

**SYLLABUS FOR UG COURSE BACHELOR OF SCIENCE
IN FOOD AND NUTRITION (Semester I-VIII)**

[AS PER NEP, 2020]

[DRAFT]

(With effect from - Session 2024-25 onwards)



UNIVERSITY OF GOUR BANGA

MALDA,

WEST BENGAL, INDIA

Evaluation details.

Course type	Full marks	Cont. Evaluation.	Semester End Examination	
Major Core	50	25	Theory	Practical
			30 (2×4=8, out of 6 questions) (4×3=12, out of 6) [10×1= out of 2, {at least 2 parts, maximum 3 parts, but a single part of question should not exceed 6 marks.}]	20
Minor Core	50	25	30 (2×4=8, out of 6 questions) (4×3=12, out of 6) [10×1= out of 2, {at least 2 parts, maximum 3 parts, but a single part of question should not exceed 6 marks.}]	20
Skill Enhancement Course	50		No theoretical examinations.	
MDC	50	10 Attendance: 05, Class performance:05.	40 (2×5=10 out of 8 questions) (5×4=20 out of 6 questions)	-----

			[10×1= out of 2, {at least 2 parts, maximum 3 parts, but a single part of question should not exceed 6 marks.}]	
VAC/AEC	25		25 MCQ	-----

❖ **Continuous evaluation for Major and Minor courses:**

Attendance: 05, Class performance: 05, Presentation/ Project: 10, Viva: 05.

Parameters of evaluation of class performance:

- Class performance: Regularity, Punctuality, Interactive, Cooperative, Carefulness, Timely assignment submission, Endorsement of Practical note book.
- Participation in the cleanliness of the laboratory.
- Departmental involvement: Cleanliness, Wall magazine, Science exhibition; Health awareness camp; community study, participation in departmental seminar and workshop.
- Co-curricular activity; Blood donation camp, participation in cultural and sports activities. Essay and quiz competition.

❖ **Continuous evaluation for MDC courses:**

Attendance: 05, Class performance: 05.

- Class performance: Regularity, Punctuality, Interactive, Cooperative, Carefulness, Timely assignment submission.

❖ **Practical Examination:**

Direction from Board of Studies and Controller of Examination department will be followed.

4 YEAR BACHELAR OF SCIENCE COURSE IN FOOD & NUTRITION

SEMESTER WISE BREAKUP (MAJOR CORE)

SEMESTER	Course Code & Title of the Course	Credits	Full Marks	Marks Division		
		L,P		Th.	Pr.	Cont. Evaluation
SEMESTER –I	Course Code-FNT-DC-MJ-101 Course Name- CONCEPT OF FOOD, NUTRITION AND HEALTH	4 (3,1)	75	30	20	25
SEMESTER –II	Course Code-FNT-DC-MJ-201 Course Name- FUNDAMENTALS OF HUMAN NUTRITION	4 (3,1)	75	30	20	25
SEMESTER – III	Course Code-FNT-DC-MJ-301 Course Name- NUTRITIONAL PHYSIOLOGY-I	4 (3,1)	75	30	20	25
	Course Code-FNT-DC-MJ-302 Course Name- BASIC FOOD SCIENCE	4 (3,1)	75	30	20	25
SEMESTER-IV	Course Code-FNT-DC-MJ-401 Course Name- BASIC BIOCHEMISTRY	4 (3,1)	75	30	20	25
	Course Code-FNT-DC-MJ-402 Course Name- BASIC DIETETICS	4 (3,1)	75	30	20	25
	Course Code-FNT-DC-MJ-403 Course Name- FOOD PRESERVATION TECHNIQUES	4 (3,1)	75	30	20	25

SEMESTER-V&VI (MAJOR CORE)

SEMESTER	Title of the Course	Credits	Full Marks	Marks Division		
		L-P		Th.	Pr	Cont evaluation ation
SEMESTER-V	Course Code: FNT-DC-MJ 501 Course Name: Nutrition in Human Life Stages.	4 (3-1)	75	30	20	25
	Course Code: FNT-DC-MJ 502 Course Name: Nutritional Physiology-II	4 (3-1)	75	30	20	25
	Course Code: FNT-DC-MJ 503 Course Name: Community Nutrition	4 (3-1)	75	30	20	25
	Course Code: FNT-DC-MJ 504 Course Name: Food Microbiology	4 (3-1)	75	30	20	25
SEMESTER-VI	Course Code: FNT-DC-MJ 601 Course Name: Pathophysiology and Therapeutic diet	4 (3-1)	75	30	20	25
	Course Code: FNT-DC-MJ 602 Course Name: Food Toxicology and Immunology	4 (3-1)	75	30	20	25

	Course Code: FNT-DC-MJ 603 Course Name: Food Standard and Safety	4 (3-1)	75	30	20	25
	Course Code: FNT-DC-MJ 604 Course Name: Nutritional Epidemiology and Biostatistics	4 (3-1)	75	30	20	25

SEMESTERWISE BREAKUP

(VII&VIII MAJOR CORE)

Semester	Discipline Specific Course/ Major Core (DC-MJ)	Credits	Full marks	Marks Division		
		L, P		Theory	Practical	Continuous evaluation
VII	Course Code: FNT DC-MJ-701 Course Name: FOOD PROCESSING, PACKAGING AND LABELLING	4 (3,1)	75	30	20	25
	Course Code: FNT DC-MJ-702 Course Name: FOOD PRODUCT DEVELOPMENT AND ENTREPRENEURSHIP	4 (3,1)	75	30	20	25
	Course Code: FNT DC-MJ-703 Course Name: ADVANCED NUTRITION	4 (3,1)	75	30	20	25
	Course Code: FNT DC-MJ-704 Course Name: *(Research Methodology)	4 (3,1)	75	30	20	25
VIII	Course Code: FNT DC-MJ-801 Course Name: Molecular Biology & Bioinformatics	4 (3,1)	75	30	20	25

	Course Code: FNTDC-MJ802: Course Name: NUTRITION AND DIET COUNSELLING	4 (3,1)	75	30	20	25
	Course Code: FNT DC-MJ-803 Course Name: NUTRACEUTICALS, FUNCTIONAL FOODS AND HEALTH	4 (3,1)	75	30	20	25
	**DC-MJ-804 (4) **(Term paper/Field report/Literature review/Book review)	4 (3,1)	PREPARATION 50. VIVA-VOCE: 25			

4TH BACHELAR OF SCIENCE (HONOURS WITH RESEARCH PROGRAMME) IN FOOD & NUTRITION

SEMESTERWISE BREAKUP (MAJOR CORE)

Semester	Discipline Specific Course/ Major Core (DC-MJ)	Credits	Full marks	Marks Division		
		L, P		Theory	Practical	Continuous evaluation
VII	Course Code: FNT DC-MJ-701 Course Name: FOOD PROCESSING, PACKAGING AND LABELLING	4 (3,1)	75	30	20	25
	Course Code: FNT DC-MJ-702 Course Name: FOOD PRODUCT DEVELOPMENT AND ENTREPRENEURSHIP	4 (3,1)	75	30	20	25
	Course Code: FNT DC-MJ-703 Course Name: ADVANCED NUTRITION	4 (3,1)	75	30	20	25
	Course Code: FNT DC-MJ-704 Course Name: *(Research Methodology)	4 (3,1)	75	30	20	25
VIII	Course Code: FNT DC-MJ-801 Course Name: Molecular	4 (3,1)	75	30	20	25

	biology & Bioinformatics					
	** DRP-1 Dissertation / Research / Project (12)	12(75×3= 225 150= PREPARATION 75= VIVA VOCE				

SEMESTER WISE BREAKUP (DISCIPLINARY MINOR COURSE)

Semester	Course Code & Title of the Course	Credits	Full Marks	Marks Division		
				Th.	Pr.	Cont. Evaluation
		L,P				
I	Course Code: FNT-DC-MN-101 Course Name -Fundamentals of Food Groups	4 (3,1)	75	30	20	25
II	Course Code: FNT-DC-MN-201 Course Name-Basic Nutrition Science	4 (3,1)	75	30	20	25
III	Course Code: FNT-DC-MN-301 Course Name-Nutritional Physiology	4 (3,1)	75	30	20	25
IV	Course Code: FNT-DC-MN-401 Course Name-Fundamentals of Dietetics	4 (3,1)	75	30	20	25
V	Course Code: FNT-DC-MN-501 Course Name : Nutrition and Phases of Human Life	4 (3,1)	75	30	20	25
VI	Course Code: FNT-DC-MN-601 Course Name- Diet Therapy	4 (3,1)	75	30	20	25

VII	Course Code: FNT DC-MN-701 Course Name: FOOD PROCESSING AND PACKAGING.	4 (3,1)	75	30	20	25
VIII	Course Code: FNT DC-MN-801 Course Name: Nutraceuticals and Functional Foods	4 (3,1)	75	30	20	25

MULTIDISCIPLINARY COURSE (MDC)

SEMESTER	COURSE	CREDIT	FULL MARKS	THEORITICAL	Cont. evaluation
SEMESTER-I	Course Code: FNT MDC-101 Course Name: Food Security and Safety	3	50	40	10
SEMESTER-II	Course Code: FNT MDC-201 Course Name: Nutrition Science and Technology	3	50	40	10
SEMESTER-III	Course Code: FNT MDC-301 Course Name: Chemical and Physical Analysis of Food	3	50	40	10

- ❖ Students on exit shall be awarded Undergraduate Certificate in Food and Nutrition after securing the requisite 20+20=40 credits in Semester I and II after completion of Internship / Apprenticeship/Project/ Community Engagement.
- ❖ Students on exit shall be awarded Undergraduate Diploma in Food and Nutrition after securing the requisite 82 credits in Semester IV after completion of completion of Internship / Apprenticeship/Project/ Community Engagement.

Detail's view of (Major Core, Minor Core and MDC)

SEMESTER– I

FNT-DC-MJ-101: CONCEPT OF FOOD, NUTRITION AND HEALTH

[TOTAL CREDITS: 4 (LECTURE-3, PRACTICAL-1)]

Course Objectives:

1. To gain knowledge on nutrition and health.
2. To provide knowledge about nutritional significance, function of different types of food products.

Learning Outcome:

The students will have a basic concept on food, nutrition and health. The student will be able to understand the chemistry and importance of different food groups. They will have fundamental concept about various food commodities.

Module-I: Basic concept of Food, Nutrients, Nutrition and Health:

- Definition: Food, Nutrients, Nutritive value, Nutrition, Optimum nutrition, Malnutrition.
- Functions of food, Balanced Diet, Food selection.
- Food Groups, Food Pyramid, My plate

Module-II: Cereals, Pulses, Legumes, Vegetables, Fruits, Milk and milk Products, Egg, Fish and Meat:

- Nutritional aspects of wheat, rice, bajra (pearl millet) and jowar (sorghum).
- Types of pulses and legumes, uses, and nutritional aspects.
- Uses and nutritional importance of commonly available vegetables and their storage.
- Fresh fruits and dry fruits– concept of raw and processed product.
- **Milk and milk Products, Egg, Fish and Meat:**
 - Composition and nutrients of milk
 - Nutritive value and Concept of milk processing, storage and Pasteurization
 - Types of processed milk, milk products (curd, yogurt, paneer and cheese)
 - Uses and nutritional importance of edible fish, egg and meat, concept of processing and storage of meat and fish.

Module-III: Fats, oils and Methods of cooking:

- Types, sources, use and nutritional aspects of fats and oils.
- Storage of fat and oils, hydrogenation, rancidity and its prevention.

- **Methods of cooking:**

- Dry, moist, frying and microwave cooking.
- Effect of various methods of cooking on foods, nutrient losses in cooking.

Module-IV- Practical:

Food Preparation:

- Process involved in different methods of modern cooking. (Demonstration)
- General concepts of weights and measures, Eye estimation of raw food items.
- Preparation of food from different food groups and their significance in relation to health.

Suggested Readings:

- ❖ B Srilakshmi, Food Science,(2024) New Age International Publishers, 8th Edition,
- ❖ Lavies S (1998). Food Commodities.
- ❖ Pomeranz Y (Ed) (1991). Functional Properties of Food Components, (2nd edition), Academic Press, New York.
- ❖ Tindall HD (1983). Vegetables in the Tropics, MacMillan Press, London.
- ❖ Winton AL, Winton KB (1999). Techniques of Food Analysis. Allied Scientific Publishers.
- ❖ Nutrition and Dietetics Book. Shubhangini A Joshi.

DISCIPLINARY MINOR COURSE

SEMESTER-I

COURSE NAME: Fundamentals of Food Groups

COURSE CODE: FNT-DC-MN-101

Credit: 4 (Theory -3, Practical-1)

Course Objectives:

3. To gain knowledge on nutrition and health.
4. To provide knowledge about nutritional significance, function of different types of food products.

Learning Outcome:

The students will have a basic concept on food, nutrition and health. The student will be able to understand the chemistry and importance of different food groups. They will have fundamental concept about various food commodities.

Module-1: Basic concept of Food, Nutrients, Nutrition and Health:

- Definition: Food, Nutrients, Nutritive value, Nutrition, Optimum nutrition, Malnutrition and Undernutrition, Functions of food, Balanced Diet, Choice of food, Food Groups, Food Pyramid, My plate
- Concept of health and Guidelines for good health

Module-2: Cereals, Pulses Vegetables, Fruits, Milk and Milk Products:

- Nutritional aspects of wheat, rice.
- Types of pulses and legumes, uses, and nutritional aspects.
- Uses and nutritional importance of commonly available vegetables and their storage.
- Fresh fruits and dry fruits– concept and nutritional significance.
- Composition and nutrients of milk. Nutritive value.
- Types of processed milk, milk products (butter, curd, paneer and cheese)

Module-3: Egg, Fish Meat, Nuts and Oil seeds:

- Composition and nutritional importance of edible fish, egg and meat
- Composition and nutritional importance of nuts and oil seeds.

Module-4 (Practical):

1. Preparation of Cereals product (Fried Rice/ Chapatti).
2. Preparation of Milk and Milk products (Custard / Payasam).
3. Preparation of Pulse products (Dal soup).

Suggested Readings:

- ❖ Hughes O, Bennion M (1970). Introductory Foods, Macmillan & Co. New York.
- ❖ Lavies S (1998). Food Commodities.
- ❖ Pomeranz Y (Ed) (1991). Functional Properties of Food Components, (2nd edition), Academic Press, New York.
- ❖ Tindall HD (1983). Vegetables in the Tropics, MacMillan Press, London.
- ❖ Winton AL, Winton KB (1999). Techniques of Food Analysis. Allied Scientific Publishers.
- ❖ Nutrition and Dietetics Book. A Joshi Shubhangini, Mc Graw Hill publication, 5th edition.

SEMESTER-I
MDC COURSE

Title of the Course: Food Security and Safety

Course Code: FNT-MDC-101

Credits: 3 (Theory-2 Tutorial-1)

Course Objectives:

1. To equip students with necessary knowledge in identifying, conserving and managing world food resources to increase food security
2. To understand the idea of food safety.

Learning Outcome:

The students will be able to understand tools of food safety. Examine issues of food security in the context of complex emergencies, fast urbanization and dynamic changes in people's lifestyles

Module 1: Introduction to Food security:

- Concept of food security, factors affecting food security.
- Types of food insecurity, poverty, hunger and malnutrition. Inter-relationship between environment, climate and agricultural (arable agriculture and live stocks) and non-agricultural (marine; fresh water; forests) food production; impact on food security.

Module 2: Food Distribution:

- The food supply chain - harvesting, transportation, storage, marketing and equitable distribution.
- Concept on public distribution system (PDS) and targeted public distribution system (TPDS).
- Packed food/dry food distribution during emergency/disaster: Advantages and limitations
- Common kitchen concept for nutritional management during emergency/disaster.

Module 3: Food Safety:

- Concept of food safety, factors affecting food safety.
- Food Safety Management Tools: Basic concept, prerequisites and principles- Good Hygiene Practices (GHPs), Good Manufacturing Practices (GMPs) Hazard Analysis and Critical Control Points (HACCP), ISO standards related to food safety.
- Food Laws and regulatory authority: PFA and FSSAI, Codex Alimentarius

TUTORIAL:

1. Field Visits: Exposure to community nutrition programs. or
2. Workshops/Seminars /webinars: Focused session on food security. [Anyone] or
3. Interactive Lectures: Lectures and Presentations: Focused on critical concepts of food security and safety.

Suggested Readings:

1. Elliott, Jennifer. 2012. An Introduction to Sustainable Development. 4th Ed. Routledge, London.
2. Kerr, Julie. Introduction to energy and climate: Developing a sustainable environment. CRC Press, 2017.
3. Food Insecurity Atlas of Rural India (2001) MS Swaminathan Research Foundation and World Food Programme.
4. Food Hygiene and Sanitation by S. Roday
5. Singhal, R. S. (1997) Handbook of indices of food quality and authenticity. Cambridge Woodhead Publishing, New York.
6. Essentials of food safety and sanitation by David Ms Swane, Nancy Rue and Richard Linton.

SEMESTER-II

MAJOR CORE

FNT-DC-MJ-201: FUNDAMENTALS OF HUMAN NUTRITION **[(TOTAL CREDITS: 4 (LECTURE-3, PRACTICAL-1)]**

Course Objectives:

1. To enable students understand the link between nutrition and health.
2. Gain knowledge on RDA.
3. To provide knowledge on growth & development.

Learning Outcome:

The course deals with a basic understanding of Nutrition, Health, RDA, Growth and development, Water balance and Food consumptions. Students learn the importance of energy and nutritional requirement of human. Knowledge is also imparted on Relationship between nutrition and health.

Module-I: Concept and definition of terms:

- Nutrition, Nutritional status, Malnutrition and Health: Nutritional genomics, Scope and History of Nutrition.
- Utilization of Nutrients. Macro and micro nutrients.
- Relationship between nutrition and health. Importance of nutrition.

Module-II: Minimum Nutritional Requirement, RDA, Food consumption and Water balance:

- RDA of different age groups. Factors affecting RDA, General principles of Formulation of RDA.
- Dietary Guidelines of Reference Man and Reference Woman.
- Introduction to major food groups.
- Variations in dietary pattern, factors in dietary variations.
- **Water balance:** Distribution of water, functions, water depletion, and water intoxication.
- **Energy in Human Nutrition:**
 - Idea of Energy and its unit, Determination of Energy in food, Energy Balance, Assessment of Energy Requirements—deficiency and excess. Calorific value of Food. Measuring of total energy requirement.
 - B.M.R. and its regulation and factors affecting BMR.

Module-III: Growth & development from infancy to adulthood:

- Somatic, physical, brain and mental development, puberty, menarche, prepubertal and pubertal changes, Factors affecting growth and development.
- Importance of Nutrition for ensuring adequate development.

Module-IV-Practical:

- Preparation of homemade ORS.
- Preparation of weaning foods for infants (Soup / Khichuri) [Any one].
- Preparation of supplementary food for different age group and their nutritional significance.
- Planning and preparation of low cost diet for undernourished children.

Suggested Readings:

- ❖ Fundamentals of Human Nutrition, Geissler Catherine, Powers Hilary, Elsevier Publication.2009.
- ❖ Mudambi S.R, M.V Rajgopal Fundamentals of Foods and Nutrition(2nded)Wiley Eastern Ltd,1990.
- ❖ Swaminathan S.: Advanced text book on Foods Nutrition Vol. I, II (2nded revised and enlarged) B.app C.1985.
- ❖ Textbook of Nutrition-Ravinder Chadha & Pulkit Mathur, Orient Blackswan Pvt. Ltd. Telangana.
- ❖ Srilakshmi B.(2024).Nutrition Science. New Delhi: New Age International.
- ❖ Clinical Nutrition & Dietetics- F. P. Antia and Philip Abraham, Oxford University Press

SEMESTER-II
DISCIPLINARY MINOR COURSE

COURSE NAME: Basic Nutrition Science

COURSE CODE: FNT-DC-MN-201

Credits: 4 (Theory-3 Practical-1)

Course Objectives:

To enable students

1. Understand the relationship between nutrition and health.
2. Knowledge gain on functions and effects of deficiency of nutrients

Learning outcome:

1. Knowledge on dietary foods and its importance.
2. Learning about deficiency symptoms macro nutrients.

Module-1: Carbohydrates:

- Classification, functions, source, and utilization. Role of dietary fiber in human nutrition.

Module-2: Protein, Fats and Oils:

- Classification, Functions, sources and utilization of proteins, Protein quality indicators – PER, BV, NPU, digestibility coefficient.
- Classification of Fatty acids, functions, sources, importance of essential fatty acids, their requirements and deficiency symptoms. Differences between fat and oil.

Module-3: Vitamins and Minerals:

- Functions, sources, deficiency disorders of Vitamin A, D, E, K, B-complex and C.
- Functions, sources and deficiency symptoms of Iron, calcium, iodine.

Module-4 (Practical):

1. Qualitative test of Carbohydrate (Glucose, fructose, galactose, sucrose and starch).
2. Identification of deficiency symptoms/disorder: Rickets, Bitot's spot, Scurvy. Marasmus and Kwashiorkor, Goiter (Slide/Photograph).

Suggested Readings:

1. Essential of food & Nutrition –Vol. 1 M. Swaminathan, Bappco,Bangalore.
2. Human Nutrition and Dietetics –Davidson S. Passmore
3. Nutrition Science: B. Srilaxmi, 2023.
4. Contemporary Nutrition - Gordon M. Wardlaw, Paul Insel et, al., (2000) Mosby,Chicago.
5. Nutrition- concepts and controversies- Eleanor Whitney –Eighth Edition (2000)
6. Basic principles of Nutrition- Seema Yadav, First edition (1997)

SEMESTER-II

MDC

Title of the Course – Nutrition Science and Technology

Course Code: MDC 201

Credits: 3 (Theoretical-2, Tutorial-1)

Objectives of the Course:

- To provide an in-depth understanding of the principles and practices of nutritional science and technology.
- To explore the biochemical, physiological and molecular mechanisms underlying human nutrition.
- To analyze the impact of nutrition on public health and disease prevention.
- To integrate advanced technologies in nutrition research and practice.
- To develop skills in nutritional assessment, intervention and policy-making.

Learning Outcome: The students will be able to understand the various tools for nutritional assessment, nutritional programmes, concept of fortified food, genetically modified food and food preservation methods.

Module 1: Public Health Nutrition and Programs: Basic concept about Applied Nutrition Programme (ANP), ICDS, Mid-day Meal Programme.

Module 2: Nutritional Assessment and Diagnostics

- Techniques and Tools for Nutritional Assessment: Idea on basic techniques and tools for nutritional assessment: anthropometric measurements, Biochemical assessment, Clinical Signs and Diet Survey.

Module 3: Food Science and Technology:

- Functional Foods and Nutraceuticals: Definition of functional foods, basic concept, classification and functions of Nutraceuticals. Basic concept of fortified food and GM food.
- Food Processing and Preservation Techniques: Preservation, importance, objectives and principles of preservation. Basic idea on preservation process like freezing, drying, pasteurization and sterilization

Tutorial:

1. Interactive Lectures:
Lectures and Presentations: Focused on critical concepts in nutritional biochemistry, public health nutrition and food technology. or
2. Field Visits: Exposure to food processing units. or
3. Online Modules: Supplementary digital resources for self paced learning and review.

Suggested Readings:

1. Jelliffe DB and Jelliffe EFP (1989). Community Nutritional Assessment, Oxford University Press WHO. The growth chart: A tool for use in infant and child health care. Geneva: WHO; 1986.
2. Swaminathan M (2009). Essentials of Foods and Nutrition, Vols -I and II. Ganesh and Co. Madras.
3. Manay S. and Shadaksharaswamy M (2002). Foods–Facts and Principles. Wiley Eastern Ltd.
4. Potter H (1995). Food Science, 5th Edition. CBS Publishers & Distributors.
5. Gibson, G., Williams, C. eds (2000): Functional Foods. Woodhead Publishing Ltd. U.K. Trease and Evans, Pharmacognosy.
6. Wildman, R.E.C. ed. (2000) Handbook of Nutraceuticals and Functional Foods, CRC Press, Boca Raton.

SEMESTER-III

MAJOR CORE

FNT-DC-MJ-301: NUTRITIONAL PHYSIOLOGY-I **[TOTAL CREDITS: 4 (LECTURE-3, PRACTICAL-1)]**

Course Objectives:

1. To enable students about the role of different organ and system of human body.
2. To provide knowledge about digestion and absorption of Carbohydrate, Protein and Fat.

Learning Outcome:

Student will be able to understand the current state of knowledge about the functional organization Digestive system, Circulatory and Cardiovascular system, and Respiratory system of the human body.

Module-I: Overview:

- Functional organization and composition of human body.
- The cell physiology. Structure, functions and organization of mammalian cell.

Module -II: Circulatory, Cardiovascular system and Respiratory system:

- Blood its composition and functions of blood components. Blood groups, Mechanism of blood coagulation.
- Functional anatomy and functions of heart.
- Cardiac cycle, cardiac output, blood pressure and its regulation.
- Functional anatomy of respiratory tract.
- Structure of Lungs and gaseous exchange (oxygen and carbon dioxide transport).

Module -III: Digestive system:

- Structure and functions of Digestive system.
- Process of digestion and absorption of food.
- Composition, function of saliva, gastric, pancreatic and intestinal juices.

Module –IV: Practical:

- Determination of pulse rate.
- Determination of blood pressure by Sphygmomanometer (Auscultatory method).
- Determination of Bleeding Time (BT) and Clotting Time (CT).
- Detection of Blood group (Slide method).
- Measurement of Haemoglobin level (Sahli's method).

Suggested Readings:

- ❖ Chatterjee CC (1988). Text Book of Physiology – Vol I & II.
- ❖ Medical Physiology for undergraduate students by Khorana Indu and Khorana Arushi. Second Edition. Elsevier Publication. 2015.
- ❖ Guyton AC, Hall JE (1966). Text book of Medical Physiology. 9th Ed. Prism Books (Pvt.) Ltd. Bangalore.
- ❖ Guyton AC (1985). Function of the Human Body, 4th Edition, W.B. Sanders Company, Philadelphia.
- ❖ Hadley ME (2000). Endocrinology. 5th ed. Pearson Education.
- ❖ Hoar WS (1984). General and comparative Physiology. 3rd ed. Prentice-Hall of India.
- ❖ Wilson (1989). Anatomy and Physiology in Health and Illness. Edinburgh, Churchill Livingstone.

FNT-DC-MJ-302: BASIC FOOD SCIENCE
[TOTAL CREDITS: 4 (LECTURE-3, PRACTICAL-1)]

Course Objectives:

To enable students:

1. About different food groups and their role in diet.
2. Concept on nutritive values and properties of Carbohydrates, Proteins and Lipids.

Learning Outcomes:

The course deals with a complete understanding of dietary sources, daily requirement, physiological role and deficiency disorders of various macronutrients and micronutrients.

Module-I: Basic Concept on Food:

- Nutrients, Nutrition.
- Classification of Food, Classification of Nutrients.

Module -II: Carbohydrates and Dietary Fibre:

- Definition, Classification. Structure and properties. Monosaccharides - glucose, fructose, galactose. Disaccharides - Maltose, lactose, sucrose Polysaccharides - Dextrin, starch, glycogen, resistance starch.
- Dietary Sources, daily requirements, functions of carbohydrate.
- Dietary Fibre: Classification, sources, composition, properties & nutritional significance.

Module-III: Proteins & Lipids:

- Definition, Classification, Structure & properties of amino acids.
- Classification, functions, structure of protein.
- Dietary Sources, daily requirements, functions. Effect of too high - too low proteins on health.
- Assessment of Protein quality (BV, PER, NPU). Factors affecting protein bio-availability including anti-nutritional factors.
- Definition, Classification, Properties and function of lipid.
- Fatty acids - composition, properties.
- Dietary Sources, daily requirements, functions.
- Role & nutritional significances of PUFA, MUFA, SFA, OMEGA-3 fatty acid.

Module-IV-Practical:

- Identification of Mono, Di and polysaccharides (Qualitative tests)
- Identification of Proteins. (Qualitative tests)
- Qualitative tests for lipid (Emulsification test, Saponification test).

Suggested Readings:

- ❖ B. Srilakshmi : Nutrition Science, New Age International Publishers.
- ❖ Sunetra Roday : Food Science & Nutrition, Oxford University Press.
- ❖ Mann and Truswell: Essentials of Human Nutrition, Oxford University Press.

DISCIPLINARY MINOR COURSE
SEMESTER-III

COURSE NAME: Nutritional Physiology

COURSE CODE: FNT-DC-MN-301

[Total Credits: 4 (Lecture-3, Practical-1)]

Course Objectives:

To enable students

1. Acquire knowledge on different physiological systems and organs.
2. Understand the process of digestion, urinary system and process of gaseous exchange.

Learning outcome:

Student will be able to understand the current state of knowledge about the functional organization (Digestive system, Circulatory and Cardiovascular system, and Respiratory system of the human body.

Module-1: Overview of physiological organ and system:

- Anatomical position and physiological functions of, Stomach, Gallbladder, Pancreas, Liver, Small intestine and Large intestine, Heart, Kidney.
- Basic concept and function of different physiological system of human body

Module-2: Digestive system and excretory system:

- Structure and functions of GI tract.
- Process of digestion and absorption of food (Carbohydrate, Protein and Fat)
- General arrangement of urinary system, Physiology of urine formation.

Module-3: Circulatory and respiratory system:

- Blood - Composition and functions of blood components. Blood groups,
- Blood pressure and its regulation, Concept on cardiac cycle, cardiac output.
- Structure of Lungs and gaseous exchange (oxygen and carbon dioxide transport).

Module-4 (Practical):

1. Identifications of different Organ (Stomach, Gallbladder, Pancreas, Liver Small intestine, Large intestine, Heart, Kidney)
2. Detection of blood group (Slide method).
3. Determination of pulse rate.
4. Determination of blood pressure.

Suggested Readings:

- ❖ Chatterjee CC (1988). Text Book of Physiology – Vol I & II.
- ❖ Medical Physiology for undergraduate students by Khorana Indu and Khorana Arushi. Second Edition. Elsevier Publication. 2015.
- ❖ Guyton AC, Hall JE (1966). Text book of Medical Physiology. 9th Ed. Prism Books (Pvt.) Ltd. Bangalore.
- ❖ Guyton AC (1985). Function of the Human Body, 4th Edition, W.B. Sanders Company, Philadelphia.
- ❖ Hadley ME (2000). Endocrinology. 5th ed. Pearson Education.

SEMESTER-III

MDC

Title of the Course -Chemical and Physical Analysis of Food

Course Code: MDC 301

Credits: 3 (Theoritical-2, Tutorial-1)

Objectives of the Course:

- To provide an advanced understanding of the chemical and physical properties of food.
- To explore analytical techniques used in the assessment of food composition, quality and safety.
- To develop practical skills in the application of chemical and physical analysis methods.
- To integrate knowledge of food chemistry and physics in solving real-world food industry problems.

Learning Outcome: Learning Outcome: The course deals with a understanding of chemical and physical properties of food, water activity and its role in food's shelf life. Students learn about various analytical techniques used in food science.

Module 1: Food Chemistry

- Chemical Composition of Food: Carbohydrates, Proteins, Lipids and Water.
- Chemical Reactions in Food: Maillard Reaction, Lipid Oxidation and Enzymatic Browning.

Module2: Physical Properties of Food- Concept on food rheology and food texture.

- Water Activity and Its Impact on Food Stability- Definition of water activity, role of water activity in food's shelf life

Module 3: Analytical Techniques in Food Science:

- Chromatographic techniques: Concept, Principal and Application- Thin layer chromatography (TLC), Gas liquid chromatography (GLC), High performance liquid chromatography (HPLC).
- Spectroscopic methods: Concept, Principle and applications: UV-Vis, NMR, IR, MS

Module 4: Tutorial:

- Interactive Lectures: Focused on advanced concepts in Food chemistry and Physical properties.
- Online Modules: Supplementary digital resources for self-paced learning and review.
- Workshops, Seminars and webinars: Focused session technological advances in food analysis.

Suggested Readings:

1. A first course in food analysis By A. Y. Sathe.
2. Hand book of analysis and quality control for fruit & vegetable products By S. Ranganathan.
3. Handling and storage of food grains by S. V. Pingale.
4. Food science chemistry & experimental food By Dr. M. Swaminathan.
5. Food chemistry by William Hogland Meyer.
6. Food adulteration By Thankamma Jacob.

SEMESTER-IV

MAJOR CORE

FNT-DC-MJ-401: BASIC BIOCHEMISTRY

[TOTAL CREDITS: 4 (LECTURE-3, PRACTICAL-1)]

Course Objectives:

To enable students

1. Acquire knowledge on chemical properties of carbohydrate, protein and lipid.
2. Learn about metabolism of carbohydrate.

Learning Outcome:

Student will be able to have coherent and systematic knowledge on carbohydrates, their types, metabolism and role of various carbohydrates in relation to human health. They will be able to understand the lipids and fatty acids, protein, vitamin, their clinical importance.

Module-I: Carbohydrate:

- Properties and dietary importance of starch, sucrose, lactose, glucose and fructose.
- Metabolism: Glycolysis, Tricarboxylic acid (TCA) cycle,

Module - II: Protein & Lipid:

- Classes, chemical properties and functions (Hydration, Denaturation / Coagulation, Enzymatic reactions, Buffering, Browning),
- Concept and definition: Complete and incomplete proteins, Biological value, Essential and non-essential amino acids.
- Classes of lipids (Simple lipids, compound lipids and derived lipids), Properties and functions of fats, oils and fatty acids (MUFA, PUFA, SFA, TFA), Clinical importance of essential fatty acids (EFA)
- Chemical reactions and functional properties of food lipids (Fractionation, hydrogenation, hydrolysis and hydrolytic rancidity, esterification, lipo-oxidation and polymerization).
- Lipoproteins: Types and clinical significance.

Module -III: Vitamins and Minerals:

- Physiological role, bio-availability and requirements, disorders related to the deficiency and excess of vitamins.
- **Minerals:**
- Macro minerals (Calcium, Magnesium, Phosphorus), Micro minerals (Iron, Iodine, Copper, Zinc), Physiological role, bio-availability and requirements, sources, disorders related to the deficiency and excess of minerals.

Module –IV-Practical:

- Preparation of buffer solution.
- Quantitative estimation of protein (Biuret method/Lowry method)
- Quantitative estimation of Carbohydrate (Anthrone method).

Suggested Readings:

- ❖ Satyanarayana U, Chakrapani U, BIOCHEMISTRY. Elsevier Publication.
- ❖ Handler, P.: Smith E.I.; Stelten, D. W. : Principles of Biochemistry, Me. Grew Hill Book Co.
- ❖ Lehninger, A.L.; Nelson, D. L. and Cox, M. M. Principles of Biochemistry. CBS Publishers and Distributors.
- ❖ Devlin, T. M. : Text Book of Biochemistry with Clinical Corelations. John Wiley and Sons.
- ❖ Strayer. L. Biochemistry. Freeman W.H. and Co.
- ❖ Assaini. J. Kaur. Text Book of Biochemistry. C.B.S. Publication.

FNT-DC-MJ-402: BASIC DIETETICS

[TOTAL CREDITS: 4 (LECTURE-3, PRACTICAL-1)]

Course Objectives:

1. Enable students to gain knowledge on different types of routine hospital diets.
2. To provide basic idea for weight management and diet for gastrointestinal tract diseases.
3. To give idea about the dietary management of infections and surgery.

Learning Outcome: Students will have a basic idea about diet therapy, routine hospital diet and the role of a dietitian. Students will be able to comprehend the diet therapy of gastrointestinal diseases, in surgical conditions.

Module-I: Basic Concepts of Diet Therapy, Routine Hospital Diets and Feeding methods:

- Therapeutic adaptation of normal diets. Principles and classification of therapeutic diets.
- Regular diet, soft diet, fluid diet. Enteral feeding – types of tube feeding, side effects/complications. Parenteral Feeding - Central and peripheral.

Module- II: Energy Modifications and Nutritional Care for Weight Management:

- Overweight and obese- Etiological factors, physiological complications and its management – Low Energy diets, behavioral modification.
- Underweight – Etiology, complications and its management.

Module-III: Diseases of Gastrointestinal Tract and Infections and Surgery:

- Etiologic factors, symptoms and dietary management for Esophagitis, Diarrhoea and Constipation.
- Etiologic factors, symptoms and dietary management- Gastritis, Peptic Ulcer and Ulcerative colitis.
- **Diet in Infections and Surgery:**
 - Fever – etiology, types, symptoms and dietary treatment-
 - Pre-Operative and Post Operative conditions.

Module- IV-Practical:

- Planning and preparation of normal diet.
- Planning and preparation of fluid diet, soft/semi solid diet.
- Planning and preparation of high protein diet, high fibre diet.

Suggested Readings:

- ❖ Lee RD & Neiman DC. (2009). Nutritional Assessment. 5th Edition. Brown & Benchmark.
- ❖ Mahan, L. K. and Escott Stump. S. (2016) Krause's Food & Nutrition Therapy 14th ed. Saunders-Elsevier ·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.
- ❖ Srilakshmi B, Dietetics 9th Edition, 2024

FNT-DC-MJ-403: FOOD PRESERVATION TECHNIQUES
[TOTAL CREDITS: 4 (LECTURE-3, PRACTICAL-1)]

Course Objectives:

1. To provide idea about preservation of food.
2. To give knowledge about storage of food.

Learning Outcomes: Students gather elaborate knowledge on the of food preservation processes.

Module- I: Food Storage and Preservation

- Preservation- Definition, objectives.
- Storage; principles, types, storage of animal and plant products, effect of cold storage.

Module- II: Food Preservation by High Temperature, Low Temperature and Irradiation:

- Processing and preservation by heat: Blanching, pasteurization and UHT processing, canning, sterilization.
- Processing and preservation by low Temperature: refrigeration, freezing and dehydrofreezing.
- Principles of using electromagnetic radiation in food processing, ionizing radiations and non ionizing radiations, advantages and disadvantages.

Module- III: Food Preservation by Drying and Non Thermal Method:

- Processing and preservation by drying, concentration and evaporation: Drying – water activity, microbial spoilage due to moisture. Dehydration of fruits, vegetables, animal products, advantages and disadvantages of different methods, sun drying, tray or tunnel drying, spray drying. Difference between Drying and Dehydration.
- **Food Preservation by Non Thermal Method:**
 - Processing and preservation by non-thermal methods: High pressure, pulsed electric field, hurdle technology. Preservation by chemical preservatives, Permissible limits for chemical preservatives.

Module- IV-Practical:

- Preparation of pickles, tomato sauce, squashes, jam and jelly.
- Visit to food industry/ dairy industry and cold storage.

Suggested Readings:

- ❖ B. Srilakshmi, Food science, New Age Publishers, 2024
- ❖ Meyer, Food Chemistry, New Age, 2004.
- ❖ Bawa. A.S, O.P Chauhanetal. Food Science. New India Publishing agency, 2013.
- ❖ Frazier WC and Westhoff DC, Food Microbiology, TMH Publication, New Delhi, 2004.
- ❖ Raina U, Kashyap S, Narula V, Thomas S, Suvira, Vir S, Chopra S (2010). Basic Food Preparation:A Complete Manual, Fourth Edition. Orient Black Swan Ltd.
- ❖ Manay S. and Shadaksharaswamy M (2002). Foods–Facts and Principles. Wiley Eastern Ltd.

SEMESTER-IV
DISCIPLINARY MINOR COURSE

COURSE NAME: Fundamentals of Dietetics

COURSE CODE: FNT-DC-MN-401

[Total Credits: 4 (Lecture-3, Practical-1)]

Course Objectives:

4. Enable students to gain knowledge on different types of therapeutic diets.
5. To provide basic idea on various feeding methods.
6. To give an idea about the dietary management of underweight, obesity, constipation etc.

Learning outcome: Students will have a basic idea about diet therapy, routine hospital diet and the role of a dietitian. Students will be able to comprehend the diet therapy of gastrointestinal diseases.

Module-1: Basic Concepts of Diet Therapy:

- Definition, Objectives, Principles and classification of therapeutic diets.
- Role of dietitian.

Module -2: Routine Hospital Diets and Feeding methods:

- Concept on menu and diet.
- Routine Hospital Diets- Regular diet, soft diet, fluid diet. Enteral and parenteral feeding – types of tube feeding.

Module- 3: Energy Modifications and Nutritional Care for Weight Management and Diet of Gastrointestinal Tract diseases:

- Overweight and obese- Aetiological factors, assessment methods, physiological complications and its management – Low Energy diets, behavioral modification.
- Underweight – Aetiology, assessment methods, complications and its management.
- Etiologic factors, symptoms and dietary management for Esophagitis, Diarrhoea and Constipation.
- Etiologic factors, symptoms and dietary management- Gastritis, Peptic Ulcer and Ulcerative colitis.

Module-4 (Practical):

1. Diet preparation- soft diet, fluid diet.
2. Dietary management of obesity and peptic ulcer.

Suggested Readings:

- ❖ Lee RD & Neiman DC. (2009). Nutritional Assessment. 5th Edition. Brown & Benchmark.
- ❖ Mahan, L. K. and Escott Stump. S. (2016) Krause's Food & Nutrition Therapy 14th ed. Saunders-Elsevier ·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.
- ❖ Srilakshmi B, Dietetics 9th Edition, 2024

SEMESTER-V

MAJOR CORE

Course Code-FNT-DC-MJ-501

Course Name- Nutrition in Human Life Stages

Course Objectives:

1. To gain knowledge about the nutritional requirement during different age groups and physical condition.
2. To know about RDA, meal planning and the effect of age on food choices.

Learning Outcome:

This course deals with actual requirement of an individual throughout the normal life span. Students obtain knowledge about the importance of breast feeding and weaning in infancy, childhood, adolescence and adulthood. Understanding the importance of additional nutritional demand during pregnancy and lactation and dietary management of Athletes and old aged people is essential for formulating an adequate diet for them.

Module-1: Nutrition for infant and children:

- Breast feeding, Formula feeding, Weaning, Supplementary foods, Nutritional management of Preterm baby.
- Diet in early childhood, elementary school age, high school age.

Module-2: Nutrition for adolescents and athletes:

- Nutritional requirement and dietary management.
- Nutritional problems and eating disorder.
- Nutritional requirements and dietary management for sportsman and athletes, Meal planning for athletes, Carbohydrate loading.

Module-3: Nutrition during pregnancy, lactation and geriatric nutrition:

- Nutritional demands of Pregnancy, Food selection during Pregnancy, Complications of pregnancy and dietary management, Diet during Lactation.
- Planning of meals for older people, Nutrition of aged persons, Physiological complications in geriatric group and dietary modifications required, Oxidative stress and aging and role of antioxidative nutrients for preventing aging.

Module-4: PRACTICAL:

- Growth chart: Plotting and Interpretation using primary or secondary data in accordance with both ICMR and WHO Chart.
- ICDS centre visit and report preparation.

Suggested Readings:

- ❖ Hoar WS (1984). General and comparative Physiology. 3rd ed. Prentice-Hall of India.
- ❖ Indian Council of Medical Research (2003). Nutrient Requirements and Recommended-Dietary Allowance for Indians. New Delhi.
- ❖ Sherwood L (2004). Human Physiology: From cells to systems. 5th ed. Thomson Brooks Cole.
- ❖ Swaminathan M (2009). Essentials of Foods and Nutrition, Vols -I and II. Ganesh and Co. Madras.
- ❖ Walker WA and Watkins JB (Ed.) (1985). Nutrition in Pediatrics, Boston, Little Brown & Co.
- ❖ WHO (1979). A growth chart for international use in Maternal and Children Health Care. Geneva.
- ❖ Wilson (1989). Anatomy and Physiology in Health and Illness. Edinburgh, Churchill Livingstone.

Course Code-FNT-DC-MJ-502

Course Name- Nutritional Physiology- II

Course Objectives:

1. To gain knowledge about various systems of human body.
2. To know about the role of nervous system, endocrine system, reproductive system and excretory system.

Learning Outcome:

Student will be able to understand the current state of knowledge about the functional organization (Excretory system, Reproductive system, Nervous system and Endocrine system) of the human body. They will be able to develop insight of normal functioning of all the organ systems of the body and their interactions.

Module-1: Nervous System and Endocrine system:

- Concept on sympathetic, parasympathetic nervous system and vagus nerve.
- Brief anatomy and functions of cerebrum, cerebellum, hypothalamus and neuron.
- Concept on synapse and synaptic transmission.
- Location, anatomy, functional morphology and hormones of pituitary, thyroid and adrenal gland.
- Structure and functions of pancreas.

Module-2: Reproductive system:

- Structure and functions of gonads, concept on menstrual cycle.
- Brief idea of pregnancy, parturition, lactation and menopause.
- Brief concept on spermatogenesis and Oogenesis process.

Module-3: Excretory system:

- Structure and function of skin.
- Regulation of temperature of the body.
- Structure and functions of kidney in special reference to nephron.
- Physiology of urine formation.

Module-4: Practical:

- Identification of histological slides / photography (Liver, Pancreas, Kidney, Testis, Thyroid gland, Pituitary, Adrenal and Ovary).
- Determination of ESR (Westergreen method)
- Detection of hCG in urine sample. (Strip method)
- Differential count of blood cell (Leishman stain/ others)

Suggested Readings:

- ❖ Chatterjee CC (1988). Text Book of Physiology – Vol I & II.
- ❖ Chaudhuri SK (2000). Concise Medical Physiology. New Central Book Agency (P)Ltd.
- ❖ Ganong W.F.(2003)-Review of Medical Physiology. 21st ed. McGraw Hill.
- ❖ Guyton AC, Hall JE (2000). Text book of Medical Physiology. 9th Ed. Prism Books(Pvt.) Ltd. Bangalore.
- ❖ Guyton AC (1985). Function of the Human Body, 4th Edition, W.B. Sanders Company, Philadelphia.
- ❖ Hadley ME (2000). Endocrinology. 5th ed. Pearson Education.
- ❖ Hoar WS (1984). General and comparative Physiology. 3rd ed. Prentice-Hall of India.
- ❖ Jain A. K (2014) Human Physiology for BDS(5th Edition), Publisher: Avichal Publishing Company; ISBN: 97881773943]

Course Code-FNT-DC-MJ-503

Course Name- Community Nutrition

Course Objectives:

1. To provide knowledge about community and health education.
2. To know about various nutrition intervention programme.

Learning Outcome:

On completion of the course, students are expected to be able to understand the concept and purpose of nutritional status assessment in community setting. They will be able to explain nutritional concerns among vulnerable sections of the community and strategies to combat them. They will gain knowledge with regard to standard methods and techniques for assessing nutritional status. Students' will be familiar with the use of indices and indicators for screening and consequent identification of malnutrition in the community.

Module-1: Community, Communication in Nutrition and Health Education:

- Community and its types – Rural and Urban
- Characteristics of Community and population
- Demography: Concept, Factors affecting demography, Demographic cycle, Indian demographic history
- Factors affecting health of the Community (Social, economical, political).
- Importance and relevance of Information, Education and communication(IEC) in Nutrition and Public Health.

Module-2: Assessment of Nutritional Status and Surveillance:

- Nutrition Monitoring and Surveillance: Objectives, Components, Process and Uses.
- Direct Nutritional status assessment of human groups - Anthropometric, Biochemical, Biophysical, Clinical and Diet survey methods.
- Nutritional anthropometry: Need and importance, standard for reference techniques of measuring height, weight, head, chest and arm circumference, interpretation of these measurements. Use of growth chart.
- Indirect assessment: Secondary sources of community health data.
- Clinical Signs: Identifying signs of PEM, vitamin A deficiency and iodine deficiency, Interpretation of descriptive list of clinical signs.

Module-3: National Nutritional Intervention Programmes and Role of Agencies:

- Objective, Target group, Scheme details - Integrated Child Development Services (ICDS), Mid-Day Meal Programme (MDMP), Vit A prophylaxis programme, Anemia prophylaxis programme, Iodine deficiency disorders control programme.
- Concept on public distribution system.
- Role of international and national organizations and agencies (WHO, F A O , UNICEF, CARE, CFTRI, ICMR, ICAR).

Module-4: Practical:

- Nutritional Anthropometric measurement:
- Anthropometric measurement of Weight for age, height for age, weight for height and its comparison with reference value. Upper arm,.
- Determination of BMI, waist - hip ratio and comments on results.
- Measurements of fat using skin fold thickness.
- Clinical assessment and sign of nutrient deficiency disorders: Protein energy malnutrition (PEM), Anaemia, Rickets, Goiter, Vitamin A, Vitamin C and Vitamin B complex (Slide/Photography).

Suggested Readings:

- ❖ Park K (2009). Park's Textbook of Preventive and Social Medicine, 20th Edition, M/s BanarasidasBhanot, Jabalpur.
- ❖ Gordis L (1996). Epidemiology, Saunders, Pennsylvania.
- ❖ Norell SE (1998): Workbook of Epidemiology. Oxford: University Press, New York.
- ❖ Owen AY and Frankle RT (1986). Nutrition in the Community, The Art of Delivering Services, 2nd Edition, Times Mirror/Mosby.
- ❖ Roday, S. (1999) Food Hygiene and Sanitation. 1st Edition, Tata McGraw Hill, New Delhi.
- ❖ Saha A, Shattock F, Mustafa T. Epidemiology in Primary Health Care. The McGraw-Hill Companies.

Course Code-FNT-DC-MJ-504

Course Name- Food Microbiology

Course Objectives:

1. To provide knowledge about microorganism structure and their culture.
2. To know about food borne diseases.

Learning Outcome:

Students will have a basic idea about microorganisms, their nature and the culture techniques of microbes. Student will be able to understand the nature of microorganisms involved in food spoilage, food infections and intoxications. They will also have knowledge on the beneficial role of microbes.

Module-1: Microorganism in food fermentation, food contamination and control of microorganisms:

- Microorganisms involved in food fermentation and their role.
- Primary sources of food contamination
- Physical and chemical methods used in sterilization and disinfection.

Module-2: Nutrient media and Microbial culture, ultra-structure of microbial cell:

- Microbial nutrition-Types of culture media, Methods of pure culture and sub culture. Composition and principles of: Nutrient Agar, MacConkey Agar, Triple-Sugar-Iron Agar.
- Structure and function of Bacterial cell wall, Capsule, Peptidoglycan, Endospore, Flagella, Fimbriae, Pili and Plasmid.
- Bacterial growth curve, Extrinsic and intrinsic factors affecting growth.

Module-3: Food infections and Food-borne diseases:

- Agents, symptoms, mode of transmission, mode of action, prevention and management: Staphylococcal intoxication, Botulism, Salmonellosis, Shigellosis.

Module-4: Practical:

- Preparation of liquid (broth) and solid media.
- Culture techniques: Spread plate, Pour plate and Streak plate.
- Staining-Simple stain, Differential stain (Gram stain).
- Microbiological examination of milk (Methylene blue reduction test).
- Pictorial identification of bacterial capsule, endospore, flagella, fimbriae, pili.

Suggested Readings:

- ❖ Frazier, W.C. (1988) Food Microbiology, Mc Graw Hill Inc. 4th Edition
- ❖ Prescott, Harley, and Klein's Microbiology, 8th edition, (2011), Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, McGraw Hill International. ISBN- 13:978 0071313674.
- ❖ Bailey and Scott's Diagnostic Microbiology, 12th edition (2007), Betty A. Forbes, Daniel F. Sahm and Alice S. Weissfeld; Mosby Elsevier Publishers, ISBN-13: 978-0808923640.
- ❖ Microbiology, 6th edition (1993), Pelczar, Chan and Krieg; McGraw Hill International, ISBN-13: 978-0070492585.
- ❖ Brock Biology of Microorganisms, 13th edition (2010), Michael T. Madigan, John M. Martinko, David Stahl and David P. Clark, Pearsons, Benjamin Cummings, ISBN-13: 978- 0321649638..
- ❖ Yasmine Motarjemi and Martin Adams (2006), Emerging Food borne pathogen- Wood Head Publishing England.

SEMESTER-V

DISCIPLINARY MINOR COURSE

Course Code-FNT-DC-MN-501

Course Name- Nutrition and Phases of Human Life

Course Objectives:

3. To gain knowledge about the nutritional requirement during different age groups and physical condition.
4. To know about RDA, meal planning and the effect of age on food choices,

Course Outcome:

This course deals with actual requirement of an individual throughout the normal life span. Students obtain knowledge about the importance of breast feeding and weaning in infancy, childhood, adolescence and adulthood. Understanding the importance of additional nutritional demand during pregnancy and lactation and dietary management of Athletes and old aged people is essential for formulating an adequate diet for them.

Module-1: Nutrition for infant, children

- Breast feeding, Formula feeding, Weaning, Supplementary foods, Nutritional management of Preterm baby.
- Diet in early childhood, elementary school age, high school age.

Module-2: Nutrition for adolescents and athletes:

- Nutritional problems and eating disorder.
- Nutritional requirements and dietary management for sportsman and athletes, Meal planning for athletes, Carbohydrate loading.
- Nutritional requirement and dietary management.

Module-3: Nutrition during pregnancy, lactation and geriatric nutrition:

- Nutritional demands of Pregnancy, Food selection during Pregnancy, Complications of pregnancy and dietary management, Diet during Lactation.
- Planning of meals for older people, Nutrition of aged persons, Physiological complications in geriatric group and dietary modifications required, role of antioxidative nutrients in geriatric health.

Module-4: PRACTICAL:

1. Growth chart: Plotting and Interpretation using primary or secondary data in accordance with both ICMR and WHO chart.
2. Clinical assessment and sign of nutrient deficiency disorders: Protein energy malnutrition (PEM), Anaemia, Rickets, Goiter, Vitamin A, Vitamin C and Vitamin B complex (Slide/Photography).

Suggested Readings:

- ❖ Hoar WS (1984). General and comparative Physiology. 3rd ed. Prentice-Hall of India.
- ❖ Indian Council of Medical Research (2003). Nutrient Requirements and Recommended-Dietary Allowance for Indians. New Delhi.
- ❖ Sherwood L (2004). Human Physiology: From cells to systems. 5th ed. Thomson Brooks Cole.
- ❖ Swaminathan M (2009). Essentials of Foods and Nutrition, Vols -1 and II. Ganesh and Co. Madras.
- ❖ Walker WA and Watkins JB (Ed.) (1985). Nutrition in Pediatrics, Boston, Little Brown & Co.
- ❖ WHO (1979). A growth chart for international use in Maternal and Children Health Care. Geneva.
- ❖ Wilson (1989). Anatomy and Physiology in Health and Illness. Edinburgh, Churchill Livingstone.

SEMESTER-VI

Major Core

Course Code: FNT-DC-MJ 601

Course Name: Pathophysiology and Therapeutic Diet

Course Objectives:

1. To give knowledge about pathophysiology of various diseases.
2. To know about dietary management of diabetes, cardiovascular diseases and renal diseases.

Learning Outcome:

Students will be able to comprehend the pathophysiology and diet therapy of various types of diabetes, cardiovascular diseases and renal diseases, Students will be able to correlate physiology with these disorders, their pathogenesis and dietary management.

Module-I: Pathophysiology, clinical symptoms, risk factors, diagnostic tests and dietary management of Diabetes:

- Types of Diabetes (Type 1, Type 2, Gestational), complications.
- Diagnosis (Oral glucose tolerance test, Urinary sugar, Blood glucose test, Glycosylated hemoglobin test).
- Diet in Diabetes and management.

Module-II: Pathophysiology, clinical symptoms, diagnostic tests and dietary management of cardiovascular diseases:

- Brief review of lipoproteins (TC, TG, LDL, HDL, VLDL)
- Hypertension
- Atherosclerosis—etiology and risk factor.
- Dietary care: ischemic heart disease and hyperlipidemia.

Module-III: Pathophysiology, risk factors, clinical features, diagnosis and dietary management of Renal diseases:

- Renal diseases (Nephritis, Glomerulonephritis, Uremia, Kidney failure, Nephrosis, Nephrolithiasis).

Module-IV: Practical: Planning and preparation of Diet chart and menu for the following diseases (Case specific):

- Hypertension
- Diabetes
- Atherosclerosis
- Renal Disease

Suggested Readings:

- ❖ Anderson L, Dibble MV, Tukki PR, Mitchall HS, and Rynbergin HJ. Nutrition in Health and Disease. 17th edition, JB Lipincott& Co. Philadelphia.
- ❖ Anita FP. Clinical Dietetics and Nutrition. Second Edition, Oxford University Press, Delhi.
- ❖ Davis J and Sherer K (1994). Applied Nutrition and Diet Therapy for Nurses, 2nd Edition, WB Saunders Co.
- ❖ Escott-Stump S (1998). Nutrition and Diagnosis Related Care, 4th Edition, Williams andWilkinson
- ❖ Garrow JS, James WPT and Ralph A (2000). Human Nutrition and Diabetics, 10th Edition, Churchill Livingstone.
- ❖ Gibney MJ, Elia M, Ljungqvist&Dowsett J. (2005) Clinical Nutrition. The Nutrition Society Textbook Series. Blackwell Publishing Company
- ❖ Gibson SR. (2005). Principles of Nutritional Assessment. 2nd Edition. Oxford University press · Joshi YK. Basics of Clinical Nutrition. 2nd Edition. Jaypee Brothers Medical Publishers.
- ❖ Lee RD & Neiman DC. (2009). Nutritional Assessment. 5th Edition. Brown & Benchmark.
- ❖ Mahan, L. K. and Escott Stump. S. (2016) Krause's Food & Nutrition Therapy 14th ed. Saunders-Elsevier · 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.
- ❖ Williams, S.R. (2001) Basic Nutrition and Diet Therapy. 11th ed. Times Mirror Mosby College Publishing
- ❖ World Cancer Research Fund & American Institute for Cancer Research (2007) Food, Nutrition, Physical Activity and the Prevention of Cancer- A Global Perspective. Washington E.D. WCRF.

Course Code- FNT-DC-MJ 602

Course Name- FOOD TOXICOLOGY AND IMMUNOLOGY

Course Objectives:

1. To give knowledge about food toxicity.
2. To know about immunology.

Learning Outcome:

This course deals with fundamentals of immunity and various types of immunity. It helps student to understand both humoral immunity, cell mediated immunity and their interaction. Toxicology deals with various types of toxic agents, their mechanism of action, resultant toxicities and their effect on environment as well as on human health. This course also ensures understanding the importance of vaccination and immunization schedule.

Module-1: Introduction to Toxicology, Food toxicity, Toxic agents:

- Classification of toxic substances
- Neuro lathyrism, Aflatoxins, Ergot, Epidemic dropsy
- Endemic ascites, Fusarium toxins
- Metals, Pesticides and Bacterial toxins.

Module-2: Cells and organs of the immune system and antigen and antibodies:

- Leucocytes, APC, Macrophage-cell and B-cell
- Mast cell, Dendritic cell and APC
- NK cells, Structure and Function of MHC.
- Definition and properties of antigenic determinants on immunoglobulin (Isotype, allotype & idiotypic)
- Structure and classes of antibodies, Monoclonal and Polyclonal antibodies.
- Principle and application of ELISA.

Module-3: Immune response, Vaccination and Immunization schedule:

- Humoral and Cellular Immunity
- Innate Immunity: Types of innate immunity, Factors affecting innate immunity, External defence system of the body, Internal defence system (Humoral factors and Cellular factors)
- Acquired immunity: Types of acquired immunity (Active and Passive immunity) Naturally acquired and artificially acquired active and passive immunity
- Herd immunity
- Types of vaccines (Live, Killed, Attenuated, Recombinant)
- National immunization schedule.

Module-4: Practical:

- Immunological reactions. (Flocculation and Precipitation)
- Bacterial isolation from rotten food items.
- Demonstration of colorimeter, spectrophotometer, centrifuge.
- Demonstration of ELISA method.
- Demonstration of MTT assay.

Suggested Readings:

- ❖ Immunology, 8th edition, (2012), Male, D., Brostoff, J., Roth, D.B. and Roitt, I., Elsevier-Saunders. ISBN-13: 978-0323080583.
- ❖ An Introduction to Immunology, Immunochemistry and Immunobiology, 5th edition, (1988), Barrett, James T., Mosby Company, St. Louis. ISBN-13: 978-0801605307.
- ❖ Immunology: An Introduction, 4th edition, (1994), Tizard, I.R., Saunders College Publishing, Philadelphia. ISBN-13: 978-0030041983.
- ❖ Cassarett and Doull's "Essentials of Toxicology" 2nd edition (2010), Klaassen and Whatkins, McGraw Hill Publisher. ISBN-13: 978-0071622400.
- ❖ Introduction to Toxicology, 3rd edition (2001), John Timbrell, Taylor and Francis Publishers. ISBN 13: 9780415247627.
- ❖ Principles of Toxicology, 2nd edition (2006), Stine Karen and Thomas M Brown, CRC press. ISBN-13: 978-0849328565.
- ❖ Immunology, 8th edition, (2012), Male, D., Brostoff, J., Roth, D.B. and Roitt, I., Elsevier-Saunders. ISBN-13: 978-03230805

Course Code: FNT-DC-MJ 603

Course Name: FOOD STANDARD AND SAFETY

Course Objectives:

1. To gain knowledge about food safety.
2. To know about food laws and regulatory authority.

Course Outcome:

Through this course students acquire knowledge about various types of Food additives, food adulterants and their health hazards. Understanding the concept of Food security and Food safety is essential for ensuring safe food handling practices and safe food storage. Information on various Food laws and regulatory authority is also imparted.

Module-1: Food safety and Food security:

- Concept of food safety, factors affecting food safety.
- Food safety measures: basic concept of HACCP
- Safe food handling practices and storing food safely.
- Concept of food security, factors affecting food security.
- Technologies for food and nutrition security.

Module-2: Food Hazard, Risk Analysis and Hygiene in food service establishments.

- Concept and types (Physical, Chemical and Biological hazards).
- Food additives-various types and their effects on health.
- Risk assessment, Risk management.
- Risk communication, Cleaning agent, disinfectants, waste disposal, pest and rodent control, Importance of sanitation and hygiene in food, Kitchen hygiene, Employee's health, Food plant hygiene.

Module-3: Food Adulteration, Food laws and Regulatory authority:

- Food adulteration, Prevention of Food Adulteration (PFA) Act.
- Common adulterants in food and their effects on health.
- Common household methods to detect adulterants in food,
- Regulating authority- FSSAI, Codex Alimentarius, Agmark, Fruit Products Order (FPO), Meat Products Order (MPO), MMPO.
- Importance of food labels in processed foods and nutritional labeling.

Module-4: Practical:

- Detection of vanaspati in Ghee.
- Detection of vanaspati in Butter.
- Detection of Khesari flour in Besan.
- Detection of Argemone oil in Edible oil.
- Detection of Metanil yellow in Turmeric.

Suggested Readings:

- ❖ Gopalan C and Kaur S (Eds.) (1993). Towards Better Nutrition, Problems and Policies, Nutrition Foundation of India.
- ❖ Tovel AP (1984). Standardising Food Service for Quality and Efficiency. AVI Publishing Company INC.
- ❖ Dept. of WCD, Govt. of India. (1993): National Nutrition Policy.
- ❖ Food and Nutrition Board, Dept. of WCD, Govt. of India (1995): National Plan of Action on Nutrition.
- ❖ Roday S (1999). Food Hygiene and Sanitation, 1st Edition, Tata McGraw Hill, New Delhi.
- ❖ Diehl JF (1995). Safety of Irradiated Foods Marcel Dekker Inc, New York.
- ❖ Raheena Begum: A textbook of food, nutrition and dietetics Sterling Publishers, New Delhi.

Course Code: FNT-DC-MJ 604

Course Name: NUTRITIONAL EPIDEMIOLOGY AND BIOSTATISTICS

Course Objectives:

1. To provide knowledge about principles of epidemiology.
2. To know about the basics of biostatistics.

Learning Outcome: Understanding the basic principles of Epidemiology with special reference to the prevalence and incidence of a disease, mortality and morbidity rate, factors influencing epidemiology of a disease. Understanding basic of biostatistic and statistic test.

Module 1: Concept of Public Health, Disease and Principles of Epidemiology:

- Basic concept on Public Health, Hygiene, Preventive medicine, Social medicine, Community medicine
- Iceberg Phenomenon of a disease, Endemic, Epidemic and Pandemic, Acute and Chronic, Communicable and Non-Communicable; Infectious, Contagious, Sporadic and Zoonotic disease
- Rate of Disease in a Population-Attack rate, Mortality and Morbidity rate, Prevalence and Incidence of a disease
- Definition and aims of Epidemiology, Factors that influence the epidemiology of a disease and re-emergence of a disease.
- Epidemiological study-Descriptive and Analytical (Case-Control, Cohort, Longitudinal and Cross-sectional).

Module-2: Introduction to statistics:

- Basic concepts in descriptive and inferential statistics.
- Types of sampling, Design of Sampling, Characteristics of good sampling.
- Data and Data Types: Primary data and Secondary Data, Methods of data collection, presentation of data-diagrammatic and graphical, Frequency distribution.
- Scales of measurement: Nominal, ordinal, interval and ratio.
- Characteristics of distributions: Skewness, Kurtosis; Percentage, percentile ranking and frequencies.

Module-3: Statistical Test:

- Measures of Central Tendency: Mean, Median, Mode.
- Dispersion: Range, Standard Deviation, Standard Error.
- Hypothesis Testing: Chi-square Test, Student 't' test, Analysis of Variance (ANOVA).

Module-4: Practical:

- Presentation of bar diagram, histogram, line diagram, pie chart using various data.
- Mean Median, Mode, Standard Deviation, and Standard Error.
- Chi-square Test.
- Epidemiological Measurement: Rate, Ratio, Proportion, Incidence and Prevalence.

Suggested Readings:

- ❖ Debjyoti Das (2012). Biostatistics.
- ❖ E. Batschelet : Introduction to Mathematics for Life Scientists, SpringerVerlag, International Student Edition, Narosa Publishing House, New Delhi (1971, 1975).
- ❖ A. Edmondson and D. Druce: Advanced Biology Statistics, Oxford University Press;1996.
- ❖ Park K (2009). Park's Textbook of Preventive and Social Medicine, 20th Edition, M/s Banarasidas Bhanot, Jabalpur.
- ❖ Gordis L (1996). Epidemiology, Saunders, Pennsylvania.
- ❖ Norell SE (1998): Workbook of Epidemiology. Oxford: University Press, New York.

SEMESTER-VI

DISCIPLINARY MINOR COURSE

Course Code-FNT-DC-MN-601

Course Name: Diet Therapy

Course Objectives:

3. To give knowledge about pathophysiology of various diseases.
4. To know about dietary management of diabetes, cardiovascular diseases and renal diseases.

Learning Outcome:

Students will be able to comprehend the pathophysiology and diet therapy of various types of diabetes, cardiovascular diseases and renal diseases, Students will be able to correlate physiology with these disorders, their pathogenesis and dietary management.

Module-I: Pathophysiology, clinical symptoms, risk factors, diagnostic tests and dietary management of Diabetes:

- Types of Diabetes (Type 1, Type 2, Gestational), complications.
- Diagnosis (Oral glucose tolerance test, Blood glucose test, Glycosylated hemoglobin test).
- Diet in Diabetes and management.

Module-II: Pathophysiology, clinical symptoms, diagnostic tests and dietary management of cardiovascular disorder/diseases:

- Brief review of lipoproteins (TC, TG, LDL, HDL, VLDL)
- Hypertension
- Atherosclerosis—etiology and risk factor.
- Dietary care: ischemic heart disease.

Module-III: Pathophysiology, risk factors, clinical features, diagnosis and dietary management of renal diseases:

- Renal diseases (Glomerulonephritis, Uremia, Kidney failure, Nephrolithiasis).

Module-IV: Practical: Planning and preparation of Diet chart and menu for the following diseases (Case specific):

- Hypertension
- Diabetes
- Atherosclerosis

Suggested Readings:

- ❖ Anderson L, Dibble MV, Tukki PR, Mitchall HS, and Rynbergin HJ. Nutrition in Health and Disease. 17th edition, JB Lipincott & Co. Philadelphia.
- ❖ Anita FP. Clinical Dietetics and Nutrition. Second Edition, Oxford University Press, Delhi.
- ❖ Davis J and Sherer K (1994). Applied Nutrition and Diet Therapy for Nurses, 2nd Edition, WB Saunders Co.
- ❖ Escott-Stump S (1998). Nutrition and Diagnosis Related Care, 4th Edition, Williams andWilkinson
- ❖ Garrow JS, James WPT and Ralph A (2000). Human Nutrition and Diabetics, 10th Edition, Churchill Livingstone.
- ❖ Gibney MJ, Elia M, Ljungqvist&Dowsett J. (2005) Clinical Nutrition. The Nutrition Society Textbook Series. Blackwell Publishing Company
- ❖ Gibson SR. (2005). Principles of Nutritional Assessment. 2nd Edition. Oxford University press · Joshi YK. Basics of Clinical Nutrition. 2nd Edition. Jaypee Brothers Medical Publishers.
- ❖ Lee RD & Neiman DC. (2009). Nutritional Assessment. 5th Edition. Brown & Benchmark.
- ❖ Mahan, L. K. and Escott Stump. S. (2016) Krause's Food & Nutrition Therapy 14th ed. Saunders-Elsevier ·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.
- ❖ Williams, S.R. (2001) Basic Nutrition and Diet Therapy. 11th ed. Times Mirror Mosby College Publishing
- ❖ World Cancer Research Fund & American Institute for Cancer Research (2007) Food, Nutrition, Physical Activity and the Prevention of Cancer- A Global Perspective. Washington E.D. WCRF.

SEMESTER-VII

MAJOR CORE

FNT DC-MJ701: FOOD PROCESSING, PACKAGING and LABELLING

Course Objectives: To enable students

1. To enable students to learn different methods of processing of plant and animal derived foods.
2. To understand the principles of food packaging and acquire skills in methods of food packaging.
3. To understand labelling of the finished product.

Learning outcomes: Comprehend the use of different temperature in food processing. It will enhance the knowledge of the students about the processing of milk and fish. Students will understand about the food packaging materials and labelling of the finished product.

Module-I: Introduction to food processing:

- Introduction to food processing: Principles of different food processing-membrane filtration, pulse electric, high pressure processing, hurdle technology.
- Processed foods- bakery products and value-added products (vegetables, fruits and dairy).
- Methods of processing and milling of wheat, rice.

Module-II: Processing of milk and fish.

- Processing of different types of milk products, (butter, cheese, yoghurt, ice cream, skim milk, chhana, paneer and gulab jamun).
- Canning, drying, cooking, curing, pickling, smoking, fish protein concentrates and fish oils.

Module-III: Food packaging and labelling:

- Definition, characteristics of packaging material, functions of packaging materials for different foods.
- Packaging materials: Introduction, requirements, types, biopolymer based edible film.
- Modern packaging materials and forms-glass containers, metal cans, composite containers, aerosol containers, rigid plastic packages, semi rigid packaging, flexible packaging, aseptic packaging.
- Packaging of finished goods: Weighing, filling, scaling, wrapping, cartooning, labeling, marking and trapping.

- Labelling: Standards, purpose, description types of labels, labeling regulation barcode, nutrition labeling, health claims, and mandatory labeling provision.

Module-IV: Practical:

- Preparation of food by sun drying, using natural and chemical preservatives.
- Testing of physical/mechanical properties of food packaging material.
- Preparation of fermented milk products. (curd/chhana/paneer).

Suggested Readings:

- ❖ Sacharows. S. Handbook of packaging materials. Avi Pub Co. Westport.
- ❖ Sri Lakshmi B (2004) Food Science. New Age Int.
- ❖ Subbulakshmi G and Udipi A. 2004. Food Processing and Preservation techniques. New Age Int.
- ❖ Swaminathan M (1992) Handbook of Food Science and Experimental foods. 2nd Ed. Bangalore.
- ❖ Potter NH and Hotchkiss JH (1996) Food Science. 5th ed. New Delhi, CBS pbs.
- ❖ Sethi M and Rao SE (2001) Food science experiments and application. CBS pbs. New Delhi.

FNT DC-MJ702: FOOD PRODUCT DEVELOPMENT AND ENTREPRENEURSHIP

Course Objectives – To enable the students to:

1. Illustrate the new product categories in food market and their characteristics.
2. Elucidate the process of new food product development in food industry.
3. Exemplify various specialty food products and their applications.
4. Acquire the skill to design and development of new food product and analyse the quality of the product.

Learning Outcomes -The students will be able to apply a product development process to generate ideas, develop concept to test Market. Learn and develop novel technology to develop new products and work collaboratively with a team in food product development. Design food and nutritional label of food products. Demonstrate the skills to conduct the organoleptic evaluation of food product.

Module-I: New Food Products:

- New food product: Introduction, need for new food product development.
- Innovative products - creative products and value-added products.
- Intellectual property protection for food innovation.
- Characteristics of consumers, customers and market places.

Module-II: New food product development in food industry:

- Development of new products for food industries.
- Sensory evaluation and consumer testing.
- Standardization and large-scale preparation safety and regulatory aspects, sanitation and waste disposal.

Module-III: Entrepreneurship:

- Definition and characteristics of entrepreneurship, key traits of successful entrepreneur.
- Principles of management, functions of management manager. Market analysis. Food licensing.
- Importance of Financial Management, Concept of cost, Budgets and budgeting process.
- Planning of A Small Food Service Unit: Survey of types of units, identifying clientele, menu, operations and delivery.
- Identifying resources, Determining investments, Development of a business plan.

Module-IV: Practical:

1. Submission of a project proposal with estimated budget for a food service unit.
2. Visit to a food industry/ food service unit.

Suggested Readings:

- ❖ Debashri, Ray.(2002). Nutritional Challenge and Total Quality Management, 1st edition;Sarup and Sons, New Delhi.
- ❖ Gordon W.Fuller (2011), New Food Product development, 3rd edition, CRC press, Newyork.
- ❖ Graf, E. and Saguy, I.S. (1991).Food Product Development: From Concept to the Market Place, Van Nostrand Reinhold New York.
- ❖ Howard R. Moskowitz, (2009), An integrated approach to new product development, CRC press, Newyork.
- ❖ Sethi Mohini (2005). Institution Food Management New Age International Publishers.
- ❖ Knight JB & Kotschevar LH (2000). Quantity Food Production Planning & Management 3rd edition John Wiley & Sons.
- ❖ Taneja S and Gupta SL (2001). Enterpreneurship development, Galgotia Publishing.

FNT DC-MJ703: ADVANCED NUTRITION

Course Objectives: To enable the students to:

1. Understand integration of nutrition with biochemistry and physiology.
2. Know about the RDA and energy expenditure.

Learning Outcomes: Students will be able to cite the functions of various macro and micro nutrients. They will understand the metabolic role and interrelationships of nutrients.

Module-I: NUTRITION SCIENCE:

- Introduction to Nutrition Science, Progress of nutrition research in India, Recommended Dietary Allowances, Energy- Components of Total Energy Expenditure (TEE), Factors affecting TEE, Measurement of Energy expenditure, Energy content of foods, Estimating Energy requirements.
- Associated nutritional problems of energy imbalance- Under nutrition & Obesity.

Module-II: CARBOHYDRATES, PROTEINS and LIPIDS:

- Carbohydrates-Relation between carbohydrates and health outcomes. Glycaemic index and glycaemic load: implication for health, Fructooligo saccharides, resistant starch. Dietary fiber and its role in prevention of diseases.
- Proteins -Functions of amino acids, EAA- sources, functions, quality of proteins, PDCAAS, Protein Energy Malnutrition. Therapeutic role of oligopeptide (glutathione, vasopressin, oxytocin)
- Lipids-Essential fatty acids: functions, requirements and its deficiency, Role of n3 & n6 in health and disease, trans fatty acids, prostaglandins, cholesterol. Importance of medium chain triglycerides, relation between lipid and different disorders (CVD, NAFLD, Diabetes and neuro degenerative diseases)

Module-III: VITAMINS and MINERALS:

- Vitamins- Water and Fat-soluble Vitamins- functions (biochemical), deficiencies and toxicities, bioavailability. Vitamin supplementation and fortification.
- Minerals- Major and trace minerals- functions, deficiency, toxicity, Bio availability- factors affecting bioavailability. Mineral fortification.

Module-IV: PRACTICAL:

1. Microscopic examination of starch from different sources.
2. Protein estimation by Lowry's method.
3. Saponification test of lipids.

Suggested Readings:

- ❖ Shills ME, Olson JA, Shike N, Ross AC (1999): Modern Nutrition in Health and Disease. 9th Ed. Williams and Wilkins
- ❖ Mahan LK & Ecott- Stump S (2000): Krause's Food, Nutrition and Diet therapy, 10th ed. WB Saunders Ltd.
- ❖ Anderson L, Dibble M, Mitchell N (1982) Nutrition in health and disease (17th ed). Philadelphia: JB. Lippincott co.
- ❖ McArdle W, Katch F, Katch V (1996) Exercise Physiology. Energy, Nutrition and Human Performance. 4th ed. Williams and Wilkins, Philadelphia
- ❖ Bamji M, Prahlad Rao N, Reddy V (2000). Text book of Human Nutrition. publishing Co. Pvt.Ltd.. 6. Swaminathan M(1985) Essentials of Food and Nutrition. Vol I and II.

FNT DC-MJ704: RESEARCH METHODOLOGY:

Course Objectives - To enable the students to:

- Understand the significance of statistics and research methodology in Home Science research.
- Identify the types, tools and methods of research and develop the ability to construct data gathering instruments appropriate to the research design.
- Apply the appropriate statistical technique for the measurement of scale and design.

Learning Outcomes - After the completion of the course, the students will be able to apply statistics in the field food and nutrition research. They will learn to identify problems and compare variables. Students will gather knowledge enough to develop research design. They will acquire skills on data collection and interpretation. Students will gain knowledge on basic concepts of theories of probability

Module-I: Fundamental of research and Research design

- Research design – Definition, need for research design, characteristics of research design.
- Research design types-Qualitative and quantitative research design. Formulation of a research design.
- Objectives, Types and characteristics of research
- Methods of Research: Experimental, Descriptive, Historical, Qualitative and Quantitative methods.
- Concept on action research and applied research.
- Concept on citation, references and bibliography.
- Research ethics- plagiarism, fabrication, falsification, ethical committees.

Module-II: Data and Data Types:

- Primary data and Secondary Data, Methods of data collection, presentation of data-diagrammatic and graphical.
- Sampling of data, Types of sampling techniques, Design of Sampling, Characteristics of good sampling.
- Theory of probability- Population and sample - Probability sampling: systematic random sampling, two stages and multistage sampling, cluster sampling.
- Non – Probability sampling: purposive, quota and volunteer sampling/snowball sampling.

Module-III: Preparation of report:

- Graphical and diagrammatic presentation, interpretation- meaning, technique, precaution, tables and figures interpretation.
- Report writing- significance, steps, types.
- Data analysis and interpretation.

Module-IV: PRACTICAL:

1. Sampling and data analysis- mean, median, mode, standard deviation, standard error of mean, probability, normal distribution, students T distribution and null hypothesis.
2. Graphical presentation techniques- histogram, bar diagram, pie chart.

Suggested Readings:

- ❖ Bandarkar, P.L. and Wilkinson T.S. (2000): Methodology and Techniques of social Research, Himalaya Publishing House, Mumbai.
- ❖ Bhatnagar, G.L. (1990): Research Methods and Measurements in Behavioural and Social Sciences, Agri. Cole Publishing academy, New Delhi.
- ❖ Dooley, D. (1995): Strategies for Interpreting Qualitative Data; Sage Publications, California.
- ❖ Gay, L.R. (1981): Educational Research, proper Solutions: Avoiding Errors in Quantitative Research. II Edn. Sage Publications: Beverly Hills, California.
- ❖ Long; J.S. (Ed) (1988): Common Problems Proper Solutions: Avoiding Errors in Quantitative Research, Beverly Hills, Sage Publications, California.
- ❖ Mukherjee, R. (1989): The Quality of Life: Valuation in Social Research, Sage Publications, New Delhi.

SEMESTER-VII

DISCIPLINARY MINOR COURSE

FNT DC-MN701: FOOD PROCESSING and PACKAGING.

Course Objectives: To enable students

1. To enable students to learn different methods of processing of plant and animal derived foods.
2. To understand the principles of food packaging and acquire skills in methods of food packaging.

Learning outcomes: Comprehend the use of different temperature in food processing. It will enhance the knowledge of the students about the processing of milk and fish. Students will understand about the food packaging materials.

Module-I: Introduction to food processing:

- Introduction to food processing- principle, objectives, food processing operations including thermal, radiation, freezing and dehydration.
- Processed foods- bakery products and value-added products (vegetables, fruits and dairy).
- Methods of processing and milling of wheat, rice.

Module-II: Processing of milk and fish.

- Processing of different types of milk products, (butter, cheese, yoghurt, ice cream, skim milk, chhana, paneer and gulab jamun).
- Canning, drying, cooking, curing, pickling, smoking.

Module-III: Food packaging.

- Definition, characteristics of packaging material, functions of packaging materials for different foods.
- Packaging materials: Introduction, requirements, types, biopolymer based edible film.
- Modern packaging materials and forms-glass containers, metal cans, composite containers, aerosol containers, rigid plastic packages, semi rigid packaging, flexible packaging, aseptic packaging.
- Packaging of finished goods: Weighing, filling, scaling, wrapping, cartooning, marking and trapping.

Module-IV: Practical:

- Preparation of food by sun drying, using natural and chemical preservatives.
- Testing of physical/mechanical properties of food packaging material.
- Preparation of fermented milk products (curd/chhana/paneer).

Suggested Readings:

- ❖ Sacharows. S. Handbook of packaging materials. Avi Pub Co. Westport.
- ❖ Sri Lakshmi B (2004) Food Science. New Age Int.
- ❖ Subbulakshmi G and Udipi A. 2004. Food Processing and Preservation techniques. New Age Int.
- ❖ Swaminathan M (1992) Handbook of Food Science and Experimental foods. 2nd Ed. Bangalore.
- ❖ Potter NH and Hotchkiss JH (1996) Food Science. 5th ed. New Delhi, CBS pbs.
- ❖ Sethi M and Rao SE (2001) Food science experiments and application. CBS pbs. New Delhi

SEMESTER-VIII
(HONOURS PROGRAMME)

FNT DC-MJ801: MOLECULAR BIOLOGY AND BIOINFORMATICS

Course Objectives:

1. To understand nucleic acids and their structure.
2. To know about genetics and bioinformatics.

Learning Outcomes:

The course deals with the basics of genetic material and the mechanism of genetic exchange. Students get introduced with the concept of genomics, proteomics and DNA recombinant Technology. In Bioinformatics, students learn how computer programming can help to restore the biological data through biological algorithm.

Module-I: Introduction to nucleic acid:

- Nucleic acid: Bases, nucleosides and nucleotides.
- DNA structure: DNA double helix (Watson and Crick Model).
- Types of DNA and RNA, DNA and RNA as genetic material.
- DNA replication: Semi-conservative replication, Basic mechanism of replication (Prokaryotes). Transcriptional unit and basic concept of transcription (Prokaryotes).

Module-II: Genetics and Recombinant DNA Technology:

- Genetic code and basic mechanism of translation (Prokaryotes).
- Basic idea on recombinant DNA technology and its applications including agriculture and food.
- Restriction endonuclease type I, II, III and IV.
- Principal and applications - PCR, SDS-PAGE and agarose gel electrophoresis.

Module-III: Introduction to Bioinformatics:

- Definition, scope, Types of biological data.
- Biological Databases-GenBank, EMBL, DDBJ, UniProt, PDB.
- Data formats- fasta, Database searching and retrieval.

- Bioinformatics Tools and Software - NCBI tools, EMBL-EBI resources.
- Applications in medicine, agriculture, food, and environment.
- Concept of BLAST, Sequence alignment (pair-wise alignment and multiple sequence alignment).

Module-IV: PRACTICAL:

1. Retrieval of nucleic acid/protein sequence from data bases.
2. Sequence alignment (pair-wise alignment and multiple sequence alignment).
3. Demonstration of plasmid DNA isolation.
4. Demonstration of Agarose Gel electrophoresis.
5. Demonstration of PCR.
6. Exposure visits to any laboratory of Biological Sciences / Biodiversity Research Centre / Biotechnology Laboratory / Rural Technology Laboratory and documentation.

Suggested Readings:

- ❖ Bolandar, M. (2001). Molecular Endocrinology. Elsevier Science.
- ❖ Alberts, B. et al. (2008). Molecular Biology of the Cell. 5th Ed. Garland Publishing
- ❖ House. Yoshinori Mine (Editor), Kazuo Miyashita (Editor), Fereidoon Shahidi (Editor): Nutrigenomics and Proteomics in Health and Disease: Food Factors and Gene Interactions.
- ❖ Van Ommen, B. (2004). Nutrigenomics: Exploiting systems biology in the nutrition and health arenas. Nutrition.20:4-8.
- ❖ Simopoulos, A.P. and Ordovas, J.M. (Editors) (2004). Nutrigenetics and Nutrigenomics. Roche, H.M. (2004). Dietary lipids and gene expression. Biochem Soc Trans. 32 (Pt6): 999 1002.
- ❖ Lesk M.A. (2008) Introduction to Bioinformatics. Oxford Publication, 3rd International Student Edition.
- ❖ Rastogi S.C., Mendiratta N. and Rastogi P. (2007) Bioinformatics: methods and applications, genomics, proteomics and drug discovery, 2nd ed. Prentice Hall India Publication.

FNT DC-MJ802: NUTRITION AND DIET COUNSELLING

Course Objectives: To enable the students to:

1. Develop diet counselling skills
2. Create awareness among the communities about the importance of diet and good health
3. Develop humanistic approach towards patients

Learning Outcomes - After the completion of the course, the students will be able to understand psychology, goals and response of patients. They will learn and develop data collecting tools. They will be able to design food and nutrition education audio visual aids and materials like pamphlets. They can develop demonstration skills to conduct group counselling.

Module-I: Introduction to counselling and counselling process:

- Counselling – Definition, Expectations, goals, scope, limits, individual group and family counselling. Counsellor – Characteristics of an effective counsellor. The Client – Characteristics, expectations.
- The Counselling Process: Techniques for obtaining relevant information. Clinical Information, Medical History and General Profile, Dietary Diagnosis - Assessing food and nutrient intakes, Lifestyles, physical activity, stress and Nutritional Status.

Module-II: Counselling Theories.

- Counselling stages- correlating relevant information and identifying areas of need. Stage I: Problem exploration and clarification Stage II: Developing new perspectives and setting goals Stage III: Implementation follow up and evaluation.
- Counselling Theories: Key Concepts and Techniques Counselling techniques, strategies and communication skills. Rapport building and opening techniques Questioning, listening, reflecting, acceptance, silence, leading reassurance, non-verbal behaviour, terminating skills, ethical principle of counselling, special areas of counselling- educational, family, health, community and counselling of alcoholic and drug addicts.

Module-III: Diet counselling at hospital and community levels:

- Approaches to counselling: psychoanalytic, behavioristic and humanistic approach. Relation between psychology and counselling. Factors influencing personality.
- Diet counselling at hospital and community levels: psychology of feeding the patients- Assessment of needs, education of the patient and follow up and establishing rapport with the patient and the family member, facilitative condition and counselling relationships, patient follow up/home visit, geriatric counselling, organizing health camp and patient feedback at community levels.

Module-IV: PRACTICAL:

1. Preparation of counselling tools – questionnaire, charts, posters, interview schedule, dietary guidelines pamphlet for any one disease.
2. Conducting mock counselling sessions – group and individual counselling for Obesity/Diabetes/Gastric disorders/Allergies/Cardiac disorders.
3. Submission of a report on visit to hospital/clinics/NGO.

Suggested Readings:

- ❖ Gelso Charles, J. and Fretz Bruce, R. Counselling Psychology, a PRISM Indian edition Harcourt Brace College Publishers, 1995.
- ❖ Srilakshmi, B. Dietetics New Age International (P) Ltd, 1997.
- ❖ Gable, J. (1997): Counselling Skills for Dietitians, Blackwell Science.
- ❖ Holli, B.B. and Calabrese, R.J. (1998): Communication and Education Skills for Dietetics Professionals. Lippin Cott Williams & Wilkins, New York.

FNT DC-MJ 803: NUTRACEUTICALS, FUNCTIONAL FOODS AND HEALTH

Course objectives: To enable students to understand:

1. Nutraceuticals and functional foods.
2. Probiotic, prebiotic and oxidative stress.

Learning Outcomes:

This course gives an insight into the recent discoveries in the field of Food and Nutrition especially Functional Foods and Nutraceuticals. It enlists the potential health benefits of common functional foods and nutraceuticals – like Prebiotics, Probiotics and Dietary Fibers. Knowledge is also imparted on the fundamentals of various methods to enhance the nutritional quality of food and nutraceutical enriched medicinal plants.

Module-I: Functional foods, Nutraceutical and Health:

- Definition and importance-functional foods, nutraceuticals, bioactive compound, phytochemicals. Development of functional foods.
- Concept, classification and sources of nutraceuticals.
- Natural occurrence of certain phytochemicals, and their role including bioavailability-flavonoids, omega–3 fatty acids, carotenoids, dietary fiber, phytoestrogens, glucosinates, organosulphur compounds, lycopene, isoflavonoids.

Module-II: Therapeutic application of Nutraceutical:

- Concept of oxidant and ROS, Antioxidant (Natural and synthetic)
- Enzymatic and non-enzymatic antioxidant.
- Oxidative stress and effect of nutraceutical on oxidative stress.
- Role of nutraceuticals in the management of diabetes, obesity and cardiovascular diseases, cancer, eye health.
- Understanding national and international regulatory frameworks for nutraceuticals and functional foods.

Module-III: Prebiotic, Probiotic and Nutraceutical Enriched Medicinal Plants:

- Types of prebiotics and their effects on gut microbes
- Health benefits and recent development of prebiotics, probiotics and Symbiotics.
- Importance of medicinal plants:
Amla, Brahmi, Arjuna, Garlic, Ginger, Tulsi, Turmeric, Ashwagandha, Aloe-Vera, Sarpgandha.
- Enhancing the nutritional quality of foods:

- Fundamentals of Germination and Fermentation.
- Food Fortification and Enrichment: Methods, advantages and limitations, safety

Module-IV: Practical:

1. Market survey of locally available functional foods
2. Formulation of the functional foods and assessment of its nutritional value.
3. Analysis of shelf-life studies on developed functional foods. (Any one)

Suggested Readings:

- ❖ Ramesh C. Chandan & Arun Kilara, *Dairy Ingredients for Food Processing*, 2011, Wiley-Blackwell, John Wiley & Sons Inc., Hoboken, New Jersey, USA.
- ❖ M. G. Traber & J. Packer, *Nutrition and Health: Oxidative Stress and Antioxidant Protection*, 2008, CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.
- ❖ Fereidoon Shahidi, *Nutraceuticals and Functional Foods*, 2004, CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.
- ❖ Norman J. Temple, Ted Wilson & David R. Jacobs, *Nutritional Health: Strategies for Disease Prevention*, 2012, Humana Press (Springer), New York, USA.
- ❖ M. S. Swaminathan, *Food and Nutrition*, 2011, Bappco Publishers, Bangalore, India.
- ❖ Shyam S. Chauhan & M. P. Dobhal, *Medicinal Plants of India*, 2010, Bishen Singh Mahendra Pal Singh, Dehradun, Uttarakhand, India.
- ❖ Gibson, Glenn R. & Roberfroid, Marcel B., *Handbook of Prebiotics and Probiotics*, 2008, CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.

FNT DC-MJ804: TERM PAPER/ FIELD REPORT/ LITERATURE REVIEW/ BOOK REVIEW.

(without research)

**** Term paper/Field report/Literature review/Book review:** Total credit=04; This may be spilt into two parts: Term paper preparation (03 credits=50) and presentation and viva-voce (01 credit, presentation=15, viva-voce=10). Examination guidelines will be prepared by the concerned BOS considering their feasibility.

Evaluation methods: Evaluation will be done in presence of external and internal examiners in home center.

Internal credit:

Internal credit and mark allotment for other papers will be accordant with previous other semesters concerned. No internal marks will be allotted for Term paper (here DC-MJ-804).

(With research): DRP-1: Dissertation/Research/Project (Credit 12)

DRP-1: Dissertation / Research / Project: Total credit=12; This may be spilt into two parts: Dissertation preparation (08 credits=150) and presentation (50)and viva-voce (25)(04 credits);

In preparation section, a student will have to focus on a relevant topic (1) literature review, (2) research gap, (3) Objective(s), (4) Materials, (5) Methods, (6) Results, (7) Discussion (8) Major findings and conclusion and (9) References (following internationally accepted style)

Evaluation methods: Evaluation will be done in presence of external and internal examiners in home center.

Internal credit and mark allotment for other papers will be accordant with previous other semesters concerned. No internal marks will be allotted for DRP1.

OR

SEMESTER-VIII

(HONOURS WITH RESEARCH)

FNT DC-MJ801: MOLECULAR BIOLOGY AND BIOINFORMATICS

Course Objectives:

3. To understand nucleic acids and their structure.
4. To know about genetics and bioinformatics.

Learning Outcomes:

The course deals with the basics of genetic material and the mechanism of genetic exchange. Students get introduced with the concept of genomics, proteomics and DNA recombinant Technology. In Bioinformatics, students learn how computer programming can help to restore the biological data through biological algorithm.

Module-I: Introduction to nucleic acid:

- Nucleic acid: Bases, nucleosides and nucleotides.
- DNA structure: DNA double helix (Watson and Crick Model).
- Types of DNA and RNA, DNA and RNA as genetic material.
- DNA replication: Semi-conservative replication, Basic mechanism of replication (Prokaryotes). Transcriptional unit and basic concept of transcription (Prokaryotes).

Module-II: Genetics and Recombinant DNA Technology:

- Genetic code and basic mechanism of translation (Prokaryotes).
- Basic idea on recombinant DNA technology and its applications including agriculture and food.
- Restriction endonuclease type I, II, III and IV.
- Principal and applications - PCR, SDS-PAGE and agarose gel electrophoresis.

Module-III: Introduction to Bioinformatics:

- Definition, scope, Types of biological data.
- Biological Databases-GenBank, EMBL, DDBJ, UniProt, PDB.

- Data formats- fasta, Database searching and retrieval.
- Bioinformatics Tools and Software - NCBI tools, EMBL-EBI resources.
- Applications in medicine, agriculture, food, and environment.
- Concept of BLAST, Sequence alignment (pair-wise alignment and multiple sequence alignment).

Module-IV: PRACTICAL:

1. Retrieval of nucleic acid/protein sequence from data bases.
2. Sequence alignment (pair-wise alignment and multiple sequence alignment).
3. Demonstration of plasmid DNA isolation.
4. Demonstration of Agarose Gel electrophoresis.
5. Demonstration of PCR.
6. Exposure visits to any laboratory of Biological Sciences / Biodiversity Research Centre / Biotechnology Laboratory / Rural Technology Laboratory and documentation.

Suggested Readings:

- ❖ Bolandar, M. (2001). Molecular Endocrinology. Elsevier Science.
- ❖ Alberts, B. et al. (2008). Molecular Biology of the Cell. 5th Ed. Garland Publishing
- ❖ House. Yoshinori Mine (Editor), Kazuo Miyashita (Editor), Fereidoon Shahidi (Editor): Nutrigenomics and Proteomics in Health and Disease: Food Factors and Gene Interactions.
- ❖ Van Ommen, B. (2004). Nutrigenomics: Exploiting systems biology in the nutrition and health arenas. Nutrition.20:4-8.
- ❖ Simopoulos, A.P. and Ordovas, J.M. (Editors) (2004). Nutrigenetics and Nutrigenomics. Roche, H.M. (2004). Dietary lipids and gene expression. Biochem Soc Trans. 32 (Pt6): 999 1002.
- ❖ Lesk M.A. (2008) Introduction to Bioinformatics. Oxford Publication, 3rd International Student Edition.
- ❖ Rastogi S.C., Mendiratta N. and Rastogi P. (2007) Bioinformatics: methods and applications, genomics, proteomics and drug discovery, 2nd ed. Prentice Hall India Publication.

DISCIPLINARY MINOR COURSE

FNT DC-MN801: Nutraceuticals and Functional Foods

Course objectives: To enable students to understand:

1. Nutraceuticals and functional foods.
2. Probiotic, prebiotic and oxidative stress.

Learning Outcomes:

This course gives an insight into the recent discoveries in the field of Food and Nutrition especially Functional Foods and Nutraceuticals. It enlists the potential health benefits of common functional foods and nutraceuticals – like Prebiotics, Probiotics and Dietary Fibers. Knowledge is also imparted on the fundamentals of various methods to enhance the nutritional quality of food and nutraceutical enriched medicinal plants.

Module-I: Functional foods, Nutraceutical and Health:

- Definition and importance-functional foods, nutraceuticals, bioactive compound, phytochemicals.
- Concept, classification and sources of nutraceuticals.
- Natural occurrence of certain phytochemicals, and their role- flavonoids, omega-3 fatty acids, carotenoids, dietary fiber, lycopene.

Module-II: Therapeutic application of Nutraceutical:

- Concept of oxidant and ROS, Antioxidant (Natural and synthetic)
- Enzymatic and non-enzymatic antioxidant.
- Oxidative stress and effect of nutraceutical on oxidative stress.
- Role of nutraceuticals in the management of diabetes, obesity and cardiovascular diseases, cancer.

Module-III: Prebiotic, Probiotic and Nutraceutical Enriched Medicinal Plants:

- Types of prebiotics and their effects on gut microbes
- Health benefits and recent development of prebiotics, probiotics and Symbiotics.
- Importance of Medicinal Plants: Amla, Garlic, Ginger, Tulsi, Turmeric, Aloe-Vera.
- Fundamentals of Germination, Fermentation and Food Fortification.

Module-IV: Practical:

1. Market survey of locally available functional foods
2. Analysis of shelf-life studies on developed functional foods. (Any one)

Suggested Readings:

- ❖ Ramesh C. Chandan & Arun Kilara, *Dairy Ingredients for Food Processing*, 2011, Wiley-Blackwell, John Wiley & Sons Inc., Hoboken, New Jersey, USA.
- ❖ M. G. Traber & J. Packer, *Nutrition and Health: Oxidative Stress and Antioxidant Protection*, 2008, CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.
- ❖ Fereidoon Shahidi, *Nutraceuticals and Functional Foods*, 2004, CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.
- ❖ Norman J. Temple, Ted Wilson & David R. Jacobs, *Nutritional Health: Strategies for Disease Prevention*, 2012, Humana Press (Springer), New York, USA.
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- ❖ Gibson, Glenn R. & Roberfroid, Marcel B., *Handbook of Prebiotics and Probiotics*, 2008, CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA