniques of Computer Application and Bioinformatics.
- Emphasis will be given to the application of Computer Application and Bioinformatics and biological databases to problem solving in real research problems.
- The students will become familiar with the use of a wide variety of internet applications, computer application, biological database, sequence alignment, biological database management, molecular docking and drug designing and will be able to apply these methods to research problems.
- The aim is to provide practical training in bioinformatics methods including accessing the major public sequence databases, structure database, drug database.
- Use of the different computational tools to find sequences, protein structure and drug molecules.
- Analysis of protein and nucleic acid sequences by various software packages.
- It also provides a step by step, theoretical and practical introduction to the development of useful tools for automation of complex computer jobs and making these tools accessible on the network from a web browser.

Course Outcomes

After completion of the course, students will be able to

CO1: Understand the basics of computer application and bioinformatics.
CO2: Identify and define the basic concepts of bioinformatics and its significance in biological data analysis.
CO3: Demonstrate the ability to choose the methods to symbolize and manage the different types of biological database, sequence alignment and phylogenetic tree analysis.
CO4: Overview about biological macromolecular structures and structure prediction methods, molecular docking and drug designing.
CO5: Develop competency in bioinformatics for solving different biological problems, data handling process and data retrieval process from different, biological databases, usage of different software for analyzing biological data, sequence alignment, molecular docking and drug designing.

CO-PO Mapping

Program Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO4	PSO5
Course Outcomes																
CO 1	3	3	-	-	-	3	-	-	-	-	3	-	-	-	-	
CO 2	-	3	-	-	-	3	-	-	-	-	-	-	-	-	-	
CO 3	-	-	-	3	3	-	3	-	-	-	-	2	-	-	-	
CO 4	-	-	3	-	3	-	-	3	-	-	-	-	-	3	-	
CO 5	-	-	-	-	3	-	-	-	3	3	-	-	2	-	3	
Average	3	3	3	3	3	3	3	3	3	3	3	2	2	3	3	

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High)
"_" means there is no correlation

Syllabus

UNIT I: Introduction to Computer Application **05 Hours**

Basics of computer hardware, software, and networking. Operating Systems software and Application Systems software. Windows features, Microsoft office, data format for biological samples.

UNIT II: Biological Databases **10 Hours**

Definition and History and Applications of Computational Biology and Bioinformatics, Internet resources, various databases and bioinformatics tools, organization of databases. Sequencing database, 3D Structure Database, Chemical Structure database, Gene Expression database, Derived Databases, Structure classification database, Protein-Protein interaction database and Pathway database.

UNIT III: Sequence Alignment and Phylogenetic Tree **10 Hours**

File formats, Basic concepts of sequence analysis, Scoring matrices, Pair wise sequence alignments, Multiple sequence alignment, Database Searches: Keyword-based searches and Sequence-based searches. Phylogenetic Trees: phylogenetic tree representation, building phylogenetic trees,

UNIT IV: Structure Prediction **10 Hours**

Overview and Introduction to Protein Structure, Sequence-Sequence Alignment Methods, Sequence Based Secondary Structure Prediction. Visualization of structures using Rasmol or ADT. Fundamentals of the methods for 3D structure prediction, Homology/comparative Modeling. AI based protein structure prediction.

Unit V: Molecular Docking and Drug Designing **10 Hours**

General approach to discovery of new drugs, lead discovery, lead modification physiochemical, principles of drug action, 3D database search, computer aided drug design, AI based drug screening, docking, molecular modelling in drug design, structure-based drug design.

Recommended Books/ Resources:

- Bioinformatics and Computational Biology-A Primer for Biologists by Basant K. Tiwary. 2022, ISBN : 978-981-16-4240-1
- Lopes H, editor. Computational Biology and Applied Bioinformatics. InTech; 2011. Available from: http://dx.doi.org/10.5772/772
- Encyclopedia of Bioinformatics and Computational Biology-ABC of Bioinformatics. Shoba Ranganathan, Kenta Nakai, Christian Schonbach. August 21, 2018, ISBN: 9780128114148
- Introduction to Bioinformatics, Teresa Attwood, David Parry-Smith, Pearson Education. ISBN: 978-8178085074
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Second Edition, Andreas D. Baxevanis, B. F. Francis Ouellette. A John Wiley & Sons, Inc., Publication. ISBN: 978-0471478782
- Jianyuan Deng and others, Artificial intelligence in drug discovery: applications and techniques, Briefings in Bioinformatics, Volume 23, Issue 1, January 2022, bbab430, https://doi.org/10.1093/bib/bbab430

Practical: **45 Hours**

1. Referencing in Scientific literature and their practical usage, PubMed
2. Sequence retrieval
3. Biological Databases: Study of different biological databases (esp. the ones given below), Format.
4. Pair wise sequence alignment, Local and Global alignment – Algorithms
5. DOT matrix analysis

6. Databases search for homologous sequence using (BLAST) and (FASTA)
7. MSA: (Clustal W, Clustal X), Algorithms-MSA, Progressive alignment etc, Problems with MSA method, Statistics behind MSA
8. MUSCLE, T-COFFEE
9. Protein structure prediction tools (2D and 3D structure prediction)
10. Molecular Docking using Autodock
11. Drug Designing using Chemsketch
12. AI application in computational biology and bioinformatics

HSCC XXXX	Fundamentals of Biostatistics	L-T-P-C:2-1-1.5-4.5

Course Objectives

- To introduce students with the fundamental principles and techniques of biostatistics.
- To provide hands-on experience with statistical software and practical exercises to reinforce the concepts learned and to emphasize the application of statistical methods in Health Sciences & Technology.
- To let students, conduct hypothesis testing, apply statistical techniques, and learn to analyse and interpret data to make evidence-based decisions in various healthcare and research settings.

Course Outcomes

After completion of the course, students will be able to
CO1. Understand the basic concepts and principles of biostatistics and its relevance to healthcare and clinical research.
CO2. Apply appropriate statistical techniques to analyse and investigate scientific questions in healthcare and research settings.
CO3. Design and conduct basic experiments or studies to investigate scientific questions in the relevant disciplines.
CO4. Apply statistical software tools to perform data analysis, interpret the output, and effectively communicate the findings of statistical analyses in healthcare and clinical research.

CO-PO Mapping

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	1	1						1	2				1	

CO 2	3	3	2						2	2	1		1		1
CO 3	1	3	2	2	1	2	1		3	2	2		1	1	2
CO 4	1	2	2		2	1	2		1		2		1	1	1
Average	**2**	**2.25**	**1.75**	**0.5**	**0.75**	**0.75**	**0.75**		**1.75**	**1.5**	**1.25**		**0.75**	**0.75**	**1**

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High)
"_" means there is no correlation

Syllabus **(45 Hours)**

UNIT I: Introduction to Biostatistics and Data Types **(5 Hours)**
Understand the importance of biostatistics in healthcare and clinical research. Define different types of data. Variables: continuous, nominal, ordinal. Scales of measurement.

UNIT II: Descriptive Statistics and Probability Distributions **(7 Hours)**
Measures of central tendency: mean, median and mode. Measures of variability: range, variance, and standard deviation. Frequency distributions and graphical representations of data: histograms, box plots, and scatter plots. Basic principles of Probability. Discuss probability distributions: discrete and continuous, normal distribution.

UNIT III: Sampling Techniques and Sampling Distributions **(6 Hours)**
Understand different sampling techniques and their applications. Discuss sampling distributions and the Central Limit Theorem. Calculate confidence intervals and understand their interpretation.

UNIT IV: Hypothesis Testing – Parametric and Non-parametric methods (15 Hours)
One-Sample Tests: formulate null and alternative hypotheses, conduct hypothesis tests for one-sample mean and proportion, Interpret test results and inferencing. Two-Sample Tests: hypothesis testing for two independent samples, Compare means and proportions between groups. Paired t-tests. Analysis of Variance (ANOVA), Understand the principles of analysis of variance, one-way ANOVA and result interpretation. Apply post hoc tests for multiple comparisons.
Nonparametric tests for situations with violated assumptions and their interpretations: Chi square tests, Wilcoxon-Signed rank test, Kruskal-Wallis, Fischer's Exact Test. Compare parametric and nonparametric tests.

UNIT V: Regression analysis and Correlation, Survival Analysis (12 Hours)

Understand the concepts of correlation and regression. Correlation coefficients. Perform simple linear regression and assess the model's goodness of fit. Multiple regression for multiple variables.

Survival analysis: Understand the principles and applications of survival analysis. Estimate survival probabilities using Kaplan-Meier curves. Apply Cox proportional hazards regression.

Practical: (45 Hours)

1. Perform basic data manipulation tasks such as importing, exporting, and cleaning data using suitable statistical software (e.g., R, SPSS, or SAS).
2. Calculate measures of central tendency (mean, median, mode) and variability (range, variance, standard deviation), construct frequency distributions and generate box plots, scatter plots, histograms using the given data.
3. Formulate null and alternative hypotheses. Perform one-sample and two-sample hypothesis tests. Interpret and communicate results using appropriate statistical language.
4. Conduct one-way ANOVA to compare means across multiple groups and perform post hoc tests for multiple comparisons and interpret the results.
5. Apply nonparametric tests and compare the results with their parametric counterparts.
6. Perform chi-square tests to analyse categorical data. Test for independence and homogeneity in contingency tables and interpret results to assess associations between variables.
7. Calculate correlation coefficients between variables, interpret and evaluate the strength of the relationship.
8. Perform simple linear regression analysis. Make predictions using regression models.
9. Design a basic study and analyse the experimental data using appropriate statistical tests and draw conclusions.

Reference Books

1. Dawson, B. and Trapp, R.G. 2019. Basic and Clinical Biostatistics. 5th ed. Lange medical books/McGraw-Hill Inc.
2. Zar, Jerrold H. 2014. Biostatistical Analysis. 5th ed. Pearson Education.
3. Selvin, S. 2011. Biostatistics: Statistical Tools for Epidemiological Research. Oxford University Press.
4. Lepš, J. and Šmilauer, P. 2020. Biostatistics with R: An introductory guide for Field Biologists. 1st ed. Cambridge University Press.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme:

Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

HSCC XXXX	**Critical Thinking and Writing (SFL)**	**L-T:1-1**

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HSCC XXXX	**Ability Enhancement/Co-curricular**	**L:0**

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HSCC XXXX	**Elective Course**	**L-T-P-C:2-1-1.5-4.5**

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SEMESTER III

HSCC XXXX	Nutrition through the Lifecycle	L-T-P-C: 2-1-1.5-4.5

Course Objectives

- To acquire knowledge of nutritional needs and issues from preconceptions to old age.
- To analyze normal growth and development and its consequences on malnutrition.
- To apply meal management principles to plan healthy and affordable balanced meals across all age groups.

Course Outcomes

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

CO1. Identify physiological changes during various stages of life cycle.

CO2. Relate different life stages and physiological changes with bodily needs of nutrients.

CO3. Understand major nutritional concerns during different life stages.

CO4. Develop a skill to plan of action, for meeting nutritional needs.

CO-PO Mapping

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	2	3	1	1	3	3	1	3	2	2	2	2
CO 2	3	3	3	2	3	1	3	3	3	1	3	2	2	2	2
CO 3	3	3	3	2	2	1	-	3	3	1	2	3	2	2	2
CO4	2	3	3	4	2	1	1	3	3	1	2	2	2	2	2
Average	2.75	3	3	2.5	2.5	1	1.6	3	3	1	2.5	2.25	2	2	2

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High)
"_" means there is no correlation

Syllabus **45 Hours**

UNIT I Nutrition during Preconception and Pregnancy (10 Hours)

Overview of preconception period, Prenatal growth and development, Physiological changes during pregnancy. Developmental stages of pregnancy. Nutritional needs and requirements in three trimesters. Pregnancy-related complications: pre-eclampsia, gestational diabetes, morning sickness, pica, dyspepsia, fatty liver in pregnancy etc. Relationship between maternal and foetal nutrition, dietary considerations.

UNIT II Nutrition during Lactation (10 Hours)

Physiology of lactation. Breast milk and it's composition, Breast-feeding advantages and breast-feeding positions/methods. Factors affecting lactation. Galactagogues. Infant formulas. Nutritional needs and requirements. Diet and feeding pattern. Barriers and facilitators to breast feeding. Weight loss and gain during pregnancy. Medication to avoid during breast-feeding.

UNIT III Nutrition during Infancy and preschoolers (8 Hours)

Infant growth and physiological development, nutritional needs and requirements for growth, Artificial feeding. Low birth weight and Preterm baby- Nutritional requirements, feeding the preterm baby, feeding problems. Apgar scale. Weaning- Need for weaning, types of supplementary foods, problems in weaning.

Nutrition in Preschool children: Growth and development, nutritional needs and requirements. Feeding dental problems and decay. Nutrition related problems of preschool children – Protein energy malnutrition- Types, symptoms, nutritional requirements and treatment.

UNIT IV Nutrition during School age and Adolescence (7 Hours)

Characteristics of school age, Nutritional needs and requirements, Feeding problems, packed lunches, Supplementary foods.

Nutrition in Adolescents: Growth and development, Puberty, physiology of menarche. Nutritional needs and requirements. Nutritional problems- Obesity, Anemia, pre-menstrual syndrome. Eating disorders – Anorexia nervosa, Bulimia nervosa, Binge eating, polyphagia, etc. Issues related to early marriage and conception.

UNIT V Nutrition during Adulthood and Old age (10 Hours)

Characteristics of adulthood: growth and development. Nutritional needs and requirements. Nutrition in Old age: General physiological changes, Theories of aging, factors influencing aging: exogenous and endogenous. Nutrition related problems of old age, Degenerative diseases. Nutritional considerations. Healthy aging: Guidelines for promoting healthy eating in old age.

Practical: (45 Hours)

1. Plan and prepare pre-pregnancy diet.
2. Plan and prepare balanced diet for pregnant women.
3. Plan a diet for pregnancy complication of gestational diabetes.
4. Plan a diet for a lactating mother.
5. Design weaning foods with five recipes.
6. Plan and design packed lunch boxes for school age children.
7. Plan behavior change aids and counselling sessions for eating disorders for adolescents.
8. Plan and design diet for sedentary/moderate/heavy adults.
9. Plan a meal for an elderly person.
10. Visit to a nursing home/ kindergarten /play school/old age home to understand the nutritional needs of children and elderly populations.

Reference Books

1. A Report of the Expert Group, Indian Council of Medical Research, National Institute of Nutrition. 2020. Recommended dietary allowances and estimated average requirements nutrient requirements for Indians. National Institute of Nutrition, Hyderabad.
2. Byrd-Bredbenner C, Berning J, Kelley D, Abbot J, Moe G and Beshgetoor D. 2022. Wardlaw's Perspectives in Nutrition. 12th Ed. McGraw Hill International Edition.
3. Judith E. Brown. 2019. Nutrition through the life cycle. 7th Edition. Cengage Learning.
4. Langley-Evans, S. C. 2015. Nutrition health and disease: a lifespan approach. 2nd Ed. John Wiley & Sons, Ltd, UK.
5. Raymond J. L. and Morrow K. 2020. Krause and Mahan's Food & the Nutrition Care Process. 15th Ed. Saunders.
6. Whitney and Rolfes. 2011. Understanding Nutrition. 12th ed. Wadsworth, Cengage Learning.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme: Continuous Assessment - 50%, mid semester examination - 20% and End term examination - 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			End Term Examination		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

HSCC XXXX	Food Safety and Laws	L-T-P-C: 2-1-1.5-4.5

Course Objectives

- To introduce students to the fundamental principles of food safety and the legal framework governing food regulations.
- To explore various aspects of food safety, including foodborne illnesses, hazard analysis, food handling practices, and regulatory requirements.
- To develop a comprehensive understanding of food safety laws and their practical implications in ensuring the safety and quality of the food supply chain.

Course Outcomes

After completion of this course, students will be able to

CO1. Understand the importance of food safety and its impact on public health.

CO2. Identify common foodborne illnesses and their causes.

CO3. Explain the principles of ISO 22000, hazard analysis and critical control points (HACCP) in food safety management.

CO4. Evaluate the key provisions and requirements of food safety laws and regulations.

CO5. Apply knowledge of food safety laws to real-world scenarios and case studies.

CO-PO Mapping

Program Outcomes / Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	2	1	1			1	1		1	2	1		2	2	1
CO 2	2	1	1		1				2	2	1		2	2	2
CO 3	2	2	3	2	1	1	1	2	1	2	2		2	1	1
CO 4	2	2	2	2		1	1	1	2	3	2		3	1	2
CO 5		2	2	1	1	2	2	1	2	3	2		2	2	3

Average	**1.6**	**1.6**	**1.8**	**1**	**0.6**	**1**	**1**	**0.8**	**1.6**	**2.4**	**1.6**		**2.2**	**1.6**	**1.8**

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High)
"_" means there is no correlation

Syllabus **45 Hours**

UNIT I: Introduction to Food Safety **(6 Hours)**

Overview of food safety concepts, definitions. Impact of foodborne illnesses on public health. Sources and causes of food contamination. Safe food handling and storage practices to prevent microbial contamination.

UNIT II: Microbiological, Chemical and Physical Hazards **(15 Hours)**

Common pathogens and foodborne illnesses. Principles of microbial growth. Limiting factors for survival / growth of pathogenic microbes. Food intoxication, food poisoning.

Common chemical and physical contaminants in food – food adulteration, food additives, heavy metals, and residues of pesticides, sanitizing agents, antibiotics, etc. Control measures for chemical and physical hazards.

UNIT III: Food Safety Management Systems **(15 Hours)**

Hazard Analysis and Critical Control Points (HACCP): Introduction to HACCP, principles and importance. Steps involved in implementing a HACCP plan.

ISO 22000:2022: Food Safety Management Systems. Overview of ISO 22000 standard and its requirements. Document control and management in ISO 22000.

Safe Quality Food (SQF): Introduction to SQF and its objectives. SQF Code: Requirements and elements. Implementation and maintenance of SQF systems.

Brand reputation through compliance (BRC): Overview, importance, advantages.

UNIT IV: Food Safety Laws, Regulations and Authorities **(9 Hours)**

International food safety agencies: Codex Alimentarius and its role in harmonizing global food safety requirements.

Food Safety Laws and Regulations: Overview of the Food Safety and Standards Act, 2006. Objectives and scope of the Act. Function of food authority. Salient features of Food Safety and Standards Act, 2006.

Bureau of Indian Standards. Six Sigma Methodology in Food Safety: Overview and importance

Practical: **45 Hours**

1. To conduct hands-on personal hygiene practices in food industry
2. Safe food handling and storage practices.
3. Microbiological analysis methods (plate count, presence of pathogens). Interpreting and reporting microbiological data.
4. Testing for food adulteration.
5. Identification of common food additives. Labelling requirements for food additives.
6. Labelling requirements for allergens. Evaluating food product labels for allergen information.
7. Conducting a HACCP analysis for a specific food product/process. Documenting critical control points and corrective actions.
8. Hygiene and sanitary requirements for big food service establishments (demonstration on-site at food industry).
9. Licensing and registration requirements for food establishments and food business operators.
10. Analysis of notable food safety violation cases in India.
11. Visit to a food industry compliant with HACCP & ISO 22000 and other regulatory standards.

Reference Books

1. Potter Norman N. and Hotchkiss, J H. Food science. 5th edition. CBS Publishers & Distributors.
2. Pelczar M J, Chan E C S and Krieg, N R. 1993. Microbiology: Concepts and Applications. Mc Graw-Hill Inc.
3. Rees N and Watson D. 2000. International standards for food safety. Aspen Publishers.
4. Paul L Knechtges. 2012. Food Safety Theory and Practice. Canada, Jones Bartlet Learning.
5. Frazier WC and Westhoff DC. 2004. Food Microbiology, New Delhi, TMH Publication.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme: Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

HSCC XXXX	Institutional Food Service Management	L-T-P-C: 3-1-1-5

Course Objectives

- Develop skills in menu planning and quantity food production for various food service organizations within specific budget.
- Develop a knowledge base about the facilities required for different types of food service units and to equip individuals in understanding and managing resources in a food service institution.

Course Outcomes

After completion of the course, the student will be able to:

CO1. Understand the unique challenges and considerations in managing food service operations in institutional settings.

CO2. Develop knowledge related to menu planning, food procurement, purchase, and inventory management.

CO3. Learn about efficient production and service techniques suitable for large-scale food service operations.

CO4. Develop skills in personnel management, financial control, and sustainability in food service operations.

CO5. Understand the different styles of food service and different cuisines across globe.

CO-PO Mapping

Program Outcomes / Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PEO 1	PEO 2	PEO 3	PEO 4

Outcomes															
CO 1	3	3	2	2	2	1	2	1	2	1	2	1	2	2	2
CO 2	3	2	1	1	1	2	2	_	2	2	2	2	2	2	2
CO 3	3	1	2	2	1	_	3	1	1	2	2	2	2	2	2
CO 4	3	1	2	2	_	2	2	1	1	3	2	2	2	2	2
CO 5	3	1	3	2	_	1	3	2	2	1	2	3	2	1	3
Average	3	1.6	2	1.8	0.8	1.2	2.4	1	1.6	1.8	2	2	2	1.8	2.2

Syllabus

UNIT I: Introduction & classification of food service institutions

Evolution of the food service industry. Broad categories of catering services: commercial and Institutional.

Introduction of food service institutions: School, commercial food service, Hospital, Travel catering, Industrial canteen. Characteristics of Food service establishment.

UNIT II: Menu Planning and Food Service

Menu planning: Overview, definition and its principles. Types of menus, construction of menu plan. Standardization of recipe: standard recipe format and its use. Types of food service: Self-service, tray service, waiter-waitress service.

UNIT III: Food Service management

Definition and principles, Organizational chart of food service institutions. Study of cuisines: Menu designing and characteristics of following cuisines - Indian, Chinese, Continental and French, Thai and Mexican.

UNIT IV: Food preparation and safety

Introduction, Principles of food preparation, Characteristics of food, Principles of food purchasing, Methods of food purchasing, storage, and inventory management. Portion sizes: Standard portion size, Portioning equipment, Portion control, Use of left over foods.

Food safety: HACCP overview, food safety standards and regulations, GMP, GHP, environmental safety, equipment and layout.

UNIT V: Management of Food service institutions

Definition and Principles of management- Financial Management: Principles, Costing, Budgeting, Accounting, Food cost control methods, Factors affecting food cost, labor cost, operating cost and overhead cost.
Personnel management: Personnel management concepts, Staff employment, Employee benefits, Methods of selection, Orientation, Training & development, Supervision, Motivation of employees.

Recommended Books/ Resources:

1. Sethi, M. and Malhan, S. 2022. Catering Management –An integrated Approach,2nd Edition New Age International Publishers, New Delhi.
2. Sethi, M. (2004) Institutional Food Management. New Age International Publishers, New Delhi.
3. Mudambi, S.R. and Rajagopal, M.V. (2007). Fundamentals of Foods, Nutrition and Diet therapy. New Age International Publishers, New Delhi.

Practical: **30 Hours**

1. Conduct a market survey to find out the prevailing cost of various food stuffs.
2. Perform standardization of the edible portion and cooked weight of foodstuff.
3. Preparing a planning prospect for setting up of a food service unit.
4. Plan and prepare different types of menus.
5. Planning and organizing a

i. Mid-day snack for preschool children.
ii. For college canteen
iii. For college hostel mess.
iv. Working women hostel.
v. Industrial canteen.
vi. Different occasions (birthday, cocktail party, conferences, etc.)

6. Visit to a food service unit.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme: Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment	**End Term Examination**	

Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

HSCC XXXX	**Environmental Science**	**L-T-P-C:3-1-0-4**

SEMESTER IV

HSCC XXXX	Meal Planning	L-T-P-C:2-1-1.5-4.5

Course Objectives:

- To understand the basics of meal planning, dietary guidelines including menu development, recipe modification, portion control, and meeting dietary needs for different populations.
- To develop practical skills in planning and preparing balanced meals while considering cultural, social, and economic factors.
- To empower students to make informed decisions and create healthy, well-balanced meals.

Course Outcomes

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

CO1. Understand concept and application of meal planning.

CO2. Demonstrate techniques of food selection, storage, and budgeting strategies for cost-effective meal planning.

CO3. Analyze popular food fads and diets in terms of their nutritional impact and suitability for individuals.

CO4. Apply the skills of meal planning to create well-balanced and nutritious meals.

CO-PO Mapping

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5

CO 1	3	3	3	2	2	1	1	3	3	1	3	2	2	2	2
CO 2	3	3	3	2	2	1	3	3	3	1	3	2	2	2	2
CO 3	3	3	3	2	2	1	-	3	3	1	2	3	2	2	2
CO4	2	3	3	4	2	1	1	3	3	1	2	2	2	2	2
Average	2.75	3	3	2.5	2	1	1.6	3	3	1	2.5	2.25	2	2	2

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High)
"_" means there is no correlation

Syllabus **45 Hours**

UNIT-I Introduction to Meal planning (12Hours)

Essentials of meal planning, Balanced diet, Factors influencing meal planning and food related behavior. Economy in food purchase: Importance of price list in food purchase. Steps involved in making price list. Menu Planning Basics: Principles and steps of menu development. Meal patterns and frequency. Food selection and storage: perishable, non-perishable and semi perishable. My plate for the day. Utilizing leftovers and minimizing food waste. Cultural and Ethnic Considerations in Meal Planning: Cultural influences on food choices and eating habits. Incorporating diversity in meal planning. Meal Planning on a Budget: Strategies for cost-effective meal planning.

UNIT II: Menu planning (10Hours)

Food exchange list in meal planning. Average nutrient content of different food stuffs by NIN-ICMR. Recipe Modification and Adaptation: Recipe analysis and nutrient modification. Substituting ingredients for healthier options. Recipe scaling and portion control. Standardization and portion sizes. Planning and classification of meals based on physical activity and age groups.

UNIT-III Type of Diets (10 Hours)

Plant based diets: Vegetarianism and Vegan diet. Merits and demerits of Vegan Diet and Vegetarianism. Nutritional considerations for plant-based diets. Balancing nutrients and protein sources. Ketogenic diet: Concept overview, merits and demerits. Concept, merits and demerits: GM (General Motors) Diet, Gluten-free diet, Mediterranean diet, Atkins diet, Western diet, Intermittent fasting, etc. Customized diets as per physiological conditions: DASH Diet, low fat diets, high protein diet, high in calcium diet, etc.

UNIT-IV Contemporary trends in Nutrition **(13 Hours)**

Functional Foods and Nutraceuticals, Nutrigenomics, Meal Planning for Sustainable Eating: Environmental considerations in meal planning. Plant-based meal alternatives. Global dietary guidelines and recommendations. Basic software programs for nutrient analysis and meal planning.

Practical: **(45 Hours)**

1. Market survey of a week's worth of groceries based on different food groups.
2. Create a price list for a specific meal considering the principles of economy in food purchase.
3. Standardization of serving sizes and portions.
4. Planning and distribution of exchange list for different meals.
5. Create menus using the principles of menu planning for a hostel mess considering the nutritional adequacy of the menus.
6. Create a balanced meal plan for a day using the My Plate guidelines.
7. Recipe modification: To analyze the recipes for nutrient content and suggest modifications using ingredients' substitutes and standardize the ingredients.
8. To input the sample menus or recipes into the software programs and analyze the nutrient content.
9. Meal planning for nutritionally adequate vegetarian/vegan meal.
10. Visit to a hostel mess to understand menu planning.

Reference Book

1. Antia, F.P. 4th Edition, (2022). Clinical Nutrition and Dietetics, Oxford University Press, Delhi

2. Mahan, L.K., Arlin, M.T. (2000). Krause's Food, Nutrition and Diet therapy, 11th edition, W.B.Saunders Company, London.
3. Shubhangini A Joshi (2021): Nutrition Dietetics. 2nd edition, Tata Mc Graw-Hill Publishing Company Limited, New Delhi.
4. Srilakshmi,B. (2005): Dietetics,5th edition, New Age International(P) Limited Publishers, New Delhi
5. Williams's Nutrition and diet Therapy. 6th edition. Times Mirror/Mosby College Publishing, St.Louis.
6. Mahtab S Bamji, N Prahlad Rao, Vinodini Reddy. Text Book of Human Nutrition. 2nd edition, Oxford & IBH Publishing Co. Pvt. Ltd.
7. Perspectives in Nutrition – Wardlaw Kessel, McGraw Hills.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme: Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			End Term Examination		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

HSCC XXXX	**Food Microbiology**	**L-T-P-C: 2-1-1.5-4.5**

Course Objectives

- To understand the key concepts in food microbiology, role of microbes in contamination and spoilage of foods.
- To gain knowledge on various methods of microbial analysis of food and dairy products and food preservation.

Course Outcomes

After completion of this course students will be able to:

CO1: Illustrate the important types and role of microorganisms associated with food.

CO2: Gain knowledge of microorganisms involved in food borne infections and intoxications.

CO3: Compare various physical, chemical and biological methods used in the control of microorganisms.

CO4: Explain principles of quality control and assess criteria for microbiological safety in various foods operations.

CO-PO MAPPING

Program	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5

Outcomes / Course Outcomes															
CO 1	3	3	2.5	2.5	2.5	2	2.5	3	3	2.5	3	3	3	3	3
CO 2	3	3	2.5	2.5	2.5	2	2.5	3	3	2.5	3	3	3	3	3
CO 3	3	3	2.5	2.5	2.5	2	2.5	3	3	2.5	3	3	3	3	3
CO 4	3	3	2.5	2.5	2.5	3	2.5	3	3	2.5	3	3	3	3	3
Average	3	3	2.5	2.5	2.5	2.2	2.5	3	3	2.5	3	3	3	3	3

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High)
"_" means there is no correlation

Syllabus **(60 Hours)**

UNIT- I: INTRODUCTION TO FOOD MICROBIOLOGY **15 Hours**

Important groups of microorganisms associated with foods; concept of probiotics and prebiotics, dairy starter cultures, lactic acid bacteria and their metabolism; factors affecting microbial growth and survival in foods; kinetics of thermal death of microorganisms; culture dependent and independent methods for the estimation of food associated microorganisms

UNIT- II: MICROBIAL CONTAMINATION AND SPOILAGE **20 Hours**

Microbial Contamination and spoilage of foods of animal origin: sources of contamination, natural microflora, microbial spoilage, and preservation methods of: A) Milk and milk products B) Fish and other sea foods C) Meat and poultry D) Egg

Microbial Contamination and spoilage of plant-based and miscellaneous foods: sources of contamination, natural microflora, microbial spoilage, and preservation methods of: A) Cereals, bread and other cereal products B) Fruits and Vegetables and their juices C) Canned Foods D) Fats and Oils E) Sugar and Sugar Products

UNIT- IV: CONTROL OF MICROBES IN FOOD ` 15 Hours

Emerging technologies for the reduction of pathogenic and spoilage microorganisms in food, role of bio-preservation in improving food safety: LAB as bio preservative, Bacteriocins, endolysins, antimicrobial peptide (AMP). microbial interference, bacteriophage; Hurdle technology; Food fermentations

UNIT- V: HAZARD ANALYSIS AND RISK ASSESSMENT 10 Hours

Hazard Analysis and Risk Assessment: Physical hazards (metals, glass, etc.), Chemical hazards (food additive, natural toxins, pesticides, antibiotics, hormones, heavy metals and packaging components), Biological hazards (virus, bacteria and fungi), Evaluation of the severity of a hazard Controlling Food Hazards. Microbiological indicators of food quality and safety, Hazard Analysis Critical Control Point (HACCP) concept.

Practical 60 Hours

1. Determination of the microbiological quality of the milk by plate count and dye reduction methods
2. Determination of the microbiological quality of selected foods
3. Isolation of spoilage microorganisms from spoiled foods (vegetables, juices, fruits, bread, milk, meat)
4. Alkaline phosphatase test to check the efficiency of pasteurization of milk.
5. Microbial fermentation for production of yogurt and sauerkraut.
6. Estimation of the thermal death point and thermal death time of heat resistant microorganisms

7. Isolation of thermophilic bacteria from wheat flour
8. Isolation of psychrophilic or psychotropic microorganisms from refrigerated foods
9. Calculation of the thermal death time and decimal reduction time of *E. coli*.

REFERENCE BOOK

1. Frazier & Westhoff (2017) Food Microbiology, 5th Ed, Tata McGraw-Hill publishing company Ltd, New Delhi.

2. Nash (2019) Fundamentals of Food Microbiology. Callisto Reference.

3. James MJ (2015) Modern Food Microbiology 6th edition, Aspen Publications and distributors, New Delhi

4. Kumar and Sharma (2019) HACCP: Applications and Challenges. Dreamtech Press

Practical: **60 Hours**

1. Determination of the microbiological quality of the milk by plate count and dye reduction methods
2. Determination of the microbiological quality of selected foods
3. Isolation of spoilage microorganisms from spoiled foods (vegetables, juices, fruits, bread, milk, meat)
4. Alkaline phosphatase test to check the efficiency of pasteurization of milk.
5. Microbial fermentation for production of yogurt and saurkraut.
6. Estimation of the thermal death point and thermal death time of heat resistant microorganisms
7. Isolation of thermophilic bacteria from wheat floor
8. Isolation of psychrophilic or psychotropics microorganisms from refrigerated foods
9. Calculation of the thermal death time and decimal reduction time of *E. coli*.

REFERENCE BOOK

1. Frazier,W.C. &Westhoff,D.C.(1997), Food Microbiology, Tata McGraw-Hill publishing company Ltd, New Delhi.
2. James,M.J. (2000) Modern Food Microbiology 6th edition, Aspen Publications and distributors, New Delhi

3. Mani,A., Selvaraj,A.M., Narayanan.L.M , Arumugham.N.(1999), MicrobiologyGeneral and Applied, Saras publications , Nagarcoil.
4. Roday,S. (1999) Food Hygiene and Sanitation, Tata Mc Graw-Hill Publishing Co. Ltd, New Delhi.
5. Powar,C.B and Daginawala, H.F. (1999) General Microbiology , Vol.II , Himalaya Publishing House.
6. Khetarpaul, N. (2009) Food microbiology, Daya publishing house, New Delhi.
7. Sommerville, C.,Jeffrey, (2004), Fundamentals of Biochemistry, Seventh edition

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme: Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment	**End Term Examination**	

Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

XXXX XXXX	**Biosafety and Aseptic Techniques**	**L-T-P-C: 2-1-1.5-4.5**

Course Objectives:

- To understand regulations, infrastructures, precautions required for isolation, cultivation, and maintenance of Biosafety levels – I, II, III and IV organisms.

Course Outcomes:

After completion of this course, the students will be able to

CO1. Understand the principles and regulations associated with Biosafety levels – I, II, III and IV.

CO2. Understand the process of risk assessment in various groups of Biosafety levels – I, II, III and IV.

CO3. Possesses skills to be accomplished to cooperate efficiently with medical staff and lab technologists in maintaining laboratory safety.

CO-PO Mapping

Program Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5

Course Outcomes															
CO 1	3	3	2.5	2.5	2.5	2.5	2.5	3	3	3	3	3	3	3	3
CO 2	3	3	2.5	2.5	2.5	2.5	2.5	3	3	3	3	3	3	3	3
CO 3	3	3	2.5	2.5	2.5	2.5	2.5	3	3	3	3	3	3	3	3
Average	3	3	2.5	2.5	2.5	2.5	2.5	3	3	3	3	3	3	3	3

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3–Strongly Mapped (High)
"_" means there is no correlation

Syllabus

UNIT I: PRINCIPLES OF STERILIZATION **5 Hours**

Basic principles and methods of Sterilization: control of microorganisms by physical methods: heat, filtration, and radiation; chemical methods: phenolics, alcohols, halogens, heavy metals, quaternary ammonium compounds, aldehydes, and sterilizing gases; evaluation of antimicrobial agent effectiveness (evaluation of efficacy of disinfectants, determination of phenol coefficient), Principle and functioning of LAF.

UNIT II: BIOSAFETY LEVELS **10 Hours**

Principles of Biosafety levels – I, II, III and IV; CDC guideline for Infrastructure, precaution and biowaste disposal system associated with the transport, cultivation, and maintenance of Biosafety levels I, II, III and IV pathogens.

UNIT III: BIOSAFETY GUIDELINES **10 Hours**

Biosafety guidelines – Department of Biotechnology (DBT), Government of India; Definition of GMOs and LMOs; ICMR and funding agencies, Roles of Institutional Biosafety Committee, the history and incidence of laboratory-acquired infections (LAI), incidents of secondary transmission from the laboratory, Outline the types of laboratory accidents leading to LAIs, Explain the role of aerosols in LAIs, Illustrate the importance of biosafety and biocontainment in minimizing the risk of LAIs.

UNIT IV: STANDARD OPERATING PROCEDURES **10 Hours**

BSL-II levels, Aseptic techniques, wearing appropriate personal protective equipment (PPE), Using BSL: II cabinet. Handling of equipment, glassware, Handling of sample collection, processing, storage, waste disposals.

Media preparation, Handling and maintenance of pure cultures, preservation of various microbes, Cultivation, and preservation methods of eukaryotic cells: Counting and passaging of eukaryotic cells of epithelial and lymphoid origins, SOPs for preservation (for long term storage) and revival of the same under laboratory condition.

Practical: **45 Hours**

1. Demonstration of various equipment and apparatus used in BSL-I and II laboratory for the cultivation and maintenance.
2. Cultivation, maintenance of pure bacterial culture isolation-pour plate, spread plate, streak plate methods.
3. Aseptic techniques and safety rules, required to follow during cultivation and maintenance in BSL- II laboratory.
4. Prepare and sterilization of cell-culture media
5. Serial passage of cell lines
6. Cultivation, maintenance of eukaryotic cell lines in BSL-II laboratory.

References

1. Meechan PJ et al. (2020) Biosafety in Microbiological and Biomedical Laboratories. 6th Ed, Centers for Disease Control and Prevention, USA https://www.cdc.gov/labs/pdf/CDCBiosafetyMicrobiologicalBiomedicalLaboratories-2020-P.pdf
2. Guidelines for Biosafety, DBT India https://dbtindia.gov.in/guidelines-biosafety
3. GENERAL GUIDELINES FOR ESTABLISHMENT OF BIOSAFETY LEVEL-3 LABORATORY (ICMR Guidelines) https://main.icmr.nic.in/sites/default/files/upload_documents/Revised_ICMR_Guidelines_2_December.pdf

4. Willey J, Sherwood L. and Woolverton C (2014). Prescott's Microbiology, 9th edi McGraw Hill
5. Bergey's manual systematic Bacteriology (2018) 11th edition

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme:

Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

HSCC XXXX	Working with Data	L-T-P-C: 1-1-0-2

HSCC XXXX	Ability Enhancement/Co-curricular	L-T-P-C:

HSCC XXXX	Food Microbiology	L-T-P-C: 2-1-1.5-4.5

Course objectives

After completion of this course, the student will be able to:

- To understand the key concepts in food microbiology, role of microbes in contamination and spoilage of foods, gain knowledge on various methods of microbial analysis of food and dairy products and food preservation.

Course Outcomes

After completion of this course students will be able to:

CO1. Discuss the important types and role of microorganisms associated with food.

CO2. Describe microorganisms involved in food borne infections and intoxications.

CO3. Compare various physical, chemical, and biological methods used in the control of microorganisms.

CO4. Explain principles of quality control and assess criteria for microbiological safety in various food operations Acquire, demonstrate, and apply knowledge about microorganisms relevant to food spoilage such as molds, yeasts, bacteria, mycotoxin producers.

CO-PO Mapping

Program / Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3

Course Outcomes														
CO 1	3	2	1	2	1	1	3	3	3	-	3	3	-	3
CO 2	3	3	-	-	-	3	3	-	-	2	-	-	3	2
CO 3	2	-	2	2	2	2	2	3	2	3	2	2	3	2
CO 4		2	3	2	2	1	-	-	3	-	-	3	-	2
Average	**2**	**1.75**	**1.5**	**1.5**	**1.25**	**1.75**	**2**	**1.5**	**2**	**1.25**	**1.25**	**2**	**1.5**	**2.25**

Syllabus **(60 Hours)**

UNIT- I: INTRODUCTION TO FOOD MICROBIOLOGY **15 Hours**

Important groups of microorganisms associated with foods; concept of probiotics and prebiotics, dairy starter cultures, lactic acid bacteria and their metabolism; factors affecting microbial growth and survival in foods; kinetics of thermal death of microorganisms; culture dependent and independent methods for the estimation of food associated microorganisms

UNIT- II: MICROBIAL CONTAMINATION AND SPOILAGE **20 Hours**

Microbial Contamination and spoilage of foods of animal origin: sources of contamination, natural microflora, microbial spoilage, and preservation methods of: A) Milk and milk products B) Fish and other sea foods C) Meat and poultry D) Egg

Microbial Contamination and spoilage of plant-based and miscellaneous foods: sources of contamination, natural microflora, microbial spoilage, and preservation methods of: A) Cereals, bread and other cereal products B) Fruits and Vegetables and their juices C) Canned Foods D) Fats and Oils E) Sugar and Sugar Products

UNIT- IV: CONTROL OF MICROBES IN FOOD ` 15 Hours

Emerging technologies for the reduction of pathogenic and spoilage microorganisms in food, role of bio-preservation in improving food safety: LAB as bio preservative, Bacteriocins, endolysins, antimicrobial peptide (AMP). microbial interference, bacteriophage; Hurdle technology; Food fermentations

UNIT- V: HAZARD ANALYSIS AND RISK ASSESSMENT **10 Hours**

Hazard Analysis and Risk Assessment: Physical hazards (metals, glass, etc.), Chemical hazards (food additive, natural toxins, pesticides, antibiotics, hormones, heavy metals and packaging components), Biological hazards (virus, bacteria and fungi), Evaluation of the severity of a hazard Controlling Food Hazards. Microbiological indicators of food quality and safety, Hazard Analysis Critical Control Point (HACCP) concept.

Practical **60 Hours**

1. Determination of the microbiological quality of the milk by plate count and dye reduction methods
2. Determination of the microbiological quality of selected foods
3. Isolation of spoilage microorganisms from spoiled foods (vegetables, juices, fruits, bread, milk, meat)
4. Alkaline phosphatase test to check the efficiency of pasteurization of milk.
5. Microbial fermentation for production of yogurt and sauerkraut.
6. Estimation of the thermal death point and thermal death time of heat resistant microorganisms
7. Isolation of thermophilic bacteria from wheat flour
8. Isolation of psychrophilic or psychotropics microorganisms from refrigerated foods
9. Calculation of the thermal death time and decimal reduction time of *E. coli*.

REFERENCE BOOK

1. Frazier & Westhoff (2017) Food Microbiology, 5th Ed, Tata McGraw-Hill publishing company Ltd, New Delhi.
2. Nash (2019) Fundamentals of Food Microbiology. Callisto Reference.
3. James MJ (2015) Modern Food Microbiology 6th edition, Aspen Publications and distributors, New Delhi
4. Kumar and Sharma (2019) HACCP: Applications and Challenges. Dreamtech Press.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme: Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

HSCC XXXX	Principle of Dietetics	L-T-P-C: 2-1-1.5-4.5

Course Objectives

- To provide a comprehensive understanding of the fundamental dietary principles and concepts related to dietetics.
- To explore the principles of nutritional care planning, assessment, and intervention.
- To develop the knowledge and skills necessary to assess nutritional needs, design appropriate nutrition interventions, monitor/evaluate the intervention and apply evidence-based guidelines for optimal health outcomes.

Course Outcomes

After completion of this course, the students will be able to

CO1. Understand the principles of diet therapy and the rationale behind dietary modifications necessary in disease conditions.

CO2. Assess nutritional status, nutritional needs and special dietary needs for patients with different disorders and use the appropriate support systems to nourish the patient.

CO3. Evaluate the nutrition support given to patients and modify accordingly.

CO4. Apply behavioral change theories and models in nutrition education and counselling to facilitate behavior change.

Program / Outcomes / Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5
CO 1	3	2	1	2	1	1	3	3	3	-	3	-	3	2	1
CO 2	3	3	-	-	-	3	3	-	-	2	-	3	2	3	2

CO 3	2	-	2	2	2	2	2	3	2	3	2	3	2	3	2
CO 4	1	2	3	2	2	1	-	-	3	-	3	-	2	3	3
Average	**2**	**1.75**	**1.5**	**1.5**	**1.25**	**1.75**	**2**	**1.5**	**2**	**1.25**	**2**	**1.5**	**2.25**	**2.75**	**2**

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High)
"_" means there is no correlation

Syllabus **30 Hours**

UNIT I: Principles of diet therapy and Nutritional Care Process **4 Hours**

Review of Normal diet. Principles of Diet Therapy. Adaptation of dietary modification necessary in disease conditions. Overview of Nutritional Care process and counselling. Factors affecting nutritional care.

UNIT II: Nutritional screening and Assessment **10 Hours**

Nutritional screening and identification of nutritional problem: Mini Nutritional Assessment (MNA), Malnutrition Universal Screening Tool (MUST), Subjective Global Assessment (SGA). Nutritional assessment: Overview and importance of nutritional assessment, Anthropometric measurements, body composition analysis, biochemical analysis, clinical evaluation, functional assessment, physical function, dietary assessment methods. Assessing nutrient requirements of patients and making a nutritional diagnosis.

UNIT III: Nutrition Interventions and its monitoring **12 Hours**

Interventions: Food and Nutrient Delivery. Modifications of the normal diet. Diet Modifications for Hospitalized Patients. Coordination of Care.

Appropriate Nutrition support: Enteral nutrition (EN), Partial parenteral and total parenteral Nutrition (TPN). EN and TPN – Indications, route, site, composition and long-term effect of use, complications. Home based and commercial Enteral formulations.

Re-feeding syndrome, Transitional Feeding. Nutrition support in long term and home care. Nutrition for the terminally ill or hospice patient. Monitoring of nutrition intervention.

UNIT IV: Education and counselling: Behavior change **4 Hours**

Behavioral change, factors affecting behavior change, models for behavior change. Counselling Strategy: Motivational Interviewing, counselling sessions for change.

Practical **45 Hours**

1. Market survey of commercial Enteral (complete, protein, disease specific) supplements and Parenteral support substrates.
2. Anthropometric Measurements and Body Composition Analysis
3. Subjective global assessment and functional nutrition assessment for comprehensive nutritional assessment.
4. Nutritional screening and identification of nutritional problem using MNA, MUST
5. Hospital diet Modification based on interpretation of disease.
6. Plan and formulate enteral tube feed (commercial and home based).
7. Planning of parenteral nutrition.
8. Role-play scenarios involving nutrition education and counselling for different health conditions.
9. Visit to the dietetics department in a hospital to show feed preparation.

Reference Books

1. Gibney MJ, Elia M, Ljungqvist & Dowsett J. 2005. Clinical Nutrition. The Nutrition Society Textbook Series. Blackwell Publishing Company.
2. Kane K. and Prelack K. 2018. Advanced Medical Nutrition Therapy.1st Ed. Jones & Bartlett Learning.
3. Mahan, L. K., Escott Stump. S. and Raymond J.L. 2022. Krause's Food and the Nutrition Care Process. 16th Ed. Saunders-Elsevier.
4. Raymond J. L. and Morrow K. 2020. Krause and Mahan's Food & the Nutrition Care Process. 15th edition. Saunders.

5. Sylvia Escott-Stump. 2021. Nutrition and Diagnosis-Related Care, 9th Ed. Academy of Nutrition and Dietetics.
6. Nix, Staci. 2016. Williams' Basic Nutrition & Diet Therapy. 15th ed. Mosby-Elsevier.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme: Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

HSCC XXXX	Community Nutrition	L-T-P-C:2-1-1.5-4.5

Course Objectives

- To explain the essential components of the health care system
- To understand the role of community nutritionists and nutrition education.
- To discuss the issues around Food and Nutrition Security.
- To evaluate the factors affecting the social, cultural, and economic aspects of Nutrition.
- To apply the skills of providing Nutrition Education and creating awareness in the community.

Course Outcomes

After completion of this course, student will be able to,

CO1 Define the Health Care System and Population Dynamics.

CO2 Describe the conceptual framework of Food and Nutrition Security.

CO3 Identify the nutrition-related Problems in the Community.

CO4 Appraise the nutrition-specific & Nutrition sensitive Programs and their implementation.

CO5 Apply the technical skills to demonstrate the nutrition education in the Community.

CO-PO Mapping

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5

CO 1	3	2	2		3	1			3	3	3	3		2	1
CO 2	3	2	2	2	2				3	3	3	3	2	3	1
CO 3	3	2	3	3	2				3	3	3	3	1	3	2
CO 4	3	1	2	2	2	1			3	3	3	2	1	3	2
CO 5	3	2	3	3	3	3	3		3	3	3	3	1	2	2
Average	3	1.8	2.4	2	2.4	1	0.6	0	3	3	3	2.8	1	2.6	1.6

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High)
"_" means there is no correlation

Syllabus **(45 hours)**

UNIT 1: Healthcare System in India **(8 Hours)**

Health Policy, Healthcare delivery system, health planning and financing in India, National Nutrition Health Programmes, National Nutrition Policy and National Nutrition Programmes.

UNIT II: Concept of Population Dynamics and Community Nutrition **(6 Hours)**

Population Dynamics - Demographic Cycles, Demographic Transition, Population Trends in India, factor affecting population growth.

Socioeconomic Perspective of India, Participation of Women in Income Generation, Relation to the Nutrition Profile of the Family, Concept of Community, Gender food security and nutrition, Community Participation, Community Nutrition: Quality of Life, Human Development. Role of Community Nutritionist.

UNIT III Food and Nutrition Security **(10 Hours)**

Basic Concepts of Nutrition and Determinants of Food and Nutrition Security (A Conceptual Framework) and India's Food Security System. Nutrition-Specific Government Programs-Public Distribution System (PDS) and the Targeted Public Distribution System (TPDS), Antyodaya Anna Yojana (AAY), Annapurna Scheme, National Food for Work Program

(NFFWP). Role of National and International NGOs in Nutrition Specific and Nutrition Sensitive Programs

Nutrition sensitive Programs- Self Employment and Wage Employment Schemes, Sampoorna Gramin Rojgar Yojana, Swarna Jayanti Gram Swarozgar Yojana (SGSY).

Nova Classification of food- Ultra-processed food/Junk, Ready to eat (convenient food) and processed food, Junk foods targeted at children.

UNIT IV Nutrition-related problems (7 Hours)

Protein Energy Malnutrition (PEM) - Prevalence, Causes, Consequences, Treatment, Prevention and Control. Different Forms of PEM - Kwashiorkor, Marasmus, Marasmic – Kwashiorkor, Sub-clinical PEM. Micronutrient Deficiencies and Prophylaxis Programs - Vitamin A Deficiency (VAD), Iron Deficiency Anemia (IDA), Iodine Deficiency Disorders (IDD) and Zinc Deficiency, etc.

UNIT V: Delivering Quality Nutrition Services (8 Hours)

Assessment of Nutritional Status in the community setting, Nutritional Screening and Surveillance, Monitoring and Evaluation. Quality Nutrition Services for Mothers- Food Supplementation and Nutrition Programs for Pregnant and Lactating Women, Nutritional Assessment, Beliefs, Avoidances and Aversions of Foods. Quality Nutrition Services for Infants, Children, Adolescent, Adults and Elderly and Nutrition-Related Health Problems & Nutrition Monitoring and Surveillance Programs.

UNIT VI: Nutrition and Health Education (6 Hours)

Behavior Change Communication, Culture and Values of Community, Interpersonal Relationship with Community, Nutrition and Behavior-Relation between Cultural Patterns and Diet-related Behaviors, Social Functions of Foods, education, food likes and dislikes, Desire for food experimentation, and Gastronomic Adventures. Inducing Change in Diet-Related Behavior and Community Participation. Theories of Nutrition Education. Food safety and storage, food budgeting.

References

- Wadhwa and Sharma, Nutrition in the Community-A textbook, Elite c2003, ISBN: 8188901024.
- Marie A. Boyle. (2022). *Community nutrition in action (8th edition)*. Cengage Learning Inc.
- Isobel R. Contento. (2015). Nutrition Education: Linking Research, Theory & Practice. Jones and Bartlett.
- Community Nutrition for Developing Countries. (2016). South Africa: AU Press.
- Frank, G. C. (2008). Community Nutrition: Applying Epidemiology to Contemporary Practice. United States: Jones and Bartlett Publishers.
- Sheila Chander Vir. (2011) Public Health Nutrition in Developing Countries (Set of 2 Volumes): Two Volume Set (Woodhead Publishing India in Food Science and Nutrition)

Research Papers

- Population -An emerging problem in the Indian subcontinent and its impact on Socio-Political Economy. (2019)
- Khurana, A., & Dhangar, I. (2014). Junk food Targeted at Children. Centre for Science and Environment.
- Mishra, U. S., Padhi, B., & Rinju. (2021). Examining calorie undernourishment in India: Is it due to choice or inadequacy? Nutrition and Health, 27(1), 17–26. https://doi.org/10.1177/0260106020949739/FORMAT/EPUB
- Monteiro, C. A., Cannon, G., Lawrence, M., Laura Da Costa Louzada, M., & Machado, (2019). Ultra-processed foods, diet quality, and health using the NOVA classification system. http://www.wipo.int/amc/en/mediation/rules.

Practical: **(45 Hours)**

1. Planning and Preparation of low-cost recipes for Protein Calorie Malnutrition, Iron and Folic acid Deficiency, Vit A deficiency and Complementary Foods (emphases on premixes and ARF), low-cost recipes for Pregnant and lactating women
2. Messages for Nutrition and Health Education: Basic Concepts, Mass Communication Media. Development, use and Evaluation of methods and aids for Nutrition and Health Education.
3. Non-Machine media: Cues of effective presentation, Planning, and Preparation: Poster, charts, Flash cards, Flannel graphs, pictures, and models.
4. Presentation of selected communication media.

5. Introduction to Global Hunger Index and Household Food Insecurity Access Scale (HFIAS) for Measurement of Food Access (FANTA) and U.S. Household Food Security Survey Module: Six-Item Short Form Economic Research Service, USDA Make a report on Global Hunger Index and critically analyze the trends of ranking India in the last 5 years.
6. Outreach activity/field trip to an anganwadi centre or organization engaged in Nutrition Services

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme: Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total

Weightage (%)	30	20	20	20	10	100

SEMESTER V

HSCC XXXX	Diet Therapy I	L-T-P-C:2-1-1.5-4.5

Course Objectives

1. To establish an understanding about acute and chronic infections and the different types of immune-mediated reactions and understand the medical nutrition therapy approaches for managing them.
2. To be able to comprehend the physiology of different organ systems including their disorders and recognize the importance of medical nutrition therapy during diseased conditions.
3. To enable students to explore the role of diet therapy in metabolic stress conditions and nutritional care before and after surgery.

Course Outcomes

After completion of this course, the students will be able to

CO1. Understand the principles and purpose of therapeutic diets and their modification from a normal diet.

CO2. Identify different types of infections and immune-mediated actions and propose appropriate diet therapy strategies for their management.

CO3. Understand the metabolic response to stress and design nutritional care plans for patients with sepsis, trauma, burns, and undergoing surgery, including bariatric surgery.

CO4. Apply diet calculation techniques for dietary treatment of advance diseases.

CO-PO Mapping

Program Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5

Course Outcomes															
CO 1	3	3	3	2	3	1	1	3	3	1	3	2	2	2	2
CO 2	3	3	3	2	3	1	3	3	3	1	3	2	2	2	2
CO 3	3	3	3	2	3	1	-	3	3	1	2	3	2	2	2
CO4	2	3	3	4	3	1	1	3	3	1	2	2	2	2	2
Average	2.75	3	3	2.5	3	1	1.6	3	3	1	2.5	2.25	2	2	2

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High)
"_" means there is no correlation

Syllabus **(45 hours)**

UNIT-I Introduction to Diet Therapy **10 Hours**

Therapeutic adaptation to the Normal Diet, purpose and principles of Therapeutic diets, modification of normal diet, Definition of hospital diet, type of hospital diet with modification. Acute and Chronic Infections – Classification and aetiology of infections, fever and immune response, Metabolic changes, Aetiology, Symptoms, management, diet therapy for acute (typhoid) chronic (tuberculosis, HIV).

UNIT-II Diet therapy for Gastrointestinal and hepatobiliary disorders **10Hours**

Diseases of the esophagus and stomach – Acute and Chronic. Common Intestinal Problems. Medical nutrition therapy in diseases of the Small Intestine. Inflammatory Bowel Diseases. Nutritional Consequences of bariatric and intestinal Surgery.

Physiology, Functions and Medical nutrition therapy in the diseases of Liver, Gallbladder and Pancreas: Acute and Chronic. Cirrhosis and its complications. Liver Resection and Transplantation.

UNIT III Diet Therapy for Thyroid and other hormone related disorders **10 Hours**

Thyroid gland Physiology. Assessment of Thyroid Disorders. Hypothyroidism. Polycystic Ovary Syndrome. Hyperthyroidism. Imbalances of the Hypothalamus-Pituitary-Thyroid (HPT) Axis and its relationship with hormones. Screening and Diagnostic Criteria. Other Endocrine System Disorders. Medical nutrition therapy.

UNIT IV Diet therapy for Adverse Reactions to Food **7 Hours**

Food Allergies and Intolerances**.** Definitions, Etiology, Pathophysiology. IgE-Mediated Reactions. Non-IgE-Mediated or Mixed Antibody Reactions. Cell-Mediated Reactions. Food Intolerances. Assessment and Medical Nutrition Therapy.

UNIT V Diet Therapy for critical care **8 Hours**

Sepsis, Trauma, Burns, and Surgery. Metabolic Response to Stress, Starvation versus Stress. Systemic Inflammatory Response Syndrome and Multiple Organ Dysfunction Syndrome. Trauma, major burns. Pre- and post-Surgery nutritional care, bariatric surgery and nutritional care.

Practical: **(45 Hours)**

1. Planning and preparation of therapeutic diet: for following conditions: Normal, soft, semisolid, and liquid diet.
2. Calculation chart of therapeutic diet for a patient suffering from hypothyroidism/hyperthyroidism.
3. Planning, preparation and dietary counselling for

a. Acute fever patients.
b. Thyroid patients/PCOD patients
c. Peptic ulcers and ulcerative colitis
d. Liver & Gall bladder diseases: hepatitis, hepatic coma, cholelithiasis/Gall bladder stone patients.
e. Acute pancreatitis.
f. Acute diarrhea.
g. Constipation.

4. Calculate and plan diet for a burn patient.
5. Calculate and plan diet for pre-surgery and post-surgery patients.

Reference Books

1. Gibney MJ, Elia M, Ljungqvist & Dowsett J. 2005. Clinical Nutrition. The Nutrition Society Textbook Series. Blackwell Publishing Company.

2. ICMR Nutrient Requirements and Recommended Dietary Allowances for Indians.

3. Kane K. and Prelack K. 2018. Advanced Medical Nutrition Therapy.1st Ed. Jones & Bartlett Learning.

4. Mahan, L. K., Escott Stump. S. and Raymond J.L. 2012. Krause's Food and the Nutrition Care Process. 13th Ed. Saunders-Elsevier.

5. Raymond J. L. and Morrow K. 2020. Krause and Mahan's Food & the Nutrition Care Process. 15th edition. Saunders.

6. Schlenker, E.D. and Roth, S.L. 2013. Williams' Essentials of Nutrition and Diet Therapy. 10th Edition. Mosby.

7. Shils, M.E., Shike, M, Ross, A.C., Caballero B and Cousins RJ. 2005. Modern Nutrition in Health and Disease. 10th Ed. Lipincott, William and Wilkins.

8. Sylvia Escott-Stump. 2021. Nutrition and Diagnosis-Related Care, 9th Ed. Academy of Nutrition and Dietetics.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme: Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

HSCC XXXX	**Epidemiology and Global Health**	**L-T-P-C:2-1-1.5-4.5**

Course Objectives

- To describe the science of epidemiology and the etiology of specific diseases.
- To interpret epidemiological information contained in scientific literature.
- To equip with basic epidemiological methods relevant to public health analysis, policy, and planning.
- To train students to get equipped with knowledge of global health policies.
- To appraise and make correct choices for designing epidemiological studies along with ethical considerations.
- To design interventions for treating and preventing ill health.

Course Outcomes

After completion of course, student will be able to:

CO1: Understand and able to comprehend the evolution of epidemiology.

CO2: Develop an understanding of various types of epidemiological studies and ethical considerations involving human subjects.

CO3: Understand the process of investigation of an outbreak and causation in Epidemiology.

CO4: Develop a research project and analytical approaches to monitoring and evaluation.

CO-PO Mapping

Program / Outcomes / Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO1	PSO2	PSO3	PSO 4	PSO 5
CO 1	3	2	1	2	1	1	-	-	3	-	3	3	-	3	1
CO 2	3	3	-	-	-	3	-	-	-	2	-	-	3	2	1
CO 3	2	-	2	2	2	2		-	2	3	2	2	3	2	-
CO 4		2	3	2	2	1	1	-	3	-	-	3	-	2	3
Average	**2**	**1.75**	**1.5**	**1.5**	**1.25**	**1.75**	**0.2**	**0**	**2**	**1.25**	**1.25**	**2**	**1.5**	**2.25**	**1**

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High)
"_" means there is no correlation

Syllabus **(45 Hours)**

UNIT I: Epidemiology: Laying the Foundations **(9 Hours)**

Definitions: Epidemiology, Public Health, and Health. Uses of Epidemiology, evolving patterns of morbidity and mortality-Demographics and disease patterns, mortality, and life expectancy trends. Roots of Epidemiology. Global Health and Sustainable Development Goals.

UNIT II: Epidemiological Study Designs **(9 Hours)**

Etiological research- Hypothesis statement**,** Epidemiological variables-Person, place, time, and data. Descriptive versus Analytical, Longitudinal versus cross-sectional. Epidemiological studies. Experimental versus observational, cohort versus case-control. Ethical conduct of studies involving human subjects.

UNIT III: Outbreak Investigation and Causation **(9 Hours)**

Background-Initial detection of Outbreaks, goals, and methods. CDC prescribed investigatory steps. Case study on disease outbreak investigations. Causation in Epidemiology-Natural history of the disease, Variability in the expression of disease, causal models.

UNIT IV: Health Services and Health Policy **(9 Hours)**

Healthcare planning and evaluation, Measuring the quality of healthcare, the planning cycle. National and international public health policy in practice. Planning a research project.

UNIT V: Monitoring and Evaluation **(9 Hours)**

Monitoring Health Care Systems, Organizations, and Programs, Surveillance, Health services information and Evaluation. Dimensions of Evaluation, evaluation process, Conceptual Framework for specifying evaluation criteria, and analytical approaches to evaluation.

Practical: **(45 hours)**

1. Introduction to case study on Covid 19 or any recent outbreak (Region specific/Uttarakhand). Conduct a preliminary/prevalence/socio-demographic study in a group.
2. Project proposal on any one identified public health issue in a selected community.
3. Community Screening: Framing open-ended and close-ended questionnaires/Probing.
4. Development of tools to assess knowledge, attitudes, and practices
5. Report on a Community Visit/Transect walk and social mapping.

Reference Books

1. Beaglehole, R. et al. (1993): *Basic Epidemiology*. Geneva, WHO.
2. Lilienfeld's Foundations of Epidemiology (Fourth Edition) Dona Schneider, David E. Lilienfeld, Oxford University Press, 2015, **ISBN:** 0199703493, 9780199703494
3. B. Burt Gerstman, Epidemiology Kept Simple: An Introduction to Traditional and Modern Epidemiology (3rd Edition), John Wiley & Sons, 2013
4. Applied Epidemiology: Theory to Practice edited by Ross C. Brownson, Diana B. Petitti, New York, 2006; online edn, Oxford Academic, 1 Sept. 2009
5. Lilienfeld, Abraham M. (1994): *Foundations of Epidemiology*. New York, Oxford University Press, (Chapter 2)
6. Denise M. Oleske: Epidemiology and the Delivery of Health Care Services (Third edition): Methods and Applications, Springer, 2009.

7. National Ethical Guidelines for Biomedical and Health Research involving Human Participants, ICMR Bioethics Unit (2017)
8. WHO Guidance For Managing Ethical Issues In Infectious Disease Outbreaks, Consensus document (2016). Available at: https://pandemicethics.org/consensus-documents/who-guidance-for-managing-ethical-issues-in-infectious-disease-outbreaks/

Suggested Readings

1. Pawson, R. & Tilley, N. (2008): *Realistic Evaluation*, Sage Pub. London. Ch. 3, pp. 55-82.
2. Doll R. & Hill A.B. (1950): Smoking and Cancer of the Lung – A Preliminary Report. *BMJ*, Sept. 30. pp.739 – 748.
3. Doll R. and Hill A. B. (1964): Mortality, Relation to Smoking - Ten Years Observation of British Doctors, *British Medical Journal,* 30th May, pp. 1300-1410.
4. Ritu Priya, Atul Kotwal & Imrana Qadeer (2009): 'Towards an Eco-social Epidemiology Approach to Goitre and Other Iodine Deficiency Disorders: A Case study of India's Technocratic Programme for Universal Iodisation of Salt'. *IJHS,* Vol. 39, No.2. pp: 343-362.
5. Susser M. & E. (1996): Choosing a Future for Epidemiology – Parts I and II. *AJPH* 86 (5) pp. 668-673 and 674-677.
6. Gopalan C. (2007): From 'Farms to Pharmacies': Beginnings of a Sad Decline. Economic and Political Weekly, September 1, 2007, pp. 3535-3536.
7. Murugesan M, Venkatesan P, Kumar S, Thangavelu P, Rose W, John J, Castro M, Manivannan T, Mohan VR, Rupali P. Epidemiological investigation of the COVID-19 outbreak in Vellore district in South India using Geographic Information Surveillance (GIS). Int J Infect Dis. 2022 Sep; 122:669-675. doi: 10.1016/j.ijid.2022.07.010. Epub 2022 Jul 8. PMID: 35811075; PMCID: PMC9263687.
8. Technical Focus: COVID-19 Early Epidemiologic and Clinical Investigations for public health response.
9. https://sdgs.un.org/goals

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme:

Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)	**Mid Term**		**Total**

Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning	**Exam**	**End Term Exam**	
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

XXXX XXXX	**Immunology**	**L-T-P-C: 2-1-1.5-4.5**

COURSE OBJECTIVES

Upon completion of the course, the student should be able to:

- Understand role of contribution scientists in the field of immunology.
- To know about the different cells and organs associated in immune regulation in the defense mechanism.
- Understand the mechanism of antigens or any foreign substances identification through innate and adaptive immunity.
- To know about the immunological disorders.
- Understand the application of different immunological techniques in disease identification.

COURSE OUTCOMES

After completion of the course, students will be able to:

CO1: Discuss history of scientists who contributed in the field of immunology.

CO2: Describe types of cells and organs that are participated in defense mechanism against the pathogens and other foreign particles.

CO3: Explain defense mechanism through Antibodies, Major histocompatibility complex and Complement systems.

CO4: Describe the dysregulation of normal immune cells and associated abnormal conditions including autoimmunity, immunodeficiency and cancer.

CO5: Relate basic technologies in immunology to diagnose different diseases.

CO-PO Mapping

Program Outcomes **Course Outcomes**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	3	3	3	2	3	1	1	3	3	1	3	2	2	2	2
CO 2	3	3	3	2	3	1	3	3	3	1	3	2	2	2	2
CO 3	3	3	3	2	3	1	-	3	3	1	2	3	2	2	2
CO4	2	3	3	4	3	1	1	3	3	1	2	2	2	2	2
CO5	2	1	3	2	3	1	1	2	1	1	2	1	2	1	2
Average	2.6	2.6	3	2.4	3	1	1.5	2.8	2.6	1	2.4	2	2	1.8	2

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High)

"_" No correlation with syllabus

Syllabus **(45 Hours)**

UNIT I: HISTORY OF IMMUNOLOGY **5 Hours**

Introduction to Innate and Adaptive immunity; Contributions of scientists to the development of field of immunology - Edward Jenner, Karl Landsteiner, Robert Koch, Paul Ehrlich, Elie Metchnikoff, Peter Medawar, MacFarlane Burnet, Neils K Jerne, Rodney Porter and Susumu Tonegawa.

UNIT II: IMMUNITY: CELLS, ORGANS AND ANTIGEN-ANTIBODY INTERACTION **8 Hours**

Structure, and Functions of: Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT.

Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Haptens; Epitopes (T & B cell epitopes); T-dependent and T-independent antigens; Adjuvants; Structure, Types, Functions and Properties of antibodies; Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); VDJ rearrangements; Monoclonal and Chimeric antibodies.

UNIT III: IMMUNE RESPONSES **8 Hours**

Primary and Secondary Immune Response; Generation of Humoral Immune Response (Plasma and Memory cells); Generation of Cell Mediated Immune Response (Self MHC restriction, T cell activation, Co- stimulatory signals).

UNIT IV: MAJOR HISTOCOMPATIBILITY COMPLEX AND COMPLEMENT SYSTEM

8 Hours

Organization of MHC locus (Mice & Human); Structure and Functions of MHC I & II molecules; Antigen processing and presentation (Cytosolic and Endocytic pathways); Components of the Complement system; Activation pathways (Classical, Alternative and Lectin pathways).

UNIT V: IMMUNOLOGICAL DYSREGULATION AND IMMUNITY IN TUMOUR

8 Hours

Types of Autoimmunity and Hypersensitivity with examples; Immunodeficiencies - SCID, DiGeorge syndrome, Chediak- Higashi syndrome, Leukocyte adhesion deficiency; Types of tumors, tumor Antigens, causes and therapy for cancers.

Unit VI: Immune technology **8 Hours**

Principles of Precipitation, Agglutination, Immunodiffusion, Immunoelectrophoresis, ELISA, Western blotting, Immunofluoresence, Flow cytometry, Immunoelectron microscopy.

References

1. Abbas AK, Lichtman AH, Pillai S. (2020). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.

2. Delves P, Martin S, Burton D, Roitt IM. (2016). Roitt's Essential Immunology.12th edition Wiley Blackwell Scientific Publication, Oxford.

3. Goldsby RA, Kindt TJ, Osborne BA. (2017). Kuby's Immunology. 8th edition W.H. Freeman and Company, New York.

4. Murphy K, Travers P, Walport M. (2018). Janeway's Immunobiology. 9th edition Garland Science Publishers, New York.

5. Peakman M, and Vergani D. (2019). Basic and Clinical Immunology. 4th edition Churchill Livingstone Publishers, Edinberg.

6. Richard C and Geiffrey S. (2019). Immunology. 8th edition. Wiley Blackwell Publication.

Practical **45 Hours**

1. Identification of human blood groups.
2. Perform Total Leukocyte Count of the given blood sample.
3. Perform Differential Leukocyte Count of the given blood sample.
4. Separate serum from the blood sample (demonstration).
5. Perform immunodiffusion by Ouchterlony method.
6. Perform DOT ELISA.
7. Perform immunoelectrophoretic.
8. Perform WIDAL test.
9. Perform Rapid Plasma Reagin (RPR) Test

REFERENCES

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.

2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition WileyBlackwell Scientific Publication, Oxford.

3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.

4. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.

5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.

6. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme: Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				Mid Term Exam	End Term Exam	Total
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			End Term Examination		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

HSCC XXXX	Bioinstrumentation	L-T-P-C:2-1-1.5-4.5

Course Objectives

- To introduce students with an idea to fill the gap between academia and research.
- To familiarize analytical techniques along with working principle, common instrumentation, and their applications.
- To engender students with the fundamental knowledge of analytical techniques required for

research careers in allied health fields.

Course Outcomes

After the completion of course, the students will be able to:

CO1: Understand different analytical techniques and their instrumentation, and operation.
CO2: Develop skill in carrying out research projects by employing centrifugation, and chromatographic and electrophoresis-based separation techniques.
CO3: Comprehend the terms, principle, instrumentation, operation, and applications of molecular spectroscopic and microscopic techniques.
CO4: Apply appropriate bioanalytical technique for identification, separation, isolation and purification of biomolecules.
CO5: Apply principles of various analytical devices used in in research and enhance problem solving techniques.

CO-PO Mapping

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	2	2	2.5	2.5	2.5	2	2.5	2	2	2	1	1	2	2	2
CO 2	2	2	2.5	2.5	2.5	2	2.5	2	2	2	1	1	2	2	2
CO 3	2	2	2.5	2.5	2.5	2	2.5	2	2	2	1	1	2	2	2
CO 4	2	2	2.5	2.5	2.5	3	2.5	2	2	2	2	2	2	2	2
CO 5	2	2	2.5	2.5	2.5	3	2.5	2	2	2	2	2	2	2	2
Average	2	2	2.5	2.5	2.5	2.2	2.5	2	2	2	1.4	1.4	2	2	2

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High) "_" means there is no correlation

UNIT I: Centrifugation **(6 Hours)**

Basic principles of centrifugation, standard sedimentation coefficient, types of centrifuges on the basis of speed, different types of rotors, principles and applications of differential, rate zonal and density gradient centrifugation.

UNIT II Chromatography **(10 Hours)**

Introduction to chromatography, principle and applications of paper chromatography, thin layer chromatography, column chromatography (adsorption, gel filtration, ion exchange, and affinity) and high-performance liquid chromatography (HPLC).

UNIT III Electrophoresis **(8 Hours)**

Introduction to electrophoresis, polyacrylamide and agarose gel electrophoresis SDS and Native-PAGE, isoelectric focusing (IEF) and 2-D gel electrophoresis.

UNIT IV Spectroscopy **(11 Hours)**

Introduction to spectroscopy, electromagnetic spectrum, Jablonski's diagram, Lambert-Beer law, principle, instrumentation and applications of UV-visible, fluorescence, Fourier-transform infrared (FT-IR) and nuclear magnetic resonance (NMR). Introduction, principle and applications of mass spectrometry, types of ionization methods (Electron impact, chemical ionisation, ESI, MALDI).

UNIT V Microscopy **(10 Hours)**

Principle of microscopy, resolving powers of different microscopes, magnification, principle and applications of: Compound microscopy, dark field microscopy, fluorescent microscopy, phase contrast microscopy, confocal and electron microscopy (SEM & TEM), Fixation and staining.

Practical: **(45 Hours)**

1. Separation of components of a given mixture using a laboratory scale centrifuge.
2. Separation of mixtures by paper / thin layer chromatography.
3. Separation of mixtures of molecules by any form of chromatography.
4. Separation of protein mixtures by sodium-dodecyl sulphate-polyacrylamide gel electrophoresis (SDS-PAGE).

5. Quantification of carbohydrates by DNS/Anthrone method using UV-Visible spectrophotometer.
6. Determination of fluorescence in bovine serum albumin.
7. Fluorescence spectroscopy-based confirmational analysis of protein molecules.
8. To perform simple direct staining to study the morphology of bacterial culture.

Reference Books

1. Principles and Techniques of Biochemistry and Molecular Biology (2018) 8th ed., Wilson, K. and Walker, J. Cambridge University Press, ISBN 13: 978-1316614761.

2. Introduction to Practical Biochemistry (2009) Sawhney, S.K. and Singh R. Narosa Publishing House (New Delhi), ISBN-13: 978-8173193026.

3. Biophysical Chemistry: Principles and Techniques (2016) Upadhyay A., Upadhyay K. and Nath N. Himalaya Publishing House, ISBN 13: 978-8183188654.

4. Principles of Fluorescence Spectroscopy (2010) 5th ed. Lakowicz J.R. Springer, ISBN 13: 978-0387312781.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme: Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			

Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

XXXX XXXX	**Design Thinking**	**L-T-P-C: 1-1-0-2**

Course Objectives

- Understand human centred design/problem solution.
- explore and apply design thinking process by using tools that are collaborative, innovative and effective.
- develop a framework for solving complex problems.
- Learning by doing, engaging, exploring and experimenting.

Course Outcomes

CO1 Understand and able to design the thinking process
CO2 Develop an understanding of various types of thinking process
CO3 Understand the process of thinking
CO4 Evaluate different thinking design
CO5 Develop analytical approaches to evaluate the thinking

CO-PO Mapping

Program Outcomes / Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS 01	PS O2	PS O3	PS O4	PS O5
CO 1															
CO 2															
CO 3															
CO 4															
CO 5															
Average															

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High)
"_" means there is no correlation

Syllabus **(30 hours)**

UNIT 1: Overview of Design Thinking

Introduction to Design thinking, Definition and classification of Design thinking, type of Design Thinking Skills

UNIT 2: Critical Thinking skills
Discussion on Design Thinking Mindset, understanding human centred design through identifying needs, Interviews and empathy building techniques, Observations and insights, Prototypes development, Experimenting and viability, Ideation.

UNIT 3: Project based Approach
Project based training to apply thinking skills in given situation for successful completion of any task. Heart-on Hands-on Head-On Approach.

Reference Books

- Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems by Larry Lifer's Design Thinking Playbook
- Change by design, How Design Thinking Transforms Organizations and Inspires Innovation by Tim Brown
- Creative Confidence by Tom Kelley,

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme: Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment	**End Term Examination**	

Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

HSCC XXXX	**Ability Enhancement/Co-curricular**	**L-T-P-C: 0-0-0-0**

HSCC XXXX	**Industrial Training/Survey/Project**	**L-T-P-C: 0-0-0-0**

SEMESTER VI

HSCC XXXX	Diet Therapy II	L-T-P-C: 2-1-1.5-4.5

Course Objectives

1. To understand the function of the kidneys and various renal disorders, and the role of medical nutrition therapy in managing these conditions.
2. To gain knowledge about diabetes mellitus, cardiovascular diseases and obesity and understand the importance of medical nutrition therapy in the management of these conditions.
3. To explore the relationship between diet
4. To understand neurological, psychiatric disorders and genetic metabolic disorders and understand the role of nutrition in managing these conditions.

Course Outcomes

After the completion of course, the students will be able to:

CO1. Understand the concept of advance diet and control measures for diseases and disorders.

CO2. Implement the role of nutrition in prevention and management of various diseases and disorders.

CO3. Analyze best diet therapy approach for dietary treatment of renal disorders, diabetes mellitus, obesity and cardiovascular diseases.

CO4. Apply the skills of diet and nutrition therapy to provide appropriate dietary interventions for specific diseased conditions.

CO-PO Mapping

Program Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3		

Course Outcomes														PSO4	PSO5
CO 1	3	1	3	2	3	1	1	3	3	1	3	2	2	2	2
CO 2	3	1	3	2	3	1	3	3	3	1	3	2	2	2	2
CO 3	3	1	3	2	3	1	-	3	3	1	2	3	2	2	2
CO4	2	1	3	4	3	1	1	3	3	1	2	2	2	2	2
CO5	2	1	3	2	3	1	1	2	1	1	2	1	2	1	2
Average	2.6	1	3	2.4	3	1	1.5	2.8	2.6	1	2.4	2	2	1.8	2

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High) "_" means there is no correlation

Syllabus (45 hours)

UNIT I Diet Therapy for Renal Disorders (10 Hours)

Physiology and function of the kidneys. Medical nutrition therapy in renal diseases: Acute Kidney Injury (Acute Renal Failure), Chronic Kidney Disease, Glomerular Diseases, End-Stage Renal Disease, Types of dialysis. Screening and Diagnostic Criteria. Various inflammatory markers.

UNIT II Diet Therapy for Diabetes Mellitus (10 Hours)

Categories of Glucose Intolerance. Screening and Diagnostic Criteria.

Current theories of diabetes prognosis: thin fat phenotype, thrifty gene hypothesis, carbohydrate-insulin model. Dietary management of Pre-diabetes and Diabetes Mellitus I and II and their acute and long-term complications. Hypoglycemia of Non-diabetic Origin.

Dietary guidelines – lifestyle management, drugs and insulin management, Carbohydrate counting.

UNIT III Diet Therapy for Cardiovascular Diseases and Weight management (10 Hours)

Medical nutrition therapy in Atherosclerosis and Coronary Heart disease (CHD): Genetic Hyperlipidemias, Hypertension, Heart Failure. Screening and Diagnostic Criteria, lipid profile and heart rhythm screening. Cardiac Transplantation. Various inflammatory markers.

Weight Management: Overview, etiology and assessment of obesity.

Physiology of obesity – role and regional distribution of adipose tissues. Concept and classification and Management of obesity – Diet, physical activity and other behavioral modifications.

UNIT IV Diet Therapy for Cancer (10 Hours)

Cancer initiation and progression and its mechanism. Role of dietary components, phytochemicals and food in cancer prevention and therapeutics. Neutropenic diet: role of diet in pre- and post- cancer therapy for promoting healthy lifestyle.

UNIT V Diet therapy for Neurological and Psychiatric disorders (5 Hours)

Medical nutrition therapy in Senility, Alzheimer's and Parkinson's disease, Epilepsy, Cerebral Palsy, other neurological disorders. Fetal Alcohol Syndrome. Role of Nutritionist in Genetic Metabolic Disorders.

Practical (45 Hours)

1. Plan, prepare and conduct dietary counselling for following disorders:
   - overweight/obese patients
   - underweight adolescent
   - renal disorders.
2. Calculate Glomerular filtration rate and comment on the protein requirements of the patient who has returned from dialysis.
3. Plan and prepare the therapeutic diet for Diabetes Mellitus. Comment on the Co-morbidity associated with diabetes in the case study (If any)
4. Calculate therapeutic diet for heart disease. Comment on the lipid profile of the given patient.
5. Plan and prepare a detailed diet menu for cancer disease while considering neutropenic diets.
6. Plan and prepare a diet for patients suffering from epilepsy while considering ketogenic diets.

7. Write dietary concept for neurological disorders.
8. Plan an Atkins diet plan for weight loss for an obese individual.

Reference Books

1. Antia, F.P. 4th Edition, (2022). Clinical Nutrition and Dietetics, Oxford University Press, Delhi
2. Mahan, L.K., Arlin, M.T. (2000). Krause's Food, Nutrition and Diet therapy, 11th edition, W.B.Saunders Company, London.
3. Shubhangini A Joshi (2021): Nutrition Dietetics. 2nd edition, Tata Mc Graw-Hill Publishing Company Limited, New Delhi.
4. Srilakshmi,B. (2005): Dietetics,5th edition, New Age International(P) Limited Publishers, New Delhi
5. Gibney MJ, Elia M, Ljungqvist & Dowsett J. 2005. Clinical Nutrition. The Nutrition Society Textbook Series. Blackwell Publishing Company.
6. ICMR Nutrient Requirements and Recommended Dietary Allowances for Indians.
7. Kane K. and Prelack K. 2018. Advanced Medical Nutrition Therapy.1st Ed. Jones & Bartlett Learning.
8. Mahan, L. K., Escott Stump. S. and Raymond J.L. 2012. Krause's Food and the Nutrition Care Process. 13th Ed. Saunders-Elsevier.
9. Raymond J. L. and Morrow K. 2020. Krause and Mahan's Food & the Nutrition Care Process. 15th edition. Saunders.
10. Schlenker, E.D. and Roth, S.L. 2013. Williams' Essentials of Nutrition and Diet Therapy. 10th Edition. Mosby.
11. Shils, M.E., Shike, M, Ross, A.C., Caballero B and Cousins RJ. 2005. Modern Nutrition in Health and Disease. 10th Ed. Lipincott, William and Wilkins.
12. Sylvia Escott-Stump. 2021. Nutrition and Diagnosis-Related Care, 9th Ed. Academy of Nutrition and Dietetics.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme :

Continuous Assessment- 50%, mid sem examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)			

					Mid Term Exam	End Term Exam	Total
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

HSCC XXXX	**Community Nutrition**	**L-T-P-C:3-1-2-6**

HSCC XXXX	**Sports Nutrition**	**L-T-P-C:3-1-2-6**

Course Objectives

- To understand basic concepts of sports nutrition

- To enable the students to understand the characteristics, physiology and body composition needs of different power/strength sports
- To impart knowledge on sports specific nutrition and hydration guidelines
- To understand the role or ergogenic aids and supplements

Course Outcomes

After completion of the course, the student should be able to:

CO1: Understand the role that each of the macronutrients and micronutrients has on physical activity and athletic performance

CO2. Examine the impact on physical activity and athletic performance on physical fitness

CO3. Assess the importance of hydration and body composition

CO4. Examine the change in nutrient requirement with age and gender

CO5. Evaluate the efficacy of commonly used dietary supplements used by athletes to enhance performance.

CO-PO Mapping

Program Outcomes / Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PS 01**	**PS O2**	**PS O3**	**PS O4**	**PS O5**
CO 1	3	3	2	2	1.5	1	3	3	3	2	3	2	3	2	2
CO 2	2	3	3	2	1.5	1	3	2	3	2	3	2	3	2	2
CO 3	2	3	2	2	1.5	1	3	3	3	2	2	2	2	2	2

CO 4	2	3	2	2	1.5	1	3	3	3	2	2	2	3	2	2
CO 5	3	3	3	2	1.5	1	3	2	3	1	3	2	2	2	2
Average	2.4	3	2.4	2	1.5	1	3	2.6	3	1.8	3	2	2.6	2	2

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High)

"_" means there is no correlation.

Syllabus

UNIT I: An Overview of Sports Nutrition 12 Hours

Definition of Sports Nutrition, basic nutrients and nutritional guidelines. Classification of sports activities. The Goal of Sports Nutrition, Eating for Exercise/Athletic Performance, Eating Disorders and Deficiencies, energy availability and RED-S, Interpretation of the information on food labels by athletes, factors to consider when developing an individualized sports nutrition plan for athletes, Role of a Sports Nutritionist.

UNIT II: Understanding Fitness and Role of Nutrients in sports performance 12 Hours

Definition of fitness, Importance and benefits of physical activity. Assessment of fitness, Approaches for keeping fit, Strategies, factors that promote lifestyle changes, self-management skills. Physical Activity Guidelines and physical activity pyramid. Energy for exercise, carbohydrate and performance, protein requirement for sports, Vitamins and minerals. impact of deficiency of nutrients on performance.

UNIT III: Hydration and Body composition 12 Hours

Fluids and electrolytes, Balancing fluid loss and intake, factors affecting fluid loss and intake, Dehydration and performance, pre- during and post exercise fluid intake, science of sports drink, sports gel. Weight loss and weight gain, strategies for maintaining optimum weight, pre and post workout diet, hyperhydration strategies.

UNIT IV: Ergogenic aids and Sports supplements **12 Hours**

Brief history of ergogenic aids, categories of ergogenic aids, Protein and amino acids as an ergogenic aid, composition of sports related beverages and food, Antioxidant supplements, energy bars, fat burners and their side effects, protein supplement, WADA banned list, Competition Nutrition- diet week before, pre and post competition meals.

UNIT V: Nutrition according to Gender and age **12 Hours**

Requirement of nutrients for different age groups, gender and type of athletes. diet for vegetarian athletes, factors affecting nutrient requirement and dietary recommendations.

Recommended Books/ Resources:

1. Wardlaw, Smith. Contemporary Nutrition: A Functional Approach. 2 nded, 2012. McGraw Hill.
2. Williams, Melvin. Nutrition for health, fitness and sports.2004. McGraw Hill.
3. Joshi, A, S. Nutrition and Dietetics, 2010. Tata McGraw Hill.
4. Anita Bean (8th edition), The complete guide to Sports Nutrition.
5. Manore, M., Meyer, N. L., & Thompson, J. (2009). Sport nutrition for health and performance. Human Kinetics.
6. Ranchordas, M. K., Rogerson, D., Ruddock, A., Killer, S. C., & Winter, E. M. (2013). Nutrition for tennis: practical recommendations. J Sports Sci Med, 12(2), 211-24.
7. Jeukendrup, A., & Gleeson, M. (2010). Sport nutrition: an introduction to energy production and performance (No. Ed. 2). Human Kinetics.
8. Seebohar, B. (2011). Nutrition periodization for athletes: Taking traditional sports nutrition to the next level. Bull Publishing Company.
9. Campbell BI. (2014). Sports Nutrition: Enhancing Athletic Performance, CRC Press, Taylor& Francis.

10. Haff GG. (2008). Essentials of Sports Nutrition Study Guide, Humana Press.
11. Dunford M and Doyle JA. (2008). Nutrition for Sport and Exercise, Thomson Wadsworth.

Books Recommended

1. Slater, G., & Phillips, S. M. (2011). Nutrition guidelines for strength sports: sprinting, weightlifting, throwing events, and bodybuilding. Journal of sports sciences, 29(sup1), S67-S77.
2. Helms, E. R., Aragon, A. A., & Fitschen, P. J. (2014). Evidence-based recommendations for natural bodybuilding contest preparation: nutrition and supplementation. Journal of the International Society of Sports Nutrition, 11(1), 20. 7. McArdle, W. D., Katch, F. I., & Katch, V. L. (2009). Sports and exercise nutrition. Lippincott Williams & Wilkins.

Practical **15 Hours**

1. Visit to sports complex and gym to witness different athletes' activities.
2. Dietary analysis- To conduct dietary assessment and analysis of athletes' current dietary intake to evaluate nutrient intake and identify are for the improvement.
3. Meal Planning- Develop personalized meal plan for athletes based on their specific nutritional needs (involve calculating macro and micronutrients).
4. Nutrient Timing- Design pre-, during- and post-exercise nutrition plan for the athletes to optimize performance and recovery.
5. Hydration assessment- Assessing hydration status and fluid requirement and loss through urine analysis and body weight measurement. (tutorials)
6. Hydration planning- Develop plans and strategies to maintain optimal fluid balance during exercise. (tutorials)
7. Sports supplement evaluation- Evaluating the effectiveness and safety of sports supplements commonly used by athletes. This may involve examining ingredients labels and researching scientific literature.
8. Sports nutrition counselling- Practicing effective communication skills to provide individualized nutrition counselling to athletes. Students may conduct mock counselling, role-play, case studies, behaviour change intervention. (tutorials)

9. Recipe modification- Modifying traditional recipes or creating new recipes to enhance their nutritional value and align with the specific dietary needs of athletes.
10. Field Experience- Gaining practical experience by working with athletes or sports team under the supervision of experienced sports nutrition professionals and observing the implementation of sports nutrition strategies in real- world settings.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme: Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

HSCC XXXX	**Start your Start Up (SFL)**	**L-T-P-C:1-1-0-2**

HSCC XXXX	**Ability Enhancement/Co-curricular**	**L-T-P-C: 0-0-0-0**

HSCC XXXX	**Industrial Training/Survey/Project**	**L-T-P-C: 0-0-0-0**

SEMESTER VII

HSCC XXXX	Public Health Nutrition	L-T-P-C:2-2-1-5

Course Objectives

- To establish an understanding of the determinants and measures of health and disease-related conditions.
- To understand the epidemiology of nutrition-related chronic diseases.
- To apply skills to design and implement evidence-based public health nutrition interventions and programs.
- To evaluate the role of public policy in promoting healthy diets and reducing the burden of chronic disease.

Course Outcomes

After completion of this course, the student will be able to:

CO1 Understanding of public health nutrition and its relation to health care delivery.

CO2 Able to do the nutritional assessment at individual and community levels.

CO3 Develop an understanding of health economics and community-based nutrition intervention.

CO4 Evaluation of the national nutrition program and strategies to combat public nutrition problems.

CO-PO Mapping

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	2	3	3	3	3	3	-	2	3	3	3	-	3	2	3
CO 2	3	2	3	2	2	2	2	2	2	3	3	3	2	1	2

CO 3	1	3	2	3	2	1	3	3	3	3	2	2	3	2	3
CO 4	2	1	2	3	1	2	-	-	2	3	2	-	-	3	3
Average	**2**	**2.25**	**2.5**	**2.75**	**2**	**2**	**1.25**	**1.75**	**2.5**	**3**	**2.5**	**1.25**	**2**	**2**	**2.75**

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High)
"_" means there is no correlation

Syllabus **(60 hours)**

UNIT I: Introduction to Public Health Nutrition (15 Hours)

Definition of public health nutrition. Key concepts, scope and future projections of public health nutrition, Health Care Delivery, Role of Public Health Nutrition in Health care Delivery. Micronutrient deficiencies: Beriberi, Ariboflavinosis, Pellagra, Folic Acid and B12 deficiency – spina bifida, pernicious anemia (disease names), Scurvy, Rickets and Osteomalacia, Fluorosis and Lathyrism.

UNIT II: Assessment of Nutritional Status in Community Settings (15 Hours)

Nutritional assessment- Goals and objectives, Methods of Assessment of Nutritional Status of Community-ABCD Approach.

Indirect Assessment- Age-Specific Mortality Rates, Cause-specific Mortality Rates, Cause-specific Nutritionally relevant morbidity Rates, Ecological factors

Direct Assessment-Use of Anthropometry, MUAC, Weight and Height.

UNIT III: Health Economics and Population Dynamics (15 Hours)

Causes, Consequences of Malnutrition, Indicators of Malnutrition, Interventions in Malnutrition and Government Expenditure on Interventions. Demographic Transition and demographic cycle, population structure, trends, and Policy in India. Principles and practices

of community nutrition. Community-based nutrition interventions. Program planning, implementation, and evaluation in community nutrition.

UNIT IV: Strategies to Combat Public Nutrition Problems (15 Hours)

Diet or Food based strategies-Dietary Diversification, Horticulture Intervention, Food Fortification. Nutrient Based Approach-Medicinal approach. Supplementation-short term preventive strategy.

Current National nutrition programs – implementation and their critical evaluation. Limited impact of National Nutrition Programs in India, Cost of improving nutrition situation in India. Role of National and International agencies in combating malnutrition.

References:

1. Public Health Nutrition, 2nd Edition. Edited on behalf of the Nutrition Society by Judith L. Buttriss, Ailsa A. Welch, John M. Kearney, and Dr. Susan A. Lanham-New. Wiley-Blackwell, 2017.
2. Keith West Jr, Catherine C. Geissler, and Lindsay Allen. Public Health Nutrition
3. Mary-Jane Schneider. 2017. Introduction to Public Health. 5th ed. Jones & Bartlett Learning, LLC.
4. Peter J. Neumann, Michael E. Chernew, and Harold A. Pollack. Health Economics
5. Mark L. Wahlqvist and Anthony J. McMichael. Global Nutrition: A Brief Overview.
6. Whitney and Rolfes. 2011. Understanding Nutrition. 12th ed. Wadsworth, Cengage Learning.

Practical (30 Hours)

1. Assessment of Nutritional Status-Nutritional Anthropometry, Body Weight, height and MUAC for Preschool Children (during a visit to a nearby school or anganwadi center)
2. Indicators of anthropometric measurements-height for age, weight for age, height for weight, body mass index, plotting and interpretation of growth charts (during a visit to a nearby school or anganwadi center)
3. To conduct dietary assessment: 24 dietary recall and using Food frequency questionnaire.
4. Conduct a survey for dietary patterns of different socio-economic status, socio-cultural and rural-urban variances and Planning of nutrition and health education program.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme:

Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

HSCC XXXX	Nutrition in Emergency	L-T-P-C:3-1-1-5

Course Objectives

- To introduce the concept of nutrition during an emergency viz. geopolitical wars, natural calamities, climate change, etc.
- To understand natural calamities and emergency condition /situation
- To analyze the interventions that are used to treat and prevent malnutrition in an emergency.
- To appraise the roles and responsibilities of the Government, UN agencies and other organizations for the coordination of nutrition-related activities during emergencies

Course Outcomes

After completion of this course, the student will be able to:

CO1: Understanding of nutritional requirements in emergency situations Understanding on how to assess, analyze and act in the emergency nutrition situation and implementation of interventions to treat and prevent malnutrition among various vulnerable age groups.

CO2: Awareness about natural calamities and examining community preparedness.

CO3: Discussion on the nutritional requirement during space sojourn.

CO4: Gather information on the military and sea/marine nutrition.

CO-PO Mapping

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	2	3	3	3	3	3	-	2	3	2	3	-	3	2	3	3
CO 2	3	2	3	2	2	2	2	2	2	3	3	3	2	1	2	2
CO 3	1	3	2	3	2	1	3	3	3	3	2	2	3	2	3	-
CO 4	2	1	2	3	1	2	-	-	2	2	2	-	-	3	3	-

Average	**2**	**2.25**	**2.5**	**2.75**	**2**	**2**	**1.25**	**1.75**	**2.5**	**2.5**	**2.5**	**1.25**	**2**	**2**	**2.75**	**1**

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High) "_" means there is no

Syllabus **(60 hours)**

UNIT I: Concept of Nutrition Emergency **(15 Hours)**

Introduction of nutritional emergencies and special conditions, ~~role and scope,~~ factors affecting the nutritional requirement, identification of most vulnerable population in special conditions. Nutritional awareness, assessment, interventions, and management process including monitoring and evaluation of the program. Major nutritional deficiency diseases in emergencies.

UNIT II: Natural Calamity and Emergency Condition **(15 Hours)**

Concept of natural calamities -floods, droughts, earthquakes, cyclones, landslides, volcanoes, epidemic, pandemics etc. geo-climatic condition and their importance in nutritional management. Nutritional requirements and responses during emergencies. National and International policies for emergency care.

UNIT III: Space Nutrition **(15 Hours)**

Concept of Space food, types, and their properties. Changes in body composition, Effects of a voyage on the nutritional status of an astronaut. Nutrient requirement and dietary management during space travel. Designing space foods.

UNIT IV: Military and Sea Nutrition **(15 Hours)**

History of military nutrition. Nutrition on operational deployment. Diet and nutritional requirements during injury/wounds. Physiological changes, Nutrient requirement, and dietary management in the human body during sea/marine travel.

Health hazards associated with extreme conditions -high and low altitude.

Practical: **(30 Hours)**

1.Critically evaluate the case studies (research papers) and submit reports for the following:

• Floods in Uttarakhand

• Covid 19 Food resources and mobilization

• Ukraine war leading to malnutrition

2.Preparation of Composite premixes (RUTF) for emergency situations

3. Visit to an organization which provide nutrition support during an emergency situation.

4. Role of Nutrition Rehabilitation Centers for Severe Acute Malnutrition. Plan a high protein and calorie-dense recipe for SAM children (4 years of age).

References:

- The Management of Nutrition in Major Emergencies, World Health Organization; 2nd edition (1 March 2000)
- Natural Disasters by David Alexander, Taylor & Francis, 2018
- Human Adaptation to Spaceflight: The Role of Nutrition, U.S. Government Printing Office (December 2014)
- Space Nutrition, Jr. Smith, Jr., Smith, Davis-Street, Neasbitt, Zwart, Davis-Street, Neasbitt, Zwart, Trafford Publishing
- Food and Nutrition Needs in Emergencies by Graeme A. Clugston Director, Nutrition for Health and Development World Health Organization Geneva, Switzerland

Research Papers:

- Hill, Neil & Fallowfield, Joanne & Price, Susan & Wilson, Duncan. (2011). Military nutrition: Maintaining health and rebuilding injured tissue. Philosophical transactions of the Royal Society of London. Series B, Biological sciences. 366. 231-40. 10.1098/rstb.2010.0213
- Bordenave N, Brown R, Basset F, Power J, Godin N, Haman F. Revisiting survival at sea from a nutrition and food perspective: rationalizing the rations. Appl Physiol Nutr Metab. 2023 Feb 1;48(2):219-225. doi: 10.1139/apnm-2022-0229. Epub 2022 Nov 4. PMID: 36332203.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme:

Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

HSCC XXXX	**Fundamentals of Research Methodology**	**L-T-P-C:3-1-1-5**

Course Objectives

- Understand basic concepts of research and its methodologies.
- Identify and define a research problem, state a hypothesis, select an appropriate research design, and implement research project.

- Discuss the concepts and procedures of sampling, ethical considerations, data collection, analysis and reporting.
- Review literature, collect and analyse data, and write a report / dissertation.

Course Outcomes

After completion of this course, the student will be able to:

CO1: Understand the basics of research, types, steps, and application.
CO2: Conduct literature review, collect data and analyse.
CO3: Identify and define a research problem, set hypothesis, and select an appropriate research design.
CO4: Demonstrate the ability to choose methods appropriate to research aims and objectives.
CO5: Report and Communicate research findings.

CO-PO Mapping

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO 1	3													
CO 2	3										1			
CO 3	3	2	1		3					1		2		
CO 4	3	2	1		3									
CO 5	3		1		1		2	1					1	

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High)
"_" means there is no correlation

Syllabus **(60 Hours)**

UNIT I: Introduction to Research **14 Hours**

Definition of research, objectives of research, applications and types of research, research process and steps involved. Collecting and reviewing literature, types of literature review (survey, systematic, meta-analysis), conceptualization, and formulation of a research problem, constructing hypothesis, identifying variables, Synopsis.

UNIT II: Design of Research and Sample Survey or Experiments **12 Hours**

Research Design-Selecting and defining a research problem, need for research design, features of a good research design, different research designs (exploratory, descriptive experimental and diagnostic research); Design of Sample Survey or Experiments: Census V/s Sample enumerations, objectives and principles of sampling, Types of sampling, Sampling and Non-sampling errors. Designing Questionnaires and interview. Determination of the sample size.

UNIT III: Measurement of Scaling Concepts **9 Hours**

Scales of measurements, nominal, ordinal, internal and ratio scales, Errors in measurements. Validity and Reliability in measurement, Scale Construction Techniques.

UNIT IV: Data Collection & Analysis **16 Hours**

Primary & secondary data, Validity and Reliability of data collection procedures, data preparation, exploratory data analysis, parametric and nonparametric tests, correlation and regression analysis, ANOVA, Multivariate Techniques, Introduction to data representation methods/tools. Like SAS, SPSS, R, etc.

UNIT V: Research Ethics & Scientific Communication **9 Hours**

Ethical conduct of research, Introduction to scientific misconduct, repeatability and reproducibility of research, Ethics and plagiarism in publication, Art of Communicating Scientifically – formats for scientific presentation and writing, conclusion, referencing and, Bibliography; journal publications, Impact factor, Citation index, Research related Software - references management, Plagiarism detection etc.

Recommended Books/ Resources:

1. Kothari C.R., “Research Methodology, Methods, and Techniques, Second edition, (2008), New Age International Publication.
2. Krishna Swamy K.N., Siva Kumar A.I., Mathirajan M., “Management Research Methodology (2006), Pearson Education, New Delhi.

3. Ranjit Kumar: Research Methodology, A step by step guide for beginners, Pearson Education, Sixth Edition 2009.
4. Mark Saunders, Philip Lewis, Adrain Thornhiu: Research Methods for Business Students, Pearson Education.
5. Ram Ahuja, "Research Methods", (2001), Rawat Publications, New Delhi. 6. Cooper D., Schindler P., Business research methods", (2003) Tata Mc-Graw Hill, New Delhi
6. https://apps.who.int/iris/bitstream/handle/10665/206929/929061157X_eng.pdf?sequence=1&isAllowed=y

Practical: **30 Hours**

1. **Literature review**
   Detailed review of literature on the chosen topic
2. **Reference management tools (Mendeley, EndNote, etc)**
   Use of reference management tools and integration into MS office
3. **Setting research question**
   Identify the research area/topic of interest, review the research trends, write about significance of the chosen topic/area, set research question(s), and develop hypothesis.
4. **Setting objectives and protocols (methods)**
   Write specific objectives and designing research methods for each objective.
5. **Data collection, analysis and representation**
6. **Report writing and communication**
   Finalize the report based on the collected and analysed data, communicate for peer-review, etc.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme:

Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			

Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

HSCXXXX	**Good Laboratory and Manufacturing Practices**	**L-T-P-C: 3-1-1-5**

COURSE OBJECTIVE

- To introduce the basic concepts of quality assurances in Good Laboratory Practices.
- To address Federal Food and Drug Law and discuss the Trade and Company Standards Control by National, International.
- To enable the students to know about the Scope and importance of GLP and GMP.

COURSE OUTCOMES

After completion of this course, the student will be able to:

CO1: To know about the detail guidelines on GLP and GMP and study the trade standards of quality Federal Food and Drug Law FDA.

CO2: Understand the concept of Regulatory requirements and approval procedures for New Drugs and technologies.

CO3: Demonstrate basic skills of good Laboratory practices, standardization and validation procedures

CO4: Mastering basic techniques for hygienic manufacturing of products, sampling and regulatory affairs,

CO-PO Mapping

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	2	3	3	3	3	3	-	2	3	2	3	-	3	2	3
CO 2	3	1	3	3	2	2	2	2	2	3	3	3	2	1	2
CO 3	1	3	2	3	2	1	3	3	3	3	2	2	3	2	3
CO 4	2	1	2	3	1	2	-	-	2	2	2	-	-	3	3
Average	**2**	**2**	**2.5**	**3**	**2**	**2**	**1.25**	**1.75**	**2.5**	**2.5**	**2.5**	**1.25**	**2**	**2**	**2.75**

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High)

"_" No correlation with syllabus

UNIT I: Good Laboratory Practices **7 Hours**

Introduction to GLP, WHO guidelines on GLP, Quality assurances in Good Laboratory Practices and Quality Standards. Advantages and Disadvantages, Concept of Quality Control. Government and trade standards of quality Federal Food and Drug Law FDA Action BSTI Laws, BSTI action and activities other food laws (Legalization).

UNIT II: Validation of Analytical Procedures **8 Hours**

Implications of cGMP and Food plant sanitation. The regulations of cGMPs Planning of Plant Sanitation Programs and Construction factors Hygienic design of food plants and equipment Sanitation in warehousing, storage, shipping, receiving, containers and packaging materials Control of rats, rodents, birds, insects and microbes. Cleaning and Disinfection: Physical and

Microbiological Approach. Food Quality and Quality control including the HACCP system (Critical quality control points in different stages of production including raw materials and processing materials)

UNIT III: Good Manufacturing Practice **7 Hours**

Good Manufacturing Practice: definitions, requirements and historical background. Quality assurance, quality management, design of quality systems. Principles for documentation in GMP, Site Master File, SMF, Monographs, Protocols (production protocols, standard operating procedures, SOP).

UNIT IV: Risk Analysis and Precautions **8 Hours**

Risk analysis and risk assessment, Qualification and validation, Microbiological test and quality control, Aseptic production, localities, clothing, Audit, monitoring, internal and external inspections

UNIT V: Sampling **10 Hours**

Sampling: Introduction, WHO guidelines, sampling plans and techniques, operating characteristics curves, maintenance of sampling records of finished product and packaging material

Ethics in manufacturing and control, Principles of quality by design (QBD). Introduction to the concept of Design of Experiment (DOE) Application of QBD principles in Biotech product development.

Regulatory Affairs: Contract manufacturing; Certification and Licensing Procedures; Material Safety Data Sheet (MSDS) preparation. Drug regulatory and accrediting agencies of world and their guidelines including USFDA, MCA, TGA, MHRA, ANVISA.

Practical: **30 Hours**

1. Basic procedures and precautions for working in a Laboratory.
2. Pre-analysis preparation and management of materials.
3. Describe Sampling techniques and perform a sampling of raw materials.
4. Accuracy and Precision of analysis method.

5. Validate the analysis method.
6. Basic procedures to produce hygiene food and drugs.
7. Procedure to formulate a Food product.
8. Storage stability tests for Developed products.
9. Packaging and transportation requirements for a product.

REFERENCES

1. cGMP starter guide: Principles in Good Manufacturing Practices for Beginners, Emmet P. Tobin, Createspace Independent Publishing Platform, April 2016.

2. Good Manufacturing Practices for Pharmaceuticals: GMP in Practice, B Cooper, Createspace Independent Publishing Platform, July 2017.

3. Sarwar Beg and Md Saquib Hasnain, Pharmaceutical Quality by design: Principles and application, Academic press, March 2019.

4. Ron S. Kenett, Shelemyahu Zacks, Daniele Amberti, Modern Industrial Statistics: with applications in R, MINITAB and JMP, 2nd Edition, Wiley, January 2014.

5. N Politis S, Colombo P, Colombo G, M Rekkas D.Design of experiments (DoE) in pharmaceutical development, Drug Dev Ind Pharm. 2017 Jun;43(6):889-901. doi: 10.1080/03639045.2017.1291672.

6. Andrew Teasdale, David Elder, Raymond W. Nims, ICH quality guidelines- An implementation guide, Dec 2017.

7. Singh, G., Agarwal, G. and Gupta, V. Drug regulatory affairs, CBS publication, 2005.

8. Marc P. Mathieu, New Drug Development: A regulatory overview, Nov 2000.

9. ICH guidelines available in the official website "https://www.ich.org". Course Outcomes: Understand that the areas that come under the Good Laboratory Practices are: personnel and organizational, testing facilities, equipment, testing and controls, records, reports, and protocol for and conduct of non-clinical labs., Understand that the areas that come under GMP are: facilities and buildings, equipment, production, process control, packaging and labeling, laboratory controls, and returned/salvaged drug products., Importance of GMP and GLP for drug regulation.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme: Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

SEMESTER VIII

HSCC XXXX Industrial Internship/Startup - BSc Honours students Research Project-BSc Honours with Research students	L-T-P-C: 15

HSCC XXXX	Sports Nutrition	L-T-P-C: 3-2-0-5

Course Objectives

- To understand basic concepts of sports nutrition
- To enable the students to understand the characteristics, physiology and body composition needs of different power/strength sports.
- To impart knowledge on sports specific nutrition and hydration guidelines
- To understand the role or ergogenic aids and supplements

Course Outcomes

After completion of this course, the student will be able to:

CO1: Identifying the role of macronutrients and micronutrients in physical activity and performance.

CO2. Exemplifying the impact of physical activity and athletic performance on physical fitness

CO3. Examine the importance of hydration and body composition in sports activity.

CO4. Illustrate the change in nutrient requirement with age and gender.

CO5. Categorize the efficacy of commonly used dietary supplements used by athletes to enhance performance.

CO-PO Mapping

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	1.5	1	3	3	3	2	3	2	3	2	2
CO 2	2	3	3	2	1.5	1	3	2	3	2	3	2	3	2	2
CO 3	2	3	2	2	1.5	1	3	3	3	2	2	2	2	2	2
CO4	2	3	2	2	1.5	1	3	3	3	2	2	2	3	2	2
CO5	3	3	3	2	1.5	1	3	2	3	1	3	2	2	2	2
Average	2.4	3	2.4	2	1.5	1	3	2.6	3	1.8	3	2	2.6	2	2

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium) 3 – Strongly Mapped (High)

"_" means there is no correlation

Syllabus

UNIT I: An Overview of Sports Nutrition **15 Hours**

Definition of Sports Nutrition, basic nutrients and nutritional guidelines. Classification of sports activities. The Goal of Sports Nutrition, Eating for Exercise/Athletic Performance, Eating Disorders and Deficiencies, Interpretation of the information on food labels by athletes, factors to consider when developing an individualized sports nutrition plan for athletes, Role of a Sports Nutritionist.

UNIT II: Understanding Fitness and Role of Nutrients in sports performance 15Hours

Definition of fitness, Importance and benefits of physical activity, health. Assessment of fitness, Approaches for keeping fit, Strategies, factors that promote lifestyle changes, self-management skills. Physical Activity Guidelines and physical activity pyramid. Energy for exercise, carbohydrate and performance, protein requirement for sports, Vitamins and minerals.

UNIT III: Hydration and Body composition 15Hours

Fluids and electrolytes, Balancing fluid loss and intake, factors affecting fluid loss and intake, Dehyration and performance, pre- during post exercise fluid intake, science of sports drink, sports gel. Weight loss and weight gain, strategies for maintaining optimum weight, pre and post workout diet.

UNIT IV: Ergogenic aids and Sports supplements 15Hours

Brief history of ergogenic aids, categories of ergogenic aids, Protein and amino acids as an ergogenic aid, composition of sports related beverages and food, Antioxidant supplements, energy bars, fat burners and their side effects.

UNIT V: Gender and age 15 Hours

The female athletes, young athletes, older athletes, diet for vegetarian athletes, factors affecting nutrient requirement and dietary recommendations.

Competition Nutrition- diet week before, pre and post competition meals.

Recommended Books/ Resources:

1. Wardlaw, Smith. Contemporary Nutrition: A Functional Approach. 2 nd ed, 2012. McGraw Hill.
2. Williams, Melvin. Nutrition for health, fitness and sports.2004. McGraw Hill.
3. Joshi, A, S. Nutrition and Dietetics, 2010. Tata McGraw Hill.
4. Anita Bean (8th edition), The complete guide to Sports Nutrition.

5. Manore, M., Meyer, N. L., & Thompson, J. (2009). Sport nutrition for health and performance. Human Kinetics.
6. Ranchordas, M. K., Rogerson, D., Ruddock, A., Killer, S. C., & Winter, E. M. (2013). Nutrition for tennis: practical recommendations. J Sports Sci Med, 12(2), 211-24.
7. Jeukendrup, A., & Gleeson, M. (2010). Sport nutrition: an introduction to energy production and performance (No. Ed. 2). Human Kinetics.
8. Seebohar, B. (2011). Nutrition periodization for athletes: Taking traditional sports nutrition to the next level. Bull Publishing Company.
9. Campbell BI. (2014). Sports Nutrition: Enhancing Athletic Performance, CRC Press, Taylor& Francis.
10. Haff GG. (2008). Essentials of Sports Nutrition Study Guide, Humana Press.
11. Dunford M and Doyle JA. (2008). Nutrition for Sport and Exercise, Thomson Wadsworth.

Books Recommended

1. Slater, G., & Phillips, S. M. (2011). Nutrition guidelines for strength sports: sprinting, weightlifting, throwing events, and bodybuilding. Journal of sports sciences, 29(sup1), S67-S77.
2. Helms, E. R., Aragon, A. A., & Fitschen, P. J. (2014). Evidence-based recommendations for natural bodybuilding contest preparation: nutrition and supplementation. Journal of the International Society of Sports Nutrition, 11(1), 20. 7. McArdle, W. D., Katch, F. I., & Katch, V. L. (2009). Sports and exercise nutrition. Lippincott Williams & Wilkins.

Practical: **15 Hours**

1. Visit sports complex and gym to witness different athletes' activities.
2. Dietary analysis- To conduct dietary assessment and analysis of athletes' current dietary intake to evaluate nutrient intake and identify are for the improvement.
3. Meal Planning- Develop personalized meal plan for athletes based on their specific nutritional needs (involve calculating macro and micronutrients).

4. Nutrient Timing- Design pre-, during- and post-exercise nutrition plan for the athletes to optimize performance and recovery.
5. Hydration assessment- Assessing hydration status and fluid requirement and loss through urine analysis and body weight measurement.
6. Hydration planning- Develop plans and strategies to maintain optimal fluid balance during exercise.
7. Sports supplement evaluation- Evaluating the effectiveness and safety of sports supplements commonly used by athletes. This may involve examining ingredients labels and researching scientific literature.
8. Sports nutrition counselling- Practicing effective communication skills to provide individualized nutrition counselling to athletes. Students may conduct mock counselling, role-play, case studies, behavior change intervention.
9. Recipe modification- Modifying traditional recipes or creating new recipes to enhance their nutritional value and align with the specific dietary needs of athletes.
10. Field Experience- Gaining practical experience by working with athletes or sports team under the supervision of experienced sports nutrition professionals and observing the implementation of sports nutrition strategies in real- world settings.

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme: Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			

Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100

HSCC XXXX	**Food Preservation and Processing**	**L-T-P-C: 3-2-0-5**

Course Objectives

- To acquire knowledge on food preservation and processing techniques
- To develop and understanding on the advanced thermal and non-thermal technologies
- To gain skills for the application of different processing and preservation techniques for different food commodities

Course Outcomes

After completion of this course, the student will be able to:

CO1. Understand the basic concepts of food preservation and processing.
CO2. Discuss and identify different thermal food preservation and processing technologies.
CO3. Evaluate the functions of packaging and identify suitable materials for packaging of food commodities.
CO4. Analyze risk factors during food processing and preservation as per food safety regulations

CO-PO Mapping

Program Outcomes / Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5
CO 1	3	2	-	1	1	1	1	1	1	-	3	2	2	1	**3**
CO 2	3	2	-	1	1	1	1	1	1	-	3	2	2	1	**3**
CO 3	3	2	-	1	1	1	1	1	1	-	3	2	2	1	**3**
CO4	3	2	-	1	1	1	1	1	1	-	3	2	2	1	**3**
CO5	3	2	-	1	1	1	1	1	1	-	3	2	2	1	**3**
Average	**3**	**2**	**-**	1	1	**1**	1	1	1		**3**	**2**	**2**	1	**3**

Syllabus **(75 Hours)**

UNIT I. Principles of Food Processing and Preservation (15Hours)

Concepts and importance of food processing and preservation; Basic principles of primary, secondary and tertiary processing; Traditional processing and preservation techniques like Baking, Roasting, Smoking, Frying, Pickling, Sulphating etc. Difference between processing and preservation of foods; Effects of processing on components, properties and nutritional value of foods.

UNIT II. Thermal Processing and Preservation Technologies (15Hours)

Principles of thermal processing; Advances in dehydration of fruits and vegetables using various drying technologies like sun drying, solar drying (natural and forced convection), osmotic, tunnel drying, fluidized fed drying, superheated steam drying, drum drying, spray drying etc.; Microwave processing; Extrusion, Blanching, Pasteurization, Canning, Sterilization, UHT processing.

UNIT III Non-Thermal Processing and Preservation Technologies (15Hours)

Principles of minimal processing and hurdle concept; High pressure processing, pulsed electric field, ultrasound processing, ozonation, irradiation, membrane filtration, Fermentation, homogenization, Freezing, freeze-drying and freeze concentration, electrolyzed water, use of natural antimicrobials and synthetic food preservatives and additives.

UNIT IV Food Packaging (15Hours)

Principles and functions of packaging; Traditional and novel packaging materials including rigid and flexible packaging; Storage and shelf-life studies; Design considerations of packaging materials; Factors determining packaging requirement of foods.

UNIT V Food Safety Issues (15Hours)

Maillard reaction products, Acrylamide: formation, occurrence, toxicity; Contaminants and adulterants, Introduction to HACCP, CODEX Alimentarius, FSSAI regulations

References:

- Fellows P J (2000) Food Processing Technology: Principles and Practice 2nd edition CRC Woodhead Publishing Ltd., Cambridge.
- Potter, N. N., & Hotchkiss, J. H. (2012). Food science. Springer Science & Business Media.
- Sun, D. W. (2014). Emerging technologies for food processing, Academic Press
- Sahay, K. M., & Singh, K. K. (2009. Unit operations of agricultural processing. Vikas Publishing House Pvt. Ltd.
- Boobis, A., Popping, B., Anelich, L., Knowles, M. E. (2022). Present Knowledge in Food Safety: A Risk-Based Approach Through the Food Chain

Modes of Evaluation: Quiz/Assignment/Presentation/ Written Exam/ Examination Scheme: Continuous Assessment- 50%, mid semester examination- 20% and End term examination- 30%

- **Theory Assessment:**

	Continuous Assessment/Internal Assessment (50)				**Mid Term Exam**	**End Term Exam**	**Total**
Components	Surprise Test/Quiz	Assignments	Group Discussion/Presentations	Project Based Learning/ Tutorials based learning			
Weightage (%)	10	10	10	20	20	30	100

- **Laboratory Assessment:**

	Continuous Assessment/Internal Assessment			**End Term Examination**		
Components	Experimental Performance	Viva voce	Lab record	Major Experiments (Practical)	Viva voce	Total
Weightage (%)	30	20	20	20	10	100