  
**UNIVERSITY OF MYSORE**  
Estd. 1916

Vishwavidyanilaya Karyasoudha  
Crawford Hall, Mysuru- 570 005

No.AC2(S)/319/2023-24

Dated: 08.11.2023

**Notification**

**Sub:-** Minor Modifications in the Syllabus of Food Science Nutrition (PG) programme with effect from the Academic year 2023-24.

- Ref:-**
1. Decision of Board of Studies in Food Science Nutrition (PG) held on 11-02-2023.
  2. Decision of the Faculty of Science & Technology meeting held on 15-03-2023.
  3. Decision of the Academic Council meeting held on 24-03-2023.

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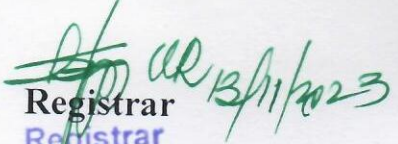
The Board of Studies in Food Science Nutrition (PG) which met on 11-02-2023 has resolved to recommended and approved the modified syllabus of Food Science Nutrition (PG) Programme with minor modifications with effect from the academic year 2023-24.

The Faculty of Science & Technology and Academic Council at their meetings held on 15-03-2023 and 24-03-2023 respectively has also approved the above said modified syllabus. Hence, it is hereby notified.

The syllabus contents may be downloaded from the University Website i.e., [www.uni-mysore.ac.in](http://www.uni-mysore.ac.in).

**To:**

1. The Registrar (Evaluation), University of Mysore, Mysuru.
2. The Chairman, BOS/DOS in Food Science Nutrition, Manasagangothri, Mysuru.
3. The Dean, Faculty of Science & Technology, DoS in Mathematics, MGM.
4. The Director, PMEB, Manasagangothri, Mysuru.
5. Director, College Development Council , Moulya Bhavan, Manasagangothri, Mysuru.
6. The Deputy Registrar/Assistant Registrar/Superintendent, Administrative Branch and Examination Branch, University of Mysore, Mysuru.
7. The PA to Vice-Chancellor/ Registrar/ Registrar (Evaluation), University of Mysore, Mysuru.
8. Office Copy.

  
**Registrar**  
Registrar  
University of Mysore  
Mysore

# UNIVERSITY OF MYSORE

Department of Studies in Food Science and Nutrition  
Manasagangotri, Mysuru-570006

## **Regulations and Syllabus**

Master of Science in Food Science and Nutrition (M.Sc)

Stream 1- Food science and Nutrition

Stream 2- Specialization in Clinical Nutrition and Dietetics

(TWO YEAR REGULAR FULL TIME PROGRAMME)

## **Under**

Choice Based Credit System (CBCS)

Continuous Assessment and Grading Pattern (CAGP)

# UNIVERSITY OF MYSORE

## Guidelines and Regulations of Master of Science in Food Science and Nutrition (Two Years- Semester Scheme Under CBCS)

### Programme Details

<b>Name of the Department</b>	: Department of Studies in Food Science and Nutrition.
<b>Subject</b>	: Food Science and Nutrition.
<b>Faculty</b>	: Science.
<b>Name of the Course</b>	: Master of Science (M.Sc)
<b>Duration of the Course</b>	: 2 years- divided into 4 semesters

### Preamble

Department of Food Science and Nutrition is offering M.Sc. Degree in Food Science and Nutrition since inception with modifications in scheme and syllabus from time to time as needed to keep abreast with latest knowledge in the field. Since the subject has grown tremendously, there is a need to specialize within the subject and train students specifically for the job market. Clinical Nutrition is one such branch of nutrition which is in great demand because of job opportunities in hospitals, clinics, and health clubs. In view of this, it was found necessary to introduce a specialization in the existing course of Food Science and Nutrition in Clinical Nutrition. Students opting for this stream can branch out in the II semester into a second stream offering this specialization. In I semester all courses will be same for both streams. There are some common papers in II and III semesters also. It is also planned to give an internship exclusively for students of clinical nutrition for better and practical training and preparation in IV semester.

The eligibility criteria is revised as students opting for clinical nutrition are required to have a stronger background of nutrition.

### Program outcomes

The program focuses on imparting updated content to understand the concepts of food science and nutrition

It will enable the students to learn the methods of assessing nutritional status and diet planning

It will prepare students to work in Food Business units/ Food Industries, apply Food safety management tools

To understand the applications of nutritional sciences in clinical interventions, communication for health promotion, food service management, food science and processing

To acquire skills to undertake systematic research in the area of food science and nutrition

### Choice-Based Credit System Syllabi of M.Sc in Food Science and Nutrition

No	Paper Code	Title of course	HC/SC/open elective	No. of credits			
				L	T	P	Total
<b>STREAM 1. FOOD SCIENCE AND NUTRITION</b>							
<b>I Semester</b>							
1.	17609	Food Science and Food Processing- I	Hard core [16 credits]	3	0	2	<b>5</b>
2.	17610	Nutritional Biochemistry		2	1	2	<b>5</b>
3.	17611	Human Nutrition		2	1	0	<b>3</b>
4.	17612	Life cycle Nutrition		2	1	0	<b>3</b>
5.	17613	Food Microbiology	Soft core [to choose 4 credits]	2	0	0	<b>2</b>
6.	17614	Public health nutrition		2	0	0	<b>2</b>
7.	17615	Assessment of Nutritional status		1	1	0	<b>2</b>
<b>II Semester</b>							
1.*	17628	Food Science and Food Processing- II	Hard core [14 credits]	3	0	2	<b>5</b>
2.*	17629	Vitamins in Nutrition		1	1	2	<b>4</b>
3.*	17630	Minerals in Nutrition		1	1	0	<b>2</b>
4.	17631	Food laws and food safety		2	1	0	<b>3</b>
5*	17632	Nutritional Epidemiology	Soft core [ to choose 4 credits]	2	0	0	<b>2</b>
6.*	17633	Nutraceuticals and Functional foods		2	0	0	<b>2</b>
7.	17634	Food additives		1	1	-	<b>2</b>
8	17635	Healthy lifestyle and nutrition	Open elective	4	-	-	<b>4</b>
<b>III Semester</b>							
1.	17650	Food Preservation	Hard core [14 credits]	3	0	2	<b>5</b>
2.	17651	Functional properties of foods		2	2	0	<b>4</b>
3.	17652	Principles of Clinical Nutrition		2	1	0	<b>3</b>
4*	17653	Biostatistics & its applications		1	1	0	<b>2</b>
5.	17654	Food fortification	Soft core [to choose 6 credits]	1	1	0	<b>2</b>
6	17655	Food packaging technology		2	0	0	<b>2</b>
7*	17656	Nutrition transition in India		2	0	0	<b>2</b>
8.	-	Project work – Part I **		0	4	0	<b>4</b>
9.	17657	Culinary Science- Principles & Techniques	Open elective	2	2	0	<b>4</b>

<b>IV Semester</b>							
1.	17669	Product Development & entrepreneurship	Hard core [8 credits]	2	2	0	<b>4</b>
2.	17670	Advances in Nutritional Sciences		1	1	0	<b>2</b>
3.	17680	Diet in diseases		1	1	0	<b>2</b>
4.	-	Project work- Part II	Soft core [to choose 6 credits]	0	6	0	<b>6</b>
5.	17694	Nutrition and Physical fitness		2	0	0	<b>2</b>
6.	17695	Storage and handling of fresh produce		1	1	0	<b>2</b>
7.	17696	Food Biotechnology		2	0	0	<b>2</b>
8.	17697	Foods in Indian Tradition	Open elective	2	-	-	<b>2</b>

**Open elective papers are for students of other courses.**

**M.Sc. Program in Food Science and Nutrition [Specialization in Clinical Nutrition & Dietetics]**

No	Paper	Title of course	HC/SC/open Elective	No. of credits			
				L	T	P	Total
<b>STREAM 2. SPECIALIZATION IN CLINICAL NUTRITION AND DIETETICS</b>							
<b>II Semester</b>							
1.*	17628	Food Science and Food Processing- II	Hard core [14 credits]	3	0	2	<b>5</b>
2.*	17629	Vitamins in nutrition		1	1	0	<b>2</b>
3.*	17630	Minerals in nutrition		1	1	0	<b>2</b>
4.	17636	Human Physiology		2	1	2	<b>5</b>
5.*	17632	Nutritional epidemiology	Soft core [to choose 4 credits]	2	0	0	<b>2</b>
6.*	17633	Nutraceuticals and functional foods		2	0	0	<b>2</b>
7.	17637	Sports nutrition		2	0	0	<b>2</b>
<b>III Semester</b>							
1.	17658	Principles of Diet therapy	Hard core [12 credits]	2	1	-	<b>3</b>
2.	17659	Clinical nutrition & dietetics-I		2	1	2	<b>5</b>
3.	17660	Food service management		1	1	0	<b>2</b>
4*	17653	Biostatistics & its applications		1	1	0	<b>2</b>
5	17665	Nutrition in extreme environments	Soft core [to choose 6 credits]	2	0	0	<b>2</b>
6.	17666	Drug and nutrient interactions		2	0	0	<b>2</b>
7.	17667	Research methods in clinical nutrition		2	0	0	<b>2</b>
8.	17668	Pediatric & Geriatric nutrition		2	0	0	<b>2</b>
<b>IV Semester</b>							
1.	17698	Clinical nutrition & dietetics-II	Hard core [10 credits]	1	1	2	<b>4</b>
2.	-	Internship ***		0	6	0	<b>6</b>
3.	17699	Nutrition counseling	Soft core [to choose 6 credits]	1	1	0	<b>2</b>
4.	17700	Nutrition in critical care		1	1	0	<b>2</b>
5.	17771	Inborn errors in metabolism		2	0	0	<b>2</b>
6.	17772	Nutrition and health issues of women		2	0	0	<b>2</b>

\* Papers common for both the streams.

\*\* To be assessed as Internal Assessment only. For all others, distribution of IA and Exam marks are 50% each. Total credits needed for M.Sc. 76, [I year: 40, II year 36] Min credit 4 and maximum of 8 credits to be chosen from other courses during II, III, and IV Semesters.

\*\*\*Internship in Hospitals / Foods service institutions + hospital / clinics.  
Certificate to be issued by the Department.

**Important Note for Stream 2: Specialization in Clinical Nutrition and Dietetics:**

During the first half of IV semester all the hard core and soft core papers, which are taught in the department will be completed. The second half will be devoted to Internship, for which students need to go outside the department for three/five days a week. Accordingly, C1 and C2 component marks will be submitted at the end of IV semester.

**FIRST SEMESTER (common to both streams)**

**HARDCORE**

**COURSE I- FOOD SCIENCE AND FOOD PROCESSING-I**

**Course Outcome**

To be equipped to handle research and work in a food industry/establishments

**Preamble**

To understand science of food and the concepts of food processing

**Pedagogy**

- Teaching, PPT, OHP presentations
- Assignment: Visit to Food Processing Industries

**Course Content**

**1. Processing of foods:**

- A.** Brief history of food processing, Types of processing- Primary, secondary and tertiary. Traditional technologies used in food processing. Advanced food processing technologies: thermal and non-thermal
- B.** Effects of processing on physical properties (density, specific gravity, viscosity, emulsions), sensory characteristics and nutritive value of foods.
- C.** Anti-nutritional factors in foods and processing methods to reduce their content

**2. Processing of wheat:** Structure, composition, primary processing, functionality in food system, role of gluten, study of preparation/ manufacture of common unleavened and leavened products like chapathi, bread, cake etc.

- 3. A. Rice:** Structure, composition, primary and secondary processing, effect of processing and cooking on nutrient content, processed products.  
**B. Millets:** Types, composition, malting, other food uses.

- 4. A. Legume:** Types, composition, milling, germination, cooking & processed products.  
**B. Oilseeds:** Use of oilseeds and oilseed meals, soya bean and groundnut– composition,

processing and food uses.

**C. Fruits and Vegetables:** Composition, pectins, plant acids, types of pigments, Physico-chemical changes during harvesting, post-harvesting, ripening, cooking and Storage.

**Practical Sessions:** Study of preparation variables and quality factors of products from the following food commodities

1. Wheat
2. Rice and millets
3. Legumes
4. Vegetables

#### **Reference:**

1. Potter, N. N., & Hotchkiss, J. H. (2012). Food science. Springer Science & Business Media.
2. Rahman, M. S. (Ed.). (2009). Food properties handbook. CRC press.
3. Fellows PJ(2009).Food processing technology, principle and practices. Wood head publishing India Pvt Ltd, New Delhi.
4. Manay, N. S. O. (2001). Food: facts and principles. New Age International.
5. Sharma, A vantina. Textbook of Food Science and Technology. CBS publication and Distributors Pvt. Ltd.
6. Srilakshmi B. Food Science. New Age International.

## **COURSE II- NUTRITIONAL BIOCHEMISTRY**

### **Course Outcome**

Enable the application of nutrient metabolism in clinical nutrition and dietetics and suggest strategies to manage the consequences due to altered nutrient metabolism

### **Preamble**

To learn chemistry of nutrients, their biochemical functions, metabolism in health and disease and to apply the same in nutrition research.

### **Pedagogy**

- Teaching, PPT, OHP presentations, classroom discussions

### **Course Content**

1. **Cell Structure and Function:** Components, cell membrane composition and functions, membrane receptors, mechanism of membrane transport, fundamentals of signal transduction.
2. **Enzymes:** Classification, nomenclature, general properties, mechanisms of enzyme action, regulation of enzyme activity. Role of Coenzymes and cofactors in enzyme activity. Factors affecting enzyme activity Enzyme inhibition, Iso-enzymes,

immobilized enzymes, clinical significance of enzyme assays.

3. **Hormones:** Classification, Second messengers, mechanism of action, neuro-endocrine control of metabolism.
4. **Metabolic pathways of macronutrients**
  - A. **Carbohydrates-** classification, physico-chemical properties. Aerobic and anaerobic degradation, Glycogenesis, Glycogenolysis, Gluconeogenesis, HMP shunt pathway. Alcoholic fermentation. Hormonal regulations of blood glucose.
  - B. **Proteins and amino acids** - Classification and structure, physico-chemical properties. Protein degradation, metabolism of aromatic, sulfur containing, BCAA, amino acid pool, fate of nitrogen (urea cycle). Glutamine and alanine cycle, protein biosynthesis.
  - C. **Lipids:** Classification, chemical structure, and properties of fatty acids. Metabolic pathways of triacylglycerol, fatty acids, cholesterol and lipoproteins. Biosynthesis of fatty acids and ketonebodies.
  - D. **Nucleic acids:** Classification, metabolism of nucleic acid components, biosynthesis of nucleotides.
  - E. **Iron and Heme Metabolism:** Iron metabolism, iron containing proteins, intestinal absorption of iron, heme biosynthesis.
5. **Integration and regulation of metabolism:** Interrelationship of carbohydrate, protein and lipid metabolism, role of liver, muscle and adipose tissues.
6. **Bioenergetics:** Principles, Endergonic and exergonic processes, High-energy compounds and their role in energy capture and transfer. Structure of mitochondria, Electron transport chain and oxidative phosphorylation.

### **Practical Session:**

#### **Techniques used in biochemical analysis:**

1. **Determination of pH:** in acids, alkalis and buffers using pH meter and indicators.
2. **Colorimeters:** Use of colorimeter in UV and visual range, Flame Photometer, fluorimeter (principle to be explained and demonstrated with one example for each).
3. **Separation techniques:** Chromatography- paper and column. Centrifugation, Electrophoresis and Dialysis. (One example for each may be demonstrated).
4. **Enzyme Assays:** Amylase, protease, lipase or alkaline phosphatase using suitable substrates, Effect of pH, temperature & substrate concentration on any one enzyme activity may be included.

#### **Reference:**

1. David L. Nelson, Michael M. Cox. L. Lehninger Principles of Biochemistry. Macmillan
2. Murray, R K., Granner, D K., Mayes, P A., & Rodwell, V W. Harper's Illustrated



- Biochemistry. Lange medical book/ McGraw-Hill.
3. Damodaran, S., Parkin, K. L., & Fennema, O. R. (Eds.). (2007). Fennema's Food Chemistry. CRCpress.
  4. Shills ME, Olson JA, Shike M & Ross AC. 1999 Modern Nutrition in Health and Disease. Williams & Wilkins
  5. Guyton. Human physiology and mechanism of disease. W.B .Saunders Company
  6. Chatterjea MN & Rana Shinde. Textbook of Medical Biochemistry. Jaypee publication.
  7. Satyanarayana U. & Chakrapani U. Biochemistry. Books & Allied (P) Ltd.

## **COURSE III- HUMAN NUTRITION**

### **Course Outcome**

Able to apply the principles of nutrition in recommending suitable nutrients in deficiencies/ malnutrition/diseases as per subject related characteristics

### **Preamble**

To familiarize with fundamentals of nutrients, their functions, quality indicators and their relationship to health

### **Pedagogy**

- Teaching, PPT, OHP presentations, classroom discussion

### **Course Content**

1. **Basis for computing nutrient requirements**, latest concepts in dietary recommendations, RDA- ICMR and WHO: their uses and limitations.
2. **Body fluids and water balance**: Body water compartments. Regulation of water balance, disorders of water imbalance
3. **Body composition**: Body compartment models, Compositional changes during life cycle, Methods of studying body composition- underwater weighing, air displacement technique, DXA (dual X-ray absorptiometry), anthropometry, bio-electrical impedance. Significance of Body composition analysis.
4. **Energy metabolism**: Basal and resting metabolism- influencing factors. Methods to determine energy requirements & expenditure. Thermo genesis, adaptation to altered energy intake, latest concepts in energy requirements and recommendations for different age groups.
5. **Carbohydrates**: Physiological functions, Sources, Glycemic index and glycemic load of foods and their uses, intrinsic and extrinsic factors affecting glycemic index. Dietary fiber-types, sources, effect on intestinal physiology and its role in health and disease. Alternate sweeteners – Synthetic and natural. Role of carbohydrates in oral health and Dental caries.
6. **Lipids**: Types (visible and invisible fats, EFA, SFA, MUFA, PUFA), sources and physiological functions. Lipoproteins – Types and functions. Role of lipoproteins, cholesterol & triglycerides in health and disease.

7. **Proteins and Amino Acids:** Nutritional classification, sources and physiological functions. Concepts of Biological value of proteins, essential and non-essential amino acids- their role in growth and development. Protein quality (PER, PDCAAS), digestibility, improving protein quality, Nitrogen balance.
8. **Regulation of food intake:** Hunger, Appetite and satiety– neural centers for regulation of food intake

### Reference:

1. Bamji, M. S., Krishnaswamy, K., & Brahmam, G. N. V. (Eds.). (2013). Textbook of human nutrition. Oxford & IBH.
2. Caballero, B. (2012). Encyclopedia of human nutrition. L. H. Allen, & A. Prentice (Eds.). Academic press.
3. Mann, J., & Truswell, S. (2012). Essentials of human nutrition. Oxford University Press.
4. Shills ME, Olson JA, Shike M & Ross AC. 1999 Modern Nutrition in Health and Disease. Williams & Wilkins

## COURSE IV- LIFE CYCLE NUTRITION

### Course Outcome

To compute gender and age-specific recommended dietary allowances of various nutrients

### Preamble

To gain knowledge about the physiological considerations and nutritional needs during human life cycle

### Pedagogy

Teaching, PPT, OHP presentations, classroom discussion, case studies

### Course Content

#### 1. Nutrition during lifespan-

- A. Pregnancy: Physiological adjustments, Nutritional requirements, Nutritional status of Indian pregnant women. Effect of malnutrition on outcome of pregnancy.
- B. Lactation: physiology of lactation, Factors affecting lactation, nutritional requirements. Effect of lactation on maternal malnutrition and fertility.
- C. Infancy; Growth and development, nutritional requirement in the first 1000 days (in utero and post-natal), advantages of breast feeding, compositional differences between human milk and milk substitutes and their suitability for infant feeding. Preterm babies, weaning practices, weaning and supplementary foods. Human milk bank - Benefits (Pre-term babies, NICU), Donor Breast milk – considerations, milk banking process, pasteurization of human breast milk. Human milk banks in India.
- D. Preschool age: Growth and Development, nutrient requirements, factors influencing

food intake, special care in feeding preschoolers, nutritional concerns.

**E.** School age and adolescent children: Growth and Development- physiologic and psychological changes, nutrient requirements, food choices and health habits, nutritional problems.

**F.** Young adults: Nutrient requirements, food choices and health habits, Nutritional status of Indian adult population, common nutritional problems.

**G.** Elderly: Physiologic changes, Nutrient requirements, Special needs, Nutritional problems.

### **Reference:**

1. Mary Kay Mitchell.(2015). Nutrition across the life span. MEDTECH, Scientific international Pvt ltd.
2. Nnakwe, N. (2012). Community nutrition: planning health promotion and disease prevention. Jones & Bartlett Publishers.
3. Paul Insel, Don Ross et al.,(2013). Discovery nutrition, Library of congress cataloging. Jones and Bratlett Publisher
4. Nutrition and the Developing Brain, edited by Victoria Hall Moran, Nicola M. Lowe, CRC Press
5. Sari Edelstein and Judith Sharlin (2009). Essential of life cycle nutrition evidence based approach Jones and Bratlett Publisher.
6. Mahan, L. K., & Raymond, J. L. (2016). Krause's food & the nutrition care process. Elsevier Health Sciences.
7. Shills ME, Olson JA, Shike M & Ross AC. 1999 Modern Nutrition in Health and Disease. Williams & Wilkins

## **SOFTCORE**

### **COURSE V- FOOD MICROBIOLOGY**

#### **Course Outcome**

Enable to explain the interactions between microorganisms and the food environment, factors influencing their growth and survival, apply the microbiological quality in food production.

#### **Preamble**

- Learn the rationale for the use of standard methods and procedures for the microbiological analysis of food
- Learn the microbiology of food preservation and food commodities; fermented and microbial foods; principles and methods for the microbiological examination of foods; micro biological quality control, and quality schemes.

#### **Pedagogy**

- Teaching, PPT, OHP presentation

- Demonstration of microscopic observation of spoiled food, culture media preparation, staining and inoculation techniques

## Course Content

### 1. Microorganisms of importance in food:

- A. Food and microorganisms- bacteria, yeast, molds, fungi and viruses- general characteristics, classification and identification
- B. Factors affecting the growth of microorganisms in food- intrinsic and extrinsic parameters that affect microbial growth
- C. Microorganisms and their importance in food microbiology (fermentation, health foods and enzymes)

### 2. Contamination and spoilage of foods- sources of contamination, principles underlying spoilage- chemical changes caused by microorganisms in:

- A. Cereals, pulses and their products
- B. Vegetables and fruits
- C. Flesh foods, eggs and poultry
- D. Milk and milk products

### 3. Methods for the Microbiological examination and Microbial Quality of foods

- A. Identification of microorganisms
- B. Culture and enumeration techniques
- C. Rapid methods and detecting spoilage specific microorganisms
- D. Quality control using microbiological criteria
- E. Codes of GMP, HACCP concept and quality system

### 4. Food hazards of microbial origin

- A. Food Borne Diseases-Types, Food Borne Intoxications-Staphylococcal poisoning, *Bacillus cereus* poisoning, Botulism.
- B. Food Borne Infections- Salmonellosis, Shigellosis, Vibrio gastroenteritis, *E. coli*, Hepatitis A and Shellfish poisoning,
- C. Food Borne Toxic infections/ toxicosis-*Clostridium perfringens*, *E.coli* gastroenteritis, Cholera, Listeriosis, Yersinia, Campylobacter, Mycotoxins- Aflatoxicosis, Ergotism

## Reference:

1. William C Frazier, Dennis C Westoff, K N Vanitha. Food Microbiology. McGraw-Hill Education.
2. Geeta Sumbali, RS Mehrotra. Principles of microbiology. Tata McGraw-Hill education pvt ltd
3. Jeffrey Pommerville. Alcamo's fundamentals of microbiology. Jones & Bartlett India Pvt Ltd.

## **COURSE VI- PUBLIC HEALTH NUTRITION**

### **Course Outcome**

Enable to assess public health nutrition problems and design appropriate education strategies.

### **Preamble**

To gain understanding of the importance of nutrition education in bringing about behaviour change in the community

### **Pedagogy**

- Teaching, PPT, OHP presentation, classroom discussion

### **Course Content**

1. Concept of public health nutrition- relationship between health and nutrition, role of public health nutritionists in the health care delivery.
2. Food and nutrition security- food production, distribution, access, availability and consumption. Socio cultural aspects and dietary patterns: their implication for nutrition and health.
3. Health care facility- primary health care of the community, health care delivery system.
4. Determinants of nutrition and health status- socio cultural, biologic, environmental and economic factor, indicators of health and malnutrition.
5. Link between nutrition and demographic changes, Health and nutrition transitions, Economical and public health implications of micro nutrient deficiencies, impact on productivity and national development.
6. Approaches and strategies for improving nutritional status and health:
  - a. National nutrition policy: need for nutrition policy, policy strategies and their implementation
  - b. Nutrition programs: National anemia prophylaxis program, Prevention of night blindness, Vitamin A prophylaxis program, National iodine prophylaxis program,
  - c. Goiter control program ICDS
  - d. National nutrition surveillance system (NNMB). Food for work etc.
  - e. NGO in community development operations
7. Nutrition Education- Importance of Nutrition Education in Public Health Nutrition.

### **Reference:**

1. Sheila Chander Vir. Public Health Nutrition in developing countries (Part I & II). Woodhead Publishing India Pvt. Ltd.
2. Mark Lawrence & Tony Worsley. Public Health Nutrition- From principles to practice. Allen & Unwin.
3. Mishra RC. Health & Nutrition Education. APH Publication corporation.

## **COURSE VII- ASSESSMENT OF NUTRITIONALSTATUS**

### **Course Outcome**

Be able to use appropriate tools, data interpretation and assess nutritional status of the community

### **Preamble**

To familiarize students with fundamentals of anthropometric techniques

### **Pedagogy**

- Teaching, PPT, OHP presentation, classroom discussion
- Assessment of nutritional status and report submission- Self assessment and community assessment.

### **Course Content**

1. **Indirect methods:** Demography, population dynamics and vital events and their health implications, indicators of health and nutrition (IMR, TMR, MMR).
2. **Direct methods:** Anthropometry, Biochemical, Clinical, Dietary and Functional indices of assessments
  - A. **Anthropometry:** Methods, reference standards in children and adults, scales of comparison (percentiles, Z score), classification and interpretation of somatic data, somatic indicators of PEM
  - B. **Biochemical:** Use of specimen types, indicators of protein-energy status, anemia, immune function, CVD risk, oxidative stress. Urine and stool analyses.
  - C. **Dietary-** Methods, nutrient intake analysis, dietary assessment in special populations and specific situations, Dietary reference intakes. Dietary Diversity: definition, methods of measurement, uses of Dietary Diversity Score (DDS)
  - D. **Clinical-** Components of clinical assessment, associations with nutrient deficiencies and biochemical status
3. **Assessing food and nutrition security** – Definition and assessment schedules, National and household food security. Factors affecting food security system. National and International systems to improve food security

### **Reference**

1. Rosalind S Gibson. Principles of Nutritional assessment. Oxford University Press.
2. Robert D Lee, David C Nieman. Nutritional assessment. McGraw Hill Higher Education.
3. Jellifee DB. 1966. The Assessment of the Nutrition Status of the Community. WHO.

## SECOND SEMESTER

### HARDCORE

#### COURSE I - FOOD SCIENCE AND FOOD PROCESSING-II

##### Course Outcomes

Students will be able to understand the effects of common food processing systems and food storage conditions.

##### Preamble

To Study of variables and quality factors of products from the food commodities.

##### Pedagogy

- Teaching, PPT, OHP presentations.
- Visit to food processing industries, food product preparation including various food groups.

##### Course Content

1. **Fats and oils:** Properties, manufacture, uses in food systems (as cooking media and shortening). Changes while cooking, Rancidity- types, mechanism and prevention. Use of fat replacers/substitutes in processed foods.
2. **A. Milk and milk products:** Composition, functionality in food system, processing of different products like ghee, butter, milk powders, khoa, paneer, cheese, milk products and ice-cream.  
**B. Eggs:** Structure and composition, changes on cooking, functional properties and products, Quality grading.
3. **A. Flesh foods:** Types, composition, structure of muscle, conversion of muscle to meat (rigor mortis, ageing, tenderizing), physico-chemical changes, cooking and processing.  
**B. Marine foods:** Types, composition, cooking and processing, spoilage.
4. **A. Jaggery and Sugar:** processing of jaggery, types, nutritional significance. Principles of sugar crystallization, stages of sugar cookery and role in Indian traditional sweet preparations, manufacturing of candies and sweets.  
**B. Manufacturing process (in brief) of coffee ,tea, cocoa, alcoholic beverages (fruit wines). Ready to serve beverages.**
5. **Processed foods:** Minimally processed, processed culinary ingredients, ultra-processed foods

**Practical Sessions:** Study of preparation variables and quality factors of products from the following food commodities.

1. Fats and Oils.
2. Milk and egg.
3. Flesh Foods.
4. Sugar and Jaggery.

## Reference:

1. Manay, N. S. O. (2001). Food: facts and principles. New Age International.
2. Potter, N. N., & Hotchkiss, J. H. (2012). Food science. Springer Science & Business Media.
3. Rahman, M. S. (Ed.). (2009). Food properties handbook. CRC press.
4. Fellows PJ(2009).Food processing technology, principle and practices. Wood head publishing India Pvt Ltd, New Delhi 3<sup>rd</sup>edition.
5. Dr. Swaminathan, Handbook of Food and Nutrition. Vol I and Vol II. The Bangalore Press.
6. B. Srilakshmi (2018). Food Science. 7<sup>th</sup>Multicolour Edition. New Age International Publishers.
7. Sharma, Avantina. Textbook of Food Science and Technology. CBS publication and Distributors Pvt. Ltd.

## COURSE II – VITAMINS IN NUTRITION

### Course Outcome

To suggest practical dietary based strategies for overcoming vitamins deficiencies in various age groups.

### Preamble

To study the metabolism, functions and deficiencies of vitamins and factors affecting nutrient interactions.

### Pedagogy

- Teaching, PPT, OHP presentations, classroom discussions.

### Course Content

1. **Introduction-** History, Definition of terms- requirements, Reference Nutrient Intakes, UTNI, protective nutrient intake, food based approaches to meet the need for vitamins, physico-chemical properties, general functions, analytical methods and compositional data sources, ADME concept, bioavailability, factors affecting variations/losses of vitamins in food.
2. **Classification-** Fat soluble vitamins and Water soluble vitamins
  - A. **Water soluble vitamins**

Vitamin C, thiamin, riboflavin, niacin, pantothenic acid, biotin, folic acid (Physicochemical properties, stability, biochemical indicators, factors affecting requirements).
  - B. **Fat soluble vitamins** (Physicochemical properties, stability, biochemical indicators, functions, factors affecting requirements).

Vitamin A- modes of degradation, role in visual cycle, conversion of carotenoids to vitamin A

Vitamin D- Formation in the skin, photochemical regulation and factors affecting synthesis of vitamin D<sub>3</sub> in human body, supplements.

Vitamin E – Vitamin E as a part of endogenous antioxidant system



Vitamin K – Role in blood clotting process, anti-platelet aggregation, anti-clotting drugs  
(vitamin K- agonists and antagonists).

### **Practical Sessions: FOOD ANALYSIS**

1. Determination of moisture, Ash - total, acid soluble and insoluble.
2. Determination of Protein in foods.
3. Determination of Fat – Crude fat.
4. Carbohydrates – Free sugars, Starch (Total & available), Dietary fiber.
5. Mineral estimation – Dry and wet ashing, calcium, iron, phosphorous.
6. Vitamin estimation – Ascorbic acid, thiamine, riboflavin and  $\beta$ carotene.

### **Reference:**

1. Bamji, M. S., Krishnaswamy, K., & Brahmam, G. N. V. (Eds.). (2013). Textbook of human nutrition. Oxford & IBH.
2. Zimmermann, M. (2001). Burgerstein's Handbook of nutrition: micronutrients in the prevention and therapy of disease.
3. David A Bender. (2003) Nutritional Biochemistry of the Vitamins. 2<sup>nd</sup> Ed. Cambridge Press.
4. B. Srilakshmi (2017), Nutrition Science. 6<sup>th</sup> Multicolor Ed. New Age International Publishers.
5. Sareen S Gropper, Jack L Smith. Advanced Nutrition and Human Metabolism. 6<sup>th</sup> Ed. Wadsworth Cengage Learning.
6. Report of a joint FAO/WHO expert consultation Bangkok, Thailand. Human Vitamin and Mineral Requirements. 2001.
7. L. Kathleen Mahan, Sylvia E Stump (2007). Krause's Food and Nutrition Therapy. 12<sup>th</sup> Ed.

## **COURSE III – MINERALS IN NUTRITION**

### **Course Outcomes**

To suggest practical dietary based strategies for overcoming mineral deficiencies in various age groups.

To minimize nutrient-mineral interactions for better absorption.

### **Preamble**

To impart in depth knowledge on ADME concept, functions and deficiency disorders.

### **Pedagogy**

- Teaching, PPT, OHP presentations, classroom discussions.

### **Course Content**

1. **Introduction** – Characteristics of minerals, bioavailability, mineral-mineral interaction, mineral composition of the body, food based approaches to meet the demand, physico-chemical properties, general functions, analytical methods and source of data, ADME concept, factors affecting variations/ losses in food, distribution in fluid compartments
2. **Classification** – Macro minerals and micro minerals.
  - A. Macro minerals – Calcium, Phosphorus, Magnesium, Sodium, Potassium, Sulphur and Chloride
 

**Calcium**- determinants of calcium balance, disorders associated with calcium deficiency and toxicity, nutritional factors affecting calcium requirement, osteoporosis- factors determining peak bone mass and loss of bone.

**Magnesium** – role in blood pressure control

**Sodium** – sodium balance, sodium intakes among Indians, role in blood pressure control

**Potassium** –potassium balance, role in acid-base balance, disorders associated with acid base imbalance, role in blood pressure control
  - B. Micro minerals – Iron, Zinc, copper, manganese, iodine, selenium, chromium, fluoride and molybdenum
 

**Iron** –iron requirements – basal losses, growth, and menstrual losses. Dietary iron absorption (haem and non- haem), factors influencing non- haem iron absorption, deficiency- causes, symptoms, prevalence and prevention, iron overload

**Zinc** –maternal zinc deficiency, RNA/ DNA synthesis, reproductive health, toxicity.

**Copper** – Wilson’s disease

**Selenium** – Immune function, role in antioxidant defense system, selenium and thyroid function

**Chromium** – role in glucose utilization and insulin action

**Iodine** - Iodine deficiency disorders

**Fluoride** – Fluoridation of water, Fluoride belt and fluorosis
  - C. **Ultra trace minerals** – significance in Human nutrition.

**Reference:**

1. Bamji, M. S., Krishnaswamy, K., & Brahmam, G. N. V. (Eds.). (2013). Textbook of human nutrition. Oxford & IBH.
2. Zimmermann, M. (2001). Burgerstein's Handbook of nutrition: micronutrients in the prevention and therapy of disease.
3. B. Srilakshmi (2017), Nutrition Science. 6<sup>th</sup> Multicolor Ed. New Age International Publishers.
4. Sareen S Gropper, Jack L Smith. Advanced Nutrition and Human Metabolism. 6<sup>th</sup> Ed. Wadsworth Cengage Learning.
5. Report of a joint FAO/WHO expert consultation Bangkok, Thailand. Human Vitamin and Mineral Requirements. 2001.
6. L. Kathleen Mahan, Sylvia E Stump (2007). Krause’s Food and Nutrition Therapy. 12<sup>th</sup> Ed

## **COURSE IV – FOOD LAWS AND FOOD SAFETY**

### **Course Outcomes**

- The course will enable candidates to identify and minimize food related health hazards in food business operations
- Enables to implement FSSAI regulations.

### **Preamble**

- To study the importance of food safety, hygiene in handling, preparation and storage of food in food processing units and food service institutions.
- To understand the regulatory aspects both at National and International level.

### **Pedagogy**

- Teaching, PPT, OHP presentations.
- Demonstration of adulteration in food samples, Classroom level skit performances on related topics.

### **Course Content**

1. A. Concept and meaning of Food quality and Food Safety, Quality assurance vs Quality control, Total Quality Management, Food quality Factors -appearance, texture flavor, B. Food adulteration, food related hazards- biological, chemical, physical and trace elements. Microbial considerations in food safety.
2. Natural toxins in food- Plant, animal and microbial origin- An overview, Regulatory concerns.
3. Food laws and regulations – concepts and trends in Food Legislation. International and Federal standards – WHO, FAO, Codex, ISO series. Food laws in India, Governing bodies- Bureau of India standards (BIS), HACCP, Food Safety and Standards Act, 2006 (FSSAI), Food policies, Food certification, Nutritional labeling
4. Exposure, estimation, toxicological requirements and risk assessment.
5. Safety aspects of water and beverages such as soft drinks, tea, coffee, cocoa.
6. Safety assessment of food contaminants and pesticide residues.
7. Safety evaluation of processed foods (RTC, RTE, RTD, ETR) and related processing techniques.

### **Reference:**

1. Kiron Prabhakar. A Practical guide to food laws and regulations. 1<sup>st</sup> Ed. Bloomsbury.
2. Sunetra Roday (2017). Food hygiene and sanitation. 2<sup>nd</sup> Ed. McGraw Hill Publications.
3. Pulkit Mathur (2018). Food Safety and Quality Control (2018).

## **SOFTCORE**

## **COURSE V – NUTRITIONAL EPIDEMIOLOGY**

### **Course Outcomes**

To improve health and nutritional status of the population.

## **Preamble**

To enable students to identify and contribute to the prevention of under-nutrition and non-communicable diseases prevalent in the population.

## **Pedagogy**

- Teaching, PPT, OHP presentations, classroom discussions.

## **Course Content**

- 1. Epidemiology-** Historical aspects, Definition, Aims and uses, Principles and application of epidemiology. Measurement of morbidity and mortality, incidence, prevalence, age-adjustment and survival analysis, life expectancy, years of potential life lost, disability-adjusted life years (DALYs). Health-adjusted life expectancy (HALE), use of morbidity and mortality statistics.
- 2. Nutrition epidemiology-** Definition, Determinants of disease, Link between eating behavior and chronic diseases. Importance of nutritional epidemiology in developing countries Diet- assessment methods used in epidemiologic research- Observation, diet history, 24 hour recall, Food frequency questionnaire, physical activity. Processing and analysis of dietary data.
- 3. Field based study designs –** Observational studies, Cross-sectional, case-controlled, cohort studies. Methods of sampling, sample size.
- 4. Classic Nutritional epidemiology studies-** Study design and methodology of selected studies - NNMB, National Family Health survey (NHFS), Framingham heart study, Dietary Approaches to stop Hypertension (DASH), Chennai urban rural epidemiological studies (CURESII).

## **Reference:**

1. Walter Willett (2012). Nutritional Epidemiology. 3<sup>rd</sup> Ed. Oxford University Press.
2. Gail C. Frank (2008) Community Nutrition- Applying epidemiology to contemporary Practice. 2<sup>nd</sup> Ed. Jones and Bartlett Publishers.
3. Sheila Chander Vir (2011). Public Health Nutrition in developing countries (Part I & II). Woodhead Publishing India Pvt. Ltd.
4. Mark Lawrence & Tony Worsley (2008). Public Health Nutrition- From principles to practice. 1<sup>st</sup> Ed. Allen and Unwin.

## **COURSE VI – NUTRACEUTICALS AND FUNCTIONALFOODS**

### **Course Outcomes**

To suggest practical diet-based approaches to improve consumption of nutraceutical/functional foods for all age groups and with special reference to disease specific groups.

## **Preamble**

To understand the classification and functions of nutraceuticals, functional foods, dietary supplements and antioxidants.

### **Pedagogy**

- Teaching, PPT, OHP presentations, classroom discussions, consumer and market survey.
- Product development using various functional food as key ingredients and report submission.

### **Course Content**

#### **1. Nutraceuticals:**

**A.** Nutraceuticals in health, their role in prevention and control of diseases.

**B.** Definition, Classification, food and non- food sources, mechanism of action. Role Of omega-3, fatty acids, carotenoids, dietary fiber, phytoestrogens, glucosinates, organo-sulphur compounds as nutraceuticals.

**C.** Nutraceutical delivery systems: encapsulation, nanotechnology, liposomes - bioavailability, functionality and shelf life stability.

**2. Prebiotics, probiotics, synbiotics and postbiotics :** definition, characteristics, types, sources, their effects on gut microbes. Role in health promotion and in chronic diseases. Production, application in health foods and safety issues.

**3. Functional foods:** Definition, development of functional foods, benefits and sources of functional foods in Indian diet. Effects of processing conditions and storage; Development of biomarkers to indicate efficacy of functional ingredients; Research frontiers in functional foods.

**4. Development of nutraceutical and functional foods:** Standards for health claims. Process of developing, preclinical & clinical studies, Marketing and Regulatory issues, Regulatory bodies in India.

### **Reference:**

1. Debasis Bagchi. Nutraceutical & Functional Food Regulation in the US and around the world (2014). 2<sup>nd</sup> Ed. Academic Press, Elsevier.
2. Yasha Jahu Pomeranz (1991). Functional Properties of Food Components. 2<sup>nd</sup> Ed. Academic Press Elsevier.
3. Geoffrey P. Webb (2011) Dietary Supplements & Functional Foods. 2<sup>nd</sup> Ed. Wiley Blackwell

## **COURSE VII – FOOD ADDITIVES**

### **Course Outcomes**

- They would get to know about the diverse food additives used in the food industries for various purposes.
- They would gain thorough knowledge about food additives intake assessments, their risk and benefits and some hypersensitivity reactions related to food additives usage.
- This would also help them in judicious selection of food.

## **Preamble**

- Students will learn about the diverse types of food additives, their functions and the properties of these additives, both in terms of chemical as well as physical properties.
- They would learn about how these properties will affect the food quality and how to put into the production lines.
- They will also learn how these additives are integrated into the food processing.

## **Pedagogy**

- Teaching, PPT, OHP presentations, classroom discussions, market survey.

## **Course Content**

1. Food additives- Definition, history, classification, role of additives in processed foods, e-numbers, role of codex commission, safety evaluation of food additives, setting ADI for food additives.
2. Chemical, technological and toxicological aspects of acid, base buffer systems, salts and chelating/sequestering agents, leavening agents, antioxidants, emulsifying and stabilizing agents, anti-caking agents, thickeners, firming agents, flour bleaching agents and bread improvers.
- 3.A. Sweetening agents- History, properties and food applications of various artificial sweeteners, ADI, food applications, advantages and disadvantages, safety evaluation.  
B. Natural and synthetic colors- history, need for food coloring, classification, basic properties, benefits of natural colors, types, health hazards associated with synthetic food colors, permissible levels, safety evaluation, food applications.
4. Food flavors- classification spices and flavoring constituents, methods of extracting flavoring compounds, factors affecting flavor perception, application of flavor in food industries.
5. Sweetening agents: Alternative sweeteners, composition, uses.

## **Reference:**

1. WHO. Evaluation of Certain Food Additives: WHO Technical Report Series-913. 2002.
2. B. Srilakshmi (2004). Dietetics. 7<sup>th</sup> Ed. New Age International pvt. ltd.
3. Manay, N. S. O. (2001). Food: facts and principles. New Age International.
4. A Larry Branen, P Michael Davidson, Seppo Salimen, John H Thorngate III (2002). Food Additives. 2<sup>nd</sup> Ed. Marcel Dekker Inc.

## **OPEN ELECTIVE FOR OTHER STUDENTS**

### **COURSE VIII – HEALTHY LIFESTYLES AND NUTRITION**

#### **Course Outcomes**

Since healthy eating is the corner stone for leading a healthy life, it enhances learner's perception of healthy lifestyle which could be adopted for preventing lifestyle related disorders

### **Preamble**

- Will know what is healthy eating
- To gain knowledge on consequences of poor eating habits
- Understand the link between health, nutrition and diseases
- Will be able to identify the key vitamins and minerals and their contribution to health

### **Pedagogy**

- Teaching, PPT, OHP presentations, classroom discussions, assignments.

### **Course Content**

- 1. Factors affecting food habits, choices and dietary patterns** – Definition of Food, Nutrition, Health, Fitness. Interrelationship between nutrition and health, concept of a desirable diet for optimum nutrition, health and fitness.
- 2. A brief review of nutrients in general**
  - A.** Energy and macronutrients– Carbohydrates, Protein, Fat - functions, sources deficiency disorders and recommended intakes.
  - B.** Micronutrients:Minerals–calcium,Iron,Iodine,andotherelements.Vitamins – A, D, E, K, B-complex, Vitamin C.
- 3. Basic principles of planning diet** – Nutritional assessment, RDA for Indians, Food groups, Dietary guides and balanced diets.
- 4.** Basics of Body composition and changes during lifespan.
- 5. Nutrition and physical fitness:**  
Exercise and Fitness- Definition, benefits, components and indicators of fitness. Nutritional requirements of exercise– fluids, vitamins and minerals, energy, Macronutrient needs and distribution, body adaptation. Approaches to the management of fitness and health in weight management.
- 6. Alternative systems for health and fitness** – Ayurveda, yoga and meditation and other methods.

### **Reference:**

1. Rosalind S Gibson. Principles of nutritional Assessment. Oxford University Press.
2. Srilakshmi (2018). Food Science. 7<sup>th</sup> Multicolour Edition. New Age International Publishers.
3. Manay, N. S. O. (2001). Food: facts and principles. New Age International.

## THIRD SEMESTER

### HARDCORE

#### COURSE I- FOOD PRESERVATION

**Course outcome:** On successful completion of this course students should be able to:

1. Apply major food preservation techniques and explain underlying principles.
2. Identify and evaluate the suitability of processing and packaging techniques for various foods.

**Preamble:** The goal of this course is to provide students with a fundamental understanding of food preservation and food packaging techniques and to ensure students are technically ready for the food industry through a practical, problem-solving approach.

#### **Pedagogy:**

- PPT, OHP, class discussions, demonstrations,
- Assignments: suitable topics of the course.

#### **Course content:**

- 1. A. Classification of food in relation to shelf life-**Spoilage in food and its control: spoilage caused by microorganism (bacteria, fungi and virus), enzymes, pests and rodents.  
**B. Food dehydration and concentration:** methods of drying and concentration, types of dryers, factors affecting drying process.
- 2. Heat processing :** Mechanism of action, methods of application to foods (Equipment), effect on food and micro-organisms
  - A. Sterilization
  - B. Pasteurization
  - C. Blanching
  - D. Canning
- 3. Cold preservation:** Mechanism of action, methods of application to foods (Equipment), effect on food and micro-organisms
  - A. refrigeration
  - B. freezing
  - C. freeze drying
  - D. Refrigerated gas storage
- 4. A. Food irradiation:** technology, application and safety assessments, effects on food and microorganisms
  - B. Chemicals in food preservation, safety of preserved foods.

#### **Practical Sessions:**

Food preservation techniques (use of different techniques in product formulation and analysis of product for quality standards).

1. Sun drying and dehydration-cereals, legumes, vegetable based.
2. Preservation with sugar-jams, jelly, preserves, etc.
3. Preservation - salt, oil, vinegar-pickling.



4. Preservation of foods using chemicals –tomato ketchup, squash.

### References:

1. Potter, N. N., & Hotchkiss, J. H. (2012). Food science. Springer Science & Business Media.
2. Rahman, M. S. (Ed.). (2009). Food properties handbook. CRC press.

## COURSE II- FUNCTIONAL PROPERTIES OF FOODS

### Course outcome:

- Understand and describe the general chemical structures of the major components of foods
- To be able to explain the observed physical properties and reactivity of major food components.
- To predict how changes in overall composition are likely to change the reactivity of individual food

### Preamble:

- To understand the chemistry of foods - composition of food, role of each component and their interaction.
- To understand the functional aspects of food components and to study their role in food processing.

**Pedagogy:** PPT, OHP, class discussions, demonstrations

### Course content:

- 1. Physico-chemical properties of foods-** Organic food components, colloids, osmotic pressure, food dispersions (sols, gels, emulsion, foam), Hydrogen ion concentration
- 2. Role of water in foods-**
  - A.** Functions of water in food system, free and bound water, importance of water activity in food quality, sorption characteristics of foods, factors influencing moisture uptake.
  - B.** Intermediate moisture foods- definition, steps in manufacturing, additives used, manufacturing of IMF based on – fruits, vegetables, meat and fish.
- 3. Functional Properties of Protein-**
  - A.** General functional properties, need for modification, techniques of modification, effect of modification on functional properties.
  - B.** Food applications of modified proteins- Textured vegetable proteins and meat analogues- characteristics, manufacturing process and their application in food sector.
- 4. A. Carbohydrates:** Starch, cellulose, hemicelluloses, hydrocolloids and gums: occurrence, functions in food systems, properties, gelatinization, retro gradation and modified starches.

**B. Browning in foods:** Enzymatic and non-enzymatic- mechanism, method of prevention, relationship to health.

**Practical Session:**

1. Water activity – water sorption isotherms of different foods.
2. Functional properties of proteins – Water and fat absorption, emulsion and foaming properties, protein gels, (application in food products)
3. Starch Gelatinization and retrogradation – Factors affecting and measurement of viscosity of starch gels, use of hydrocolloids/gums.
4. Browning reactions in foods.

**References:**

Fellows PJ(2009).Food processing technology, principle and practices. Wood head publishing India Pvt Ltd, New Delhi 3<sup>rd</sup>edition.

**COURSE III- PRINCIPLES OF CLINICAL NUTRITION**

**Course outcome:** Develop competence in the skills of assessment, planning, management and evaluation of food service, *nutrition* and dietetic services in institutional food, community *nutrition*, and clinical dietetics

**Preamble:** To study the principles of therapeutic nutrition needs of adults and children and design appropriate dietary plans based on individual and group needs.

**Pedagogy:**

- PPT, OHP, class discussions, demonstrations
- Assignments: hospital based surveys, field work on various food service institutions.

**Course content:**

- 1. Introduction to Clinical Nutrition and Dietetics** - Definition and history of dietetics. Concepts of a desirable diet for optimum health. Interrelationship between food, nutrition and health. Factors affecting food choices, Physiologic factors regulating food intake- role of neurotransmitters and nutrients in hunger and satiety.
- 2. Role and responsibilities of dieticians-** Specific functions, team approach in patient care, psychological consideration, interpersonal relationship with patients. Nutrition and medical ethics. Hospital dietary- scope and importance, types of food service, quality management.
- 3. Nutrition screening and assessment in clinical settings-** Nutrition screening and assessment methods (MNA, SGA, PG-SGA, MUST, disease specific tools). Nutrition care process- Assessment, Diagnosis, Interpretation, Monitoring, and Evaluation (ADIME). Usage of International Dietetic terminologies.
- 4. Principles and Objectives of Medical nutrition therapy-**
  - A.** Characteristics of a Regular diet, rationale for modifications in terms of energy and other nutrients, texture, consistency. Translation of diet orders into menu: defining

nutrient needs, desirable dietary pattern, menu plan, use of exchange list, types of menu. Monitoring food intake.

**B.** Enteral and Parenteral feeding: indications, types (commercial and kitchen-based feeds), methods of administration, monitoring and associated complications.

**5. Dietary principles and management of special conditions-**

**A.** Protein and energy malnutrition (hospital and domiciliary treatment)

**B.** Febrile diseases-classification of fevers, metabolism, general dietary considerations, diet in acute and chronic fevers (typhoid and tuberculosis)

**C.** Surgical conditions, Burns and organ transplants

**6. Nutrition in adverse reactions to food:** pathogenesis, food allergens, symptoms, tests for diagnosis, food allergies - pollen food allergy syndrome, latex –fruit syndrome, food dependent, exercise- induced anaphylaxis, food induced anaphylaxis, food –protein induced enter colitis syndrome, cow’s milk protein allergy (CMPA). Food intolerances - lactose, fructose intolerance. Management - restricted diets, elimination diets and hypo-sensitization.

**References**

1. Bamji, M. S., Krishna swamy, K., & Brahmam, G. N. V. (Eds.). (2013). Textbook of human nutrition. Oxford &IBH.
2. Srilakshmi, B. (2007). Dietetics. New Age International.
3. Zimmermann, M. (2001). Burgerstein's Handbook of nutrition: micronutrients in the prevention and therapy of disease.

**COURSE IV- BIO-STATISTICS ANDITSAPPLICATIONS**

**Course outcome:** Will acquire skills to use the appropriate research methodology for data collection, to apply statistical tests for data interpretation and conclusion.

**Preamble:** To understand the principle concepts about biostatistics and its application in food science and nutrition research relation.

**Pedagogy:** PPT, OHP, class discussions, assignments, software application workshops

**Course content:**

1. Introduction to Statistics - Conceptual understanding of statistical measures, Sampling Design and Different types of sampling techniques – Probability sampling and Non-probability sampling, Classification and Tabulation of data.
2. Measurement of Central tendency, Measures of Variation, Graphical methods of data presentation.
3. Binomial distribution; nature and properties of Normal distribution; Meaning of parametric and non parametric tests.
4. Hypothesis testing: Z test; Unpaired and Paired t test; Chi-square test.
5. Analysis of Variance: One way ANOVA; Post Hoc tests; Factorial, ANOVA; ANCOVA; Introduction to Multivariate analysis: MANOVA, MANCOVA, Factor Analysis, Discriminant analysis.
6. Correlation and Regression: Meaning; Regression; Methods of Correlation – Biserial, Point biserial, Tetrachoric, Phi coefficient, Kendal’s Tau.
7. Use of Computers in Statistical Analysis – The computer system and technology,

Important characteristics of computer applications in research using SPSS Package, usage of statistical calculators available in web.

8. Practical Exercises under Tutorials - Introduction to Computer application in Statistics – Data entry, spread sheets – data analysis and statistical interpretation using statistical software like SPSS and MINITAB –reporting.

## References

1. Arun Bhadra Khanal.(2016), Methods in biostatistics for medical students and research workers, Jaypee Brother Medical Publisher.
2. CR Kothari.(1990). Research methodology –Methods and techniques, 2 nd Edition,New age International.
3. Rajinith Kumar (2016). Research Methodology step by step guide for beginners. Pearson India Education.

## SOFTCORE

### COURSE V- FOODFORTIFICATION

**Course outcome:** Will be able to apply dietary based food fortification as an important nutrition intervention to fight micronutrient deficiencies and to reduce their incidence in many low- and middle-income countries.

**Preamble:** To understand the basic principles of food fortification and the use of diet based approaches to control micronutrient malnutrition to learn the legal considerations and Criteria governing the selection of mandatory or voluntary fortification.

**Pedagogy:** PPT, OHP, class discussions, demonstrations, product development

**Course content:**

#### 1. Food fortification-

- A. Needs, objectives, principles and rationale, selection and basis of fortification, selection and use of specific food vehicles, ongoing programs, food laws for fortification, types of fortification.
- B. Characteristics of nutrients used in fortification of food- types and levels of nutrients added (vitamin A, vitamin D, iodine, zinc, B-vitamins, calcium, selenium, fluorine and other nutrients

#### 2. Technology of fortifying cereal products.

- A. Characteristics of nutrients used in cereal fortification, Types and levels micronutrients to be added.
- B. Fortification methods – commercial and industrial fortification (Encapsulation, spray drying, freeze drying and nanotechnology - in brief), Bio- fortification, domestic fortification.
- C. Fortification premixes, Design and composition of premixes and quality control Fortification of bread, pasta, noodles, biscuits, and breakfast cereals.

#### 3. Technology of fortifying beverages, candies, snack products

- A. Technology of fortifying beverages - Importance of beverage fortification, Health benefits of fortification, Bioavailability, Organic v/s inorganic salts.

- B.** Technology of fortifying candies - Product formulation, Nutrient bioavailability, Packaging, storage, shelf life and cost.
  - C.** Snack products - Rationale for micronutrient fortification of snack products, Choice of products and selection of micronutrients, Challenges in fortifying snack products, Nutrient interaction and bioavailability.
- 4. Other special fortified products** - salt, sugar, oil, Nutri-bars, Granola bars, health foods- technology, stability of nutrients, challenges in fortification, safety issues, packaging and cost.

#### **References:**

1. Coles, L. (Ed.). (2013). Functional foods: The connection between nutrition, health, and food science. Apple Academic Press.
2. NIN (2017), Indian food composition tables.
3. Lindsay Allen and Bruno De Benoist (2006). Guidelines for food fortification with micronutrients WHO-FAO library of congress catalogue .

### **COURSE VI- FOODPACKAGINGTECHNOLOGY**

**Course outcome:** To relate the properties of food packages to conversion technologies, processing and packaging technologies and user requirements including safety, convenience and environmental issues.

**Preamble:** To acquaint the students with detail knowledge of modern technology involved in food packaging and their applications.

**Pedagogy:** PPT, OHP, class discussions, demonstrations, packaging material demonstration, assignments, visits

#### **Course content:**

1. **Food packaging** - Need and role in extending shelf life of foods. Design and testing of package materials, package performance. Principles in the development of safe and protective packing, safety assessment of food packaging materials.
2. **Food packaging systems, product characteristics and package requirements:** Different forms of packaging such as rigid, semi-rigid, flexible forms and different packaging system for: (a) dehydrated foods (b) frozen foods (c) dairy products (d) fresh fruits and vegetables (e) meat, poultry and sea foods.
3. **Types of packaging materials** (metals, glass, paper and plastics), their characteristics and uses. Paper: pulping, fibrillation and beating, types of papers and their testing methods.  
Glass: composition, properties, types of closures, methods of bottle making;  
Metals: Tinplate containers, tinning process, components of tinplate, tin free steel (TFS), types of cans, aluminum containers, lacquers;  
Plastics: types of plastic films, laminated plastic materials, co-extrusion.
4. **A. Package accessories and advances in packaging technology** (active packaging, modified atmosphere packaging, aseptic packaging, and packages for microwave ovens, biodegradable plastics, edible gums and coatings).  
**B. Packaging equipment and machinery:** Vacuum, CA and MA packaging machine;

gas packaging machine; seal and shrink packaging machine; form and fill sealing machine; aseptic packaging systems; retort pouches, bottling machines; carton making machines, package printing.

### **References:**

Robertson, G. L. (2016). Food packaging: principles and practice. CRC press.

## **COURSE VII- NUTRITION TRANSITION IN INDIA**

**Course outcome:** To apply the concepts of nutritional sciences in clinical interventions, communication for health promotion, food service management, food science and processing.

**Preamble:** To enable the students to learn the methods of assessing human nutritional needs and the impact of transitions in dietary habits and lifestyle and its impact on non-communicable disease trends in the Indian scenario.

**Pedagogy:** PPT, OHP, class discussions, assignments, survey.

### **Course content:**

- 1. Transitions in India-** Socio-economic, Demographic, Health and Nutrition transitions. Demographic transitions in major Indian states, impact of urbanization, link between fetal malnutrition to emergence of chronic disease.
- 2. Nutrition Transition-** definition, stages of transition, key drivers, dietary profiles (urban-rural differences), Double and Triple burden of Malnutrition, Dietary and lifestyle changes- changing trends in consumer preference. Link between ultra-processed food intake and prevalence of nutrition-related non-communicable diseases.
- 3. Nutrition related non-communicable diseases-** Prevalence and Risk factors for NCD's - Diabetes, Hypertension, Cancer, Osteoporosis, Cardiovascular diseases, Obesity, Childhood obesity. Urban- rural differences in NCD risk. Prevention of NCDs- National and International initiatives.
- 4. Classic studies on Nutrition transitions in India-** Objectives and study design-
  - A.** Chennai Urban Rural Epidemiologic Study (CURES)
  - B.** Prospective Urban Rural Epidemiology (PURE)
  - C.** Jaipur Heart watch study (JHW)

### **References**

1. Manay, N. S. O. (2001). Food: facts and principles. New Age International.
2. Mann, J., & Truswell, S. (2012). Essentials of human nutrition. Oxford University Press.
3. Mary Earle & Richard Earle., Food Product Development: Maximizing Success., CRC, Woodhead Publishing Ltd., 2001
4. Mary Kay Mitchell. (2015). Nutrition across the life span. MEDTECH, Scientific international Pvt ltd.
5. Nnakwe, N. (2012). Community nutrition: planning health promotion and disease prevention. Jones & Bartlett Publishers.

## **COURSE VIII- PROJECT WORK**

### **Course content**

The candidate will select a topic under the guidance of a faculty, develops a research plan in Food science, Community nutrition, Clinical or Experimental nutrition. The formative research plan comprising of topic selected, related review of literature, objectives and study design shall be presented for approval. At the end of the semester, this proposal shall be submitted for evaluation.

Note: It is mandatory that students opting for this soft core in III semester will continue with the Part II in IV semester. Allotment of candidates is subject to availability of faculty.

## **OPEN ELECTIVE PAPER FOR OTHER STUDENTS**

### **COURSE IX- CULINARY SCIENCE - PRINCIPLES AND TECHNIQUES**

**Course outcome:** Apply principles from the various facets of culinary science and related disciplines to solve practical, real-world problems.

**Preamble:** To learn culinary terminology knowledge as described to food products.

**Pedagogy:** PPT, OHP, class discussions, demonstrations, product development practical

**Course content:**

#### **Introduction to cookery, culinary history, aims and objectives of cooking**

- 1. Food ingredients and their nutritional value** – Bulk/staple foods, (cereals, legumes, fruits and vegetables, eggs, fish and marine foods, milk and milk products) fats and oils, spices, flavoring agents, additives, beverages.
- 2. Methods of cooking** – Pre-processing of foods, cooking, roasting, frying, grilling, baking, boiling, microwaving, solar, infra-red cooking.
- 3. Principles of cooking and role of food components** – using specific examples for different types of foods such as Cereal and legume based dishes. Preparation of gravies and curries, Spices and flavoring ingredients, baked products, Egg cookery, meat and fish Indian sweets and snacks, Preserved products.

#### **Practical Sessions**

##### **Demonstration and preparation of common recipes**

1. Cereal based products: Wheat products – Chapathi, poori, upma. Rice dishes and fermented foods
2. Food Accompaniments: Cooking of legumes, dhals, and vegetables Preparation of gravies and curries.
3. Appetizers, sweets and snacks Soups and puddings, Indian sweets and snacks Baked products
4. Animal foods and preserved products, Egg cookery, Cooking of meat and fish, Preparation of preserved products.

#### **References**

1. Damodaran, S., Parkin, K. L., & Fennema, O. R. (Eds.). (2007). Fennema's food chemistry. CRCpress.
2. Earle, R., & Anderson, A. (Eds.). (2001). Food Product Development: Maximizing success. CRC Press.

## **FOURTH SEMESTER**

### **HARD CORE**

#### **COURSE – I: PRODUCT DEVELOPMENT AND ENTREPRENEURSHIP**

##### **Course Outcomes**

Students will be able to apply marketing and advertising principles to describe consumer behaviour in food selection.

##### **Preamble**

To describe techniques that can be used to monitor quality of raw ingredients and final products & learn marketing techniques.

##### **Pedagogy**

- PPT, OHP, Class Discussion, Assignment, Practical demonstration.

##### **Course Content**

###### **1. Product Development**

- A. Designing new product – types and drawing forces
- B. Need for product development
- C. Stages of product development
- D. Consumer research
- E. Role of sensory evaluation in consumer product acceptance.

###### **2. Sensory evaluation of foods**

- A. Importance, need and application for product formulation
- B. Basic tastes, threshold tests for basic tastes,
- C. Sensory panel, type, selection and training,
- D. Types of sensory tests- Subjective and objective sensory evaluation,
- E. Instruments used for sensory attributes – color, texture, flavor and odor.

- 3. Consumer Behavior & Marketing:** Factors influencing food purchases, product acceptance, purchasing trends. Changing food trends.

- 4. Special food processing technologies and novel food ingredients** – Membrane technology (reverse osmosis and ultra-filtration), agglomeration, agitation, air classification, extrusion, automation in food industries.



5. **Entrepreneurship** - Starting and managing an enterprise - Steps in preparing a business plan, Components of management, Developing managerial skills, Managing a food industry. Qualities of an entrepreneur

### **Practical Sessions**

1. Sensory analysis: Different types of sensory tests for basic tastes and sensory attributes of products.
2. Project on different sensory techniques and responses utilizing prepared food products, analysis and presentation of sensory data.
3. Stepwise development of a new food product, standardization, acceptability studies and submission of project report.
4. Survey on types of convenience foods / consumer behavior / analysis of food labeling.

### **References:**

1. Earle, R., & Anderson, A. (Eds.). (2001). Food Product Development: Maximizing Success. CRC Press.
2. Fuller, G. W. (2016). New food product development: from concept to marketplace. CRC Press.
3. Gordon W Fuller., (2004) New Food Product Development: from Concept to Marketplace,
4. HalMacfie, (2007) Consumer- led food product development, CRC.
5. Mary Earle &Richard Earle., Food Product Development: Maximizing Success., CRC, Wood head PublishingLtd.,2001

## **COURSE – II: ADVANCES IN NUTRITIONAL SCIENCE**

### **Course Outcomes**

On completion candidate will demonstrate critical understanding of key concepts and potential applications in the field of nutritional sciences, nutrigenomics and personalised nutrition.

### **Preamble**

To learn the advanced topics in nutritional sciences focusing on the most recent nutrition research and current topics in the media as well as emerging nutrition related issues. To study the nutrient needs in extreme environment.

### **Pedagogy**

- Teaching, PPT, OHP, Class Discussion, Assignment.

### **Course Content**

1. **Preclinical and clinical research methods in Nutrition** – Preclinical research (*in vitro*, *ex vivo* and animal studies). Clinical - Cross sectional Longitudinal, Retrospective,

Prospective, cohort studies etc. CONSORT Model, Clinical Trials Registry of India, Ethics in research.

2. **Nutrition and brain development** – critical periods of brain and cognitive development, maternal status and brain development, role of macronutrients in general and specific nutrients – Long chain PUFA, omega 3 fatty acids, antioxidants, nutrient interactions, nutrient supplementation.
3. **Nutrition and work performance** – Relationship between nutrition, physical fitness and work capacity. (Anaerobic and aerobic capacity) Energy expenditure and Nutrient demands.
4. **Nutrition for Space, Mines, Underwater** – Introduction - Environmental challenges - Changes in body composition – Changes in nutritional intake – Nutritional requirements – Special diets – Designer foods.
5. **Nutrition and Infection** – Introduction, patho-physiology of immune response to infection - nutritional modulation of immune function – malnutrition and immune competence – nutrients of importance – metabolic consequences of infection – altered nutritional requirements – nutrient recommendations – Immuno-nutrition for the critically ill
6. Recent concepts in Human Nutrition:–
  - A. Nutrigenomics- Definition (nutrigenomics, metabolomics, proteomics, pharmacogenomics and transcriptomics), nutrient-gene interactions, nutrigenomics and non-communicable diseases, impact of nutrigenomics – nutrition research, nutrition therapy, food industry and nutrition policy
  - B. Fetal origins of adult disease – nutritional basis and genetic link – intrauterine nutrition- birth weight, maternal nutrition, Barker's hypothesis.
  - C. Gut microbiome- definition, gut microbes, their metabolites and influence on human health and disease, fecal transplantation.

## References

1. Bemadette. M. Marriott and Sydne J Carlson, Nutritional needs in cold and high altitude environments.
2. Eldon W Askew, Cold weather and high altitude nutrition- overview of the issues
3. Yoshinori Mine, Kazuo Miyashita, Fereidoon Shahidi.(2009). Nutrigenomics and proteomics in health and disease, Food factors and Gene Interactions, Wiley-Blackwell.
4. Sari Edelstein and Judith Sharlin (2009). Essential of life cycle nutrition evidence based approach Jones and Bratlett Publisher.
5. Caballero, B. (2012). Encyclopedia of human nutrition. L. H. Allen, & A. Prentice (Eds.). Academic press.
6. Debra AK and Penny NK.(1996). Nutrition in women's health
7. Mark L and Tony W (2008). Public health nutrition from principles to practice, Library of congress cataloging, First south Asian edition.
8. Bao, Y., & Fenwick, R. (Eds.). (2004). Phytochemicals in health and disease. CRC Press.
9. Nelms, M., & Sucher, K. (2015). Nutrition therapy and patho physiology. Nelson

Education.

10. Doug kechinjan, Optimizing nutrition for performance at altitude- A literature review

## **COURSE – III: DIET IN DISEASES**

### **Course Outcomes**

Acquire skills to develop appropriate medical nutrition therapy for specific disease states and provide the appropriate intervention, including calculating and defining diets.

### **Preamble**

To identify the patho-physiology of diseases and how they relate to nutrition.

### **Pedagogy**

- Teaching, PPT, OHP, Class Discussion, Assignment, case studies

### **Course Content**

1. **Overweight & Obesity**- classification, causative factors (behavioral risk factors), overview of approaches to treatments and interventions.
2. **Cardiovascular disease** -etiology, incidence, symptoms, long-term and short-term treatment in coronary disease (myocardial & cerebral infarction), congestive heart failure and hypertension.
3. **Diabetes**- Etiology, symptoms, classification, Metabolism, nutrition therapy (OHA and Insulin), prevention, monitoring criteria. Short term and long term complications and management.
4. **Diseases of Liver, Gall bladder & Pancreas**-Hepatitis, (A, B, and C), Cirrhosis, alcoholic liver disease, Gall stones, pancreatitis, pancreatic surgery- Causes, Prevention and dietary management.
5. **Renal disease** - Nephrotic syndrome, Acute and Chronic renal failure- diagnostic procedures and principles of dietary management. Dialysis, medical nutrition therapy.
6. **Gastrointestinal diseases/disorders** –Gastro-oesophageal reflux and esophagitis, Gastritis and Peptic ulcer. Characteristics of and comparison of the stomach and duodenal ulcers. Diagnostic tests for mal-absorption, sprue and tropical sprue, diarrhoea, constipation, diverticular disease, IBD and IBS.
7. **Cancer, HIV/AIDS**: Diagnosis, role of dietary factors in cancer incidence, metabolic effects of cancer, Nutritional implications of cancer therapy, Nutritional management. Stages of HIV infection, Medical and nutritional therapy, Nutrition impact symptoms – diarrhea, mal-absorption, disorders of oral cavity.
8. **Case studies** – Select any two conditions and collect patient's details and feeding care offered in hospital.

### **References**

1. Cresci, P. D. (Ed.). (2015). Nutrition support for the critically ill patient: A guide to practice. CRC Press.

2. Escott-Stump, S. (2008). Nutrition and diagnosis-related care. Lippincott Williams & Wilkins.
3. Gopalan C and Shetty P.(1998). Diet nutrition and chronic disease – An Asian perspective Smith-Gordon-Nishimura.
4. Mahan, L. K., & Raymond, J. L. (2016). Krause's food & the nutrition care process. Elsevier Health Sciences.
5. Mark L and Tony W (2008). Public health nutrition from principles to practice, Library of congress cataloging, First south Asian edition.
6. Robinson, Lawler: Normal & Therapeutic Nutrition (17th ed.) Macmillan Publishing Co.
7. Robinson. HC et al., (1986) Normal and therapeutic nutrition (17th edition), Macmillan publishing company.
8. Shills and Young. Modern Nutrition in Health and Disease
9. Thibodeau, G. A., & Patton, K. T. (2010). Human body in health & disease. Mosby/Elsevier.

## **SOFT CORE**

### **COURSE – IV:PROJECT WORK-Part II**

#### **Course Content**

The work planned in III semester will be undertaken by student under the guidance of an advisor. The research should be submitted at the end of semester in the form of a thesis. The project work can be undertaken at University departments, affiliated research institutions, quality control laboratories, food industries or other institutions with prior approval.

### **COURSE – V: NUTRITION ANDPHYSICALFITNESS**

#### **Course Outcome**

They will be able to work as a fitness coach.

#### **Preamble**

To learn to classify physical activities based on frequency, intensity, and type.

#### **Pedagogy**

- Teaching, PPT, OHP, Class Discussion, Assignment.

#### **Course Content**

Definition and benefits of fitness, components of fitness, cardio respiratory fitness, Factors influencing health and well being.

1. Overview of factors influencing-
  - A. Food intake : Food habits, food fads and fallacies, their influence on health and

wellbeing

**B.** Health issues in athletes - sports anemia, bone density, micronutrient deficiencies.

**2.** Approaches to the management of fitness and health.

**A.** Diet and exercise - Effect of specific nutrients on work performance and physical fitness.

**B.** Fuel and other nutrients that support physical activity (metabolic pathways)

**C.** Mobilization of fuel stores during exercise. Importance of carbohydrate loading.

Fluid and electrolyte balance fluid requirements, losses, heat stroke, fluid/electrolyte replacement

**3.** Ergogenic aids - dietary supplements, use of permissible supplements, Sports drinks, beverage choices. Regulatory aspects (FSSAI).

### **Reference**

1. Berning, J. R., & Steen, S. N. (2005). Nutrition for sport and exercise. Jones & Bartlett Learning.
2. Campbell, B. I. (2013). Sports nutrition: enhancing athletic performance. CRC Press.
3. Fink, H. H., Fink, W. S. L. H. H., & Mikesky, A. E. (2013). Practical applications in sports nutrition. Jones & Bartlett Publishers.

## **COURSE – VI: STORAGE AND HANDLING OFFRESHPRODUCE**

### **Course Outcome**

- Understand technologies of post-harvest technology and its role in providing better quality produce to the consumer.
- Understand importance of prevention of losses.
- Learn storage and cold chain management, quality control, various standards required for domestic and export market.

### **Preamble**

- It familiarizes with different aspects of post- harvest technology and recent developments that have taken place in this field.
- Student will be made aware of the technological changes that are occurring in this field

### **Pedagogy**

Teaching, PPT, OHP, Class Discussion, Assignment.

### **Course Content**

**1. Storage and handling of food grains.**

**A.** Food grains and their characteristics, Commercial importance of grains, and standards for food grains.

- B. Marketing and handling of grains, cleaning, grading, weighing, conveying equipment, and mechanical conveyers. Grain sampling, segregation, moisture migration. Moisture determination – drying and aeration.
  - C. Insects and mites of food grains - types, and control measures [storage facility, warehousing practices, physical, chemical, biological, and other methods of insect control]
  - D. Storage structures of grains.
- 2. Storage and handling of fruits and vegetables** - Vegetables as living products- Respiration and heat production.
- A. Harvesting practice and equipment, Preparation for market, Shipping containers and Consume rpackage.
  - B. Commodity requirements – leafy vegetables, unripe fruits, ripe fruits, underground structures
  - C. Treatment prior to shipment and storage, Ventilated storage, refrigerated storage Transportation by Rail, Highway, Air and Sea
  - D. Market disorders, physical injuries and diseases of fruits and vegetables Protection during wholesale and retail distribution.
- 3. Storage and handling of milk and milk products**
- A. Milk - sources, contamination, chemical composition, keeping quality, grading of milk, microbiology of milk and its products.
  - B. Milk products – Butter, cheese, curds, fermented dairy products. Spoilage and preservation of dairy products.
  - C. Microbial changes and types of spoilage – souring, gas formation, proteolysis, ropiness, alkali production, changes in butter fat, flavor changes, colour changes.
  - D. Preservation techniques – pasteurization, UHT, cooling, chilling and freezing, use of preservatives – added and developed.
- 4. Storage and handling of poultry, flesh and marine foods.**
- A. Poultry- meat and eggs: spoilage, quality tests, packaging and transportation
  - B. Meat – Classes of meat, spoilage of fresh and cured meats, types of spoilage, aerobic and anaerobic. Sources of contamination, control measures – hygiene, biological control, use of antibodies, ionizing radiations. Packaging of meat.
  - C. Fish – Characteristics, appearance, chemical composition, spoilage, enzymic, microbial and chemical action. Transportation – by sea, rail, railroad container, mechanical refrigerators, cars, packing fresh fish and frozen fish. Refrigeration and freezing of fish and other shellfish.

## References

1. Lloyd Ryall A and Pentzer WT (2017). Handling transportation and storage of fruits and vegetables, Medtech scientific international pvt limited (Vol 1 &2)
2. Khader V Textbook on food storage and preservation. Kalyani

## COURSE – VII:FOOD BIOTECHNOLOGY

### Course Outcome

The course will enable the student to understand and apply the principles and current practices of processing techniques and the effects of processing parameters on product quality.

### **Preamble**

- To study the principles and application of biotechnology in food production.
- Understand the principles of fermentation processes to make a food product safe for consumption.

### **Pedagogy**

Teaching, PPT, OHP, Class Discussion, Assignment.

### **Course Content**

1. Historical perspective of biotechnology and fermentation technology, Branches of biotechnology, Global scenario, use of biotechnology in food processing, agriculture and pharmaceutical field. Types and mechanism of fermentation, effect on nutritional value, health benefits. Single cell protein- production, importance and its application.
2. Genetically modified foods - Need for GM foods – The food challenges, DNA recombinant technology, cell and tissue culture (plant and animal), Potential benefits in agriculture, Crop engineered for input and output traits, nutritional improvement, animal foods, issues of concern, tests for detecting GM foods, safety of GM foods.
3. Technology for production of alcoholic beverages- Manufacturing of wine, beer, whisky, brandy, neutral spirits etc- Raw materials, processing, storage and packaging.
4. Microbial fermentation of Indian Traditional foods-
  - A. Cereal and legume based products, traditional and yeast leavened products-role of leavening, manufacturing of bread, sour dough, rye bread, kulcha, naan, bhatura.
  - B. Vegetables and fruits – lactic acid fermentation – principles, difference processes of lactic acid fermentation, factors affecting lactic acid fermentation, products based on lactic acid fermentation.
  - C. Milk products – yoghurt, butter- milk, cheese: general requirements for fermented milk product production and factors affecting the quality of product.
  - D. Meat and fish- fermentation and drying procedures, starter cultures, processing steps, sensory quality and physical properties.

### **References**

1. Byang. H Lee (2014), Fundamentals of Food Biotechnology, John Wiley and sons
2. Lloyd Ryall A and Pentzer WT (2017). Handling transportation and storage of fruits and vegetables, Medtech scientific international pvt limited (Vol 1 &2).

### **OPEN ELECTIVE**

## **COURSE – VIII: FOODS IN INDIAN TRADITION**

### **Course Outcomes**

- Comprehend the importance and benefits of traditional meal and
- Understand traditional methods of food processing and their benefits and hazards including the types of ethnic meals and their health benefits.

### **Preamble**

- Explain similarities and differences between the cuisines of different regions of India.
- Describe the Indian method of serving a meal.

### **Pedagogy**

- Teaching, PPT, OHP, Class Discussion, Assignment, Practical demonstrations

### **Course Content**

1. History of Indian foods - Ancestral legacies, Food and culture, Indian food ethos.
2. Traditional Indian Dietary patterns and Indian ethnic cuisines
3. Nutritional/medicinal quality of traditional foods - Traditional food beliefs, foods in Ayurveda.
4. Traditional food processing technologies.

### **References**

1. Rhee S.R Lee J & Lee C (2011). Importance of lactic acid bacteria in Asian fermented foods, Microbial cell factors.10 (suppl):89-101.



### **Course outcomes.**

- It equips the beneficiaries with the latest knowledge in the respective science and understands the wider horizons of nutrition.
- Registered Dietitians are indispensable providers of food and nutrition services all over the world; keeping this in mind the syllabus provides speculative knowledge for registered dietitian examination.
- Inculcates the urge for research.

### **Preamble:**

- This program intends to produce competitive Dietitians and Nutritionists in various relevant fields including public health service it also focuses on producing committed dietitians with the skill in dealing with the community and the critically ill patients at hospitals and manage the patient's symptoms with nutritional support through nutritional intervention which requires personalized calculation for every clinical presentation
- Develop socially committed dietitians with the skill in dealing with the community.
- Basic Life Support practical session equips one with the knowledge and skills to handle an emergency situation.

### **Pedagogy**

- Teaching- PPT, and OHP presentations
- Assignment: To conduct case studies on patients at hospitals and to carry research projects. This exposure will help them to learn practically how to deal with the patients clinic presentations

## **COURSE CONTENT II SEMESTER**

### **COURSE 1: FOOD SCIENCE AND FOOD PROCESSING- II**

[Common paper]

### **COURSE 2: VITAMINS IN NUTRITION**

[Common paper]

### **COURSE 3: MINERALS IN NUTRITION**

[Common paper]

### **COURSE 4: HUMAN PHYSIOLOGY**

#### **Course outcome:**

Apply concepts and knowledge of the general terminology, cell structure and function, histology, gross anatomy and physiology related to the diseases/ clinical scenarios

**Preamble:** To introduce concepts in Human Physiology and functions of the various systems of the human body.

**Pedagogy:** Teaching, PPT, and OHP presentations, group discussions

**Course content:**

1. **Cell physiology-** structure and function of cell and its components, review of cell membrane transport systems. Structure and function of bone, cartilage and connective tissue. Types of muscles, structure and function.
2. **Digestive system:** structure and function of organs of GI tract, digestion and absorption of food. Role of enzymes and hormones on digestion and absorption.
3. **Circulatory and cardiovascular system:** Blood and its composition, function, blood coagulation and blood groups, use of blood indices for diagnosis. Structure, function of heart and blood vessels, regulation of cardiac output and blood pressure. Pulmonary and systemic circulation.
4. **Respiratory system:** review of structure and function, role of lungs in exchange of gases, transport of O<sub>2</sub> and Co<sub>2</sub>, role of hemoglobin and buffer systems.
5. **Nervous system:** Peripheral and autonomic nervous system, structure and function of neuron, conduction of nerve impulse, synapse
6. **Renal system:** organs in the urinary system, formation of urine, Role of kidney in maintenance of pH of blood, acid-base and fluid balance.
7. **Endocrine system:** endocrine glands ( pituitary, thyroid, parathyroid, islets of Langerhans, adrenals, ovary and testis,) functions, regulation of hormone secretion, symptoms of deficiency and excess secretion
8. **Immune system:** cell mediated and humoral immunity, immune response. Role in inflammation and defense.

**PRACTICAL – BLOOD AND URINE ANALYSIS**

- a) Collection and storage of biological samples for clinical use. Commonly used tests for diagnosis of various diseases (CVD, diabetes, renal failure, hypo and hyper thyroidism, TB, typhoid, HIV and cancer) and their interpretation (Indices will have to be calculated using analyzed values of each student for interpretation)

- b) **Blood and urine analysis:** i. Total blood count including ESR, ii. Total serum proteins and their fractions. iii. Blood glucose (GTT), (Fasting and post-prandial), iv. Serum lipid fraction – Cholesterol, triglyceride, LDL and HDL, v. Blood urea, vi. Serum calcium. (GTT to be conducted at any clinic/hospital)
- c) **Urine:** Creatinine, Glucose and protein(albumin).

## REFERENCE

- Guyton. Human physiology and mechanism of disease. W.B.Saunders Company
- Mahan, L. K., & Raymond, J. L. (2016). Krause's food & the nutrition care process. Elsevier Health Sciences.
- Nelms, M., & Sucher, K. (2015). Nutrition therapy and pathophysiology. Nelson Education.
- Shills and Young. Modern Nutrition in Health and Disease
- Waugh, A., & Grant, A. (2010). Ross & Wilson anatomy and physiology in health and illness. Elsevier Health Sciences.

## SOFT CORE

### COURSE 5: NUTRITIONAL EPIDEMIOLOGY

[Common Paper]

### COURSE 6: NEUTRACEUTICALS AND FUNCTIONAL FOODS

[Common Paper]

### COURSE 7: SPORTS NUTRITION

**Course outcome:** Students will understand the concept of fitness and basic terminologies and nutritional guidelines/ recommendations for fitness and sports

**Preamble:** To provide students the basic knowledge of significance of fitness and sports in maintaining health & nutritional supplements

**Pedagogy:** Teaching, PPT, and OHP presentations and assessment of nutritional status of sports persons

#### Course content:

1. **Approaches to the management of fitness and health:** Nutrition, exercise, physical fitness and health- their inter relationship. Significance of physical fitness and nutrition in prevention and management of weight control regimes. Nutrition guidelines for maintenance of health and fitness.
2. **Nutritional requirements of exercise:** Effect of specific nutrients on work performance and physical fitness. Nutrients that support physical activity, Mobilization of fuel stores during exercise. Fluid requirements.
3. **Nutrition in sports:** Sports specific requirements- Importance of carbohydrate loading, pre-game and post-game meals, Diets for persons with high energy requirements, stress, fracture and injury

4. **Dietary supplements and Ergogenic aids:** Definitions, Use of different nutrigenic / ergogenic aids and commercial supplements, Sports drinks, sports bars etc

**REFERENCE:**

1. Berning, J. R., & Steen, S. N. (2005). Nutrition for sport and exercise. Jones & Bartlett Learning.
2. Campbell, B. I. (2013). Sports nutrition: enhancing athletic performance. CRC Press.
3. Fink, H. H., Fink, W. S. L. H. H., & Mikesky, A. E. (2013). Practical applications in sports nutrition. Jones & Bartlett Publishers.
4. Ssgt Doug kechinjan, Optimizing nutrition for performance at altitude- A literature review

**COURSE CONTENT - III SEMESTER**

**HARD CORE**

**COURSE 1 - PRINCIPLES OF DIET THERAPY**

**Course outcome:** Develop competence in the skills of assessment, planning, management and evaluation of food service, nutrition and dietetic services in institutional food, community nutrition, and clinical dietetics

**Preamble:** To study the principles of therapeutic nutrition needs of adults and children and design appropriate dietary plans based on individual and group needs.

**Pedagogy:** Teaching- PPT, and OHP presentations, case studies and visits to hospitals

**Course Content**

**1 Introduction to clinical nutrition and dietetics:** definition and history of dietetics, Interrelationship between food, nutrition and health. Factors affecting food choices. Concepts of a desirable diet for optimum health. Rationale for nutritional support in an institution, the food guide.

**2. Role and responsibility of dieticians:** Factors in patient care, team approach in patient care, psychological considerations, interpersonal relationships with patients, importance of nutrition education, medical ethics, Hospital dietary-scope and importance, types of food service, quality management.

**3. Nutrition Care Process (NCP)-** Nutritional assessment, - History taking, Nutrient intake analysis, anthropometry, usefulness of nutrition laboratory data, assessment of protein – energy status, Nutrition counseling: definition, concept, role of clinical dietician, the recipient and counseling environment and goals of counseling.

**4. Basic principles of planning a normal diet-** characteristics of normal diet, meeting nutrient requirement of individuals family and institutions, applications of dietary guidelines for the community, interrelationship between food nutrition and health, factors affecting food choices and regulation of food intake- hunger, satiety and role of neurotransmitters.

#### **5. Objectives of diet therapy**

**a) Regular diet and rationale for modifications** in energy and other nutrients, texture, fluid, soft diets. analysis of dietary intake , Food and nutrient delivery .

**b) Enteral and parenteral feeding:** principles, types, methods of administration, monitoring and complications

#### **6. Dietary principles and management for special conditions:**

a) Protein and energy malnutrition (hospital and domiciliary treatment) Nutrient deficiencies–Vitamin A, iodine, iron, osteoporosis.

b) Children with special needs- preterm infants, Cerebral palsy, Athetoids , Spastics, Cleft palate, Mental retardation

c) Food allergy and food intolerance- Definition, etiology, food allergens, symptoms and diagnosis of food allergies, nutritional management- restricted diets, elimination diets and hypo- sensitization

d) Febrile diseases –classification of fevers, metabolism, general dietary considerations, diet in typhoid and tuberculosis

e) Nutrition in dental conditions – Nutritional factors in tooth development: dental caries, pathophysiology and dental decay, factors affecting carcinogenicity of foods, role of fluoride in tooth development, preventive care.

### **COURSE 2 - CLINICAL NUTRITION & DIETETICS –I**

**Course outcome:** Acquire skills in planning and preparation of therapeutic diets for various disease conditions

**Preamble:** Acquire knowledge about the pathophysiology of diseases, changes in nutrient metabolism

**Pedagogy:** Teaching- PPT, and OHP presentations, case studies and visits to hospitals

#### **Course Content**

##### **1. Medical nutrition therapy for Upper and Lower gastrointestinal disorders (Pathology, etiology, symptoms and management):**

a) Disorders of the Esophagus, Gastro-esophageal reflex and esophagitis (GERD)

b) Disorders of stomach- indigestion, dyspepsia, gastritis, Peptic ulcer, gastroparesis.

c) Disorders of small and large intestine: malabsorption syndrome (sprue, ulcerative colitis, Crohn's disease, inflammatory bowel disease, irritable bowel syndrome, Sprue, Diarrhea, Constipation, Diverticulosis and Diverticulitis, Hernia, Hemorrhoids, short bowel syndrome, Fistula, Intestinal ostomies.

2. **Medical nutrition therapy in pulmonary diseases (Pathology, etiology, symptoms and management):**  
Acute (pulmonary aspirations pneumonia, pulmonary failure, acute respiratory distress syndrome) and Chronic pulmonary disorders, (Bronchopulmonary dysplasia, cystic fibrosis, tuberculosis; Bronchial asthma, chronic obstructive pulmonary disease (COPD), effect of lung diseases on nutritional status.
3. **Medical nutrition therapy in Rheumatic disorders:** Osteo arthritis, rheumatic arthritis, scleroderma, systemic lupus erythematosus Gout-: Treatment, prevention
4. **Medical nutrition therapy in Hepatobiliary and pancreatic disorders (Pathology, etiology, symptoms and management):**
  - a) Liver function tests, Hepatitis (A,B,C, Fulminant,) alcoholic liver disease and cirrhosis, non-alcoholic steatohepatitis, cholestatic liver disease, End stage liver disease and complications, inherited disorders (Wilson's disease, alpha-antitrypsin, hameochromatosis).
  - b) Cholecystitis, Cholelithiasis, cholangitis.
  - c) Acute and chronic pancreatitis, functional tests and dietary management.
5. **Medical nutrition therapy in Neurologic disorders (Pathology, etiology, symptoms and management):**  
[Epilepsy, Migraine, Alzheimer's, Parkinson's, hemorrhagic stroke, Myasthenia gravis], pathogenesis, causes of malnutrition, Feeding issues and strategies.
6. **Nutrition in thyroid and adrenal disorders(Pathology, etiology, symptoms and management):** Thyroid physiology, assessment of thyroid disorders, dietary management in hypo and hyperthyroidism, Cushing syndrome, Addison's disease, adrenal fatigue. Note: Pathology, etiology, symptoms and management of each disease to be covered
7. **PRACTICALS**
  1. Menu planning, food selection, planning and preparation of related dietary modification
  2. Medical terminology and interpretation
  3. Prepare counseling aids.
  4. Visit to the hospitals-learn to use medical record to obtain required information.
  5. Development of NCP for specific disease
  6. Food exchange list and application
  7. Introduction to case studies Description of the task – Apply the components of nutrition care process - includes interpretation of an individual's anthropometric measures, biochemical data, history, and dietary intake followed by writing a nutrition diagnosis, identifying nutritional goals of management and formulation of nutritional intervention and monitoring strategies.

## REFERENCES

1. Ruth M DeBusk , Nutrigenomics : The foundation for individualized nutrition, 168-171 36. Sari Edelstein and Judith Sharlin (2009). Essential of life cycle nutrition evidence based approach Jones and Bratlett Publisher.
2. Srilakshmi, B. (2007). Dietetics. New Age International.

3. Zimmermann, M. (2001). Burgerstein's Handbook of nutrition: micronutrients in the prevention and therapy of disease.
4. Gopalan C and Shetty P.(1998). Diet nutrition and chronic disease – An Asian perspective Smith-Gordon-Nishimura.
5. IDA.(2018).Clinical dietetics manual 2<sup>nd</sup> edition ELITE publishing house, New Delhi.
6. Mahan, L. K., & Raymond, J. L. (2016). Krause's food & the nutrition care process. Elsevier Health Sciences.
7. Nelms, M., & Sucher, K. (2015). Nutrition therapy and pathophysiology. Nelson Education.
8. Robinson, Lawler: Normal & Therapeutic Nutrition (17th ed.) Macmillan Publishing Co.
9. Robinson. HC et al., (1986) Normal and therapeutic nutrition (17th edition), Macmillan publishing company.
10. Shills and Young. Modern Nutrition in Health and Disease
11. Whitney, E. N., Cataldo, C. B., & Rolfes, S. R. (1998). Understanding normal and clinical nutrition . Wadsworth Publishing Company, Inc.

### **COURSE 3 - FOOD SERVICE MANAGEMENT**

**Course outcome:** Will enable to work in various types of food service institutions

**Preamble:** To impart knowledge of basic aspects of food service operations and management In hospitals and other food service institutions

**Pedagogy:** Teaching- PPT, and OHP presentations, visits to food service institutions such as hospitals, hotels and restaurants

#### **Course Content**

1. **Food service Institutions-** Definition and importance, various types of food service institutions like hospitals, school meals, hostels, industrial canteens, commercial hotel/ canteens etc. Institutions catering to different types of handicapped personnel.
2. **Theories about approaches to food service management**
3. **Developing objectives and goals-** Definition and importance, types of goals Policies, procedures and rules.
4. **Principles and procedures of management-** Managerial roles and responsibilities, the manager and leadership quality. Tools of management – organization chart, types, structure, function; work improvement techniques.
5. **Human resource management** – recruitment, training, placement, promotion, personnel records, work appraisals. .
6. **Material management** – Principles of quantity food purchase- selection, buying and

accounting of different foods. Inventory management- assessing requirements, receiving and release of stocks. Record maintenance.

7. **Quantity food preparation and service-** Factors in menu planning for large groups, systems for maintaining quality in food preparation and service. Menu planning, Selection, purchasing, receiving, storage and waste management. Maintenance of food supply records.
8. **Financial management** – Budgeting, costing and cost control, accounting.
9. **Hazards and safety standards in food service units**
  - a) Sanitation measures for Food, Personnel and Unit Hygiene, Training techniques for food service personnel in Sanitation.
  - b) Safety- causes of accidents, types and sources of contamination, 3 Es of Safety
  - c) Food laws - FPO, ISI, AGMARK, PFA, New Food Bill 2018
  - d) Quality standards-HACCP, ISO, NABH, licensing by FSSAI

#### **PRACTICAL SESSION**

\*Report submission (internal valuation)

1. Standardization of recipes- costing of recipes.
2. Survey of hostels and cafeteria to assess various aspects of food service management. Submit a report.

## **COURSES 4 - BIOSTATISTICS & ITS APPLICATION (COMMON PAPER)**

### **SOFT CORE**

## **COURSE 5 - NUTRITION IN EXTREME ENVIRONMENTS**

**Course outcome:** To be able to design foods for persons working in extreme environments to enhance work performance and minimize health problems

**Preamble:** To understand the role of nutritional requirements in extreme environmental conditions. To assess the nutritional status of scientists on space missions

**Pedagogy:** Teaching- ppt and OHP presentations,

### **Course Content**

**1.General Adaptive Mechanisms to Environmental Extremes:** Role of nutrition in successful acclimatization (physiological changes, nutrient requirement), cascade effect of environmental extremes, adverse metabolic consequences of adaptations, risk of various diseases due to adaptation (obesity, dehydration, and musculoskeletal disorders).

**2. Nutritional requirements in cold and high altitude:** Metabolic adaptations to heat, cold and high altitude. Changes in body composition, Circadian rhythm, management of IBW, nutrient needs (macro and micronutrients, fluid and electrolytes). Prevention of hypoxia through nutrition, nutrient -dense foods, Food choices.

**3. Nutritional requirements for space missions:** Physiological changes, assessment of nutritional status, exercise and bone loss during space missions. Space food system selection of food and beverages, nutrients of importance, designer foods, Food safety issues.



**4. Nutritional requirements in marine conditions:** Physiological changes, food storage and preparation facilities, sea sickness, Ready-to-eat rations, prevention of nutrient deficiencies, food supply for Indian navy

#### REFERENCES

1. Bemadette. M. Marriott and Sydne J Carlson, Nutritional needs in cold and high altitude environments 4. Berning, J. R., & Steen, S. N. (2005).
2. Nutrition for sport and exercise. Jones & Bartlett
3. Eldon W Askew, Cold weather and high altitude nutrition- overview of the issues

#### COURSE 6 - DRUG & NUTRIENT INTERACTIONS

**Course outcome:** Enables to identify the factors that promote drug nutrient interactions and suggest suitable strategies to prevent

**Preamble:** To understand the potential drug nutrient interactions and influence on clinical outcomes

**Pedagogy:** Teaching-using OHP and ppt presentations and assignments related to the topic

#### Course Content

1. **Drugs and pharmaceutical compounds-** natural and synthetic, use of excipient. Characteristics of drug action - Pharmaco-dynamics, pharmacokinetics, pharmaco genomics. Drug abuse and drug resistance.
2. **Mechanisms of interactions** – effect of drugs on ingestion, digestion, absorption, metabolism of nutrients and excretion. Effect on nutritional status, effect on organ function. Host and Drug / Nutrient factors – Host factors (age, body size, composition, genetics, lifestyle, underlying medical condition), Drug/Nutrient factors (dose, route and time of administration )
3. **Effects of Specific Foods and Dietary Components on Drug Metabolism** - effects of dietary composition, interactions between medication and milk, grape fruit and other fruit juices, antacids, anticoagulants, dietary supplements (eg., garlic, ginger, caffeine),to discuss evidence
4. **Interactions in Patients Receiving Enteral & Parenteral Nutrition** – factors contributing to interactions – enteral feeding site ( gastric, duodenal, jejunal), drug form. Parenteral - Co-infusion compatibility and stability, influence

#### REFERENCES

1. Boullata, J. I., & Armenti, V. T. (Eds.). (2004). Handbook of Drug' Nutrient Interactions. Springer Science & Business Media
2. Food-Drug interactions (chapter 16) Z.M Pronskey and Sr Jeanne, P Crowe Journals- Amer J Clin Nutr, Pharmacology, J American Dietetic association
3. Mann, J., & Truswell, S. (2012). Essentials of human nutrition. Oxford University

Press.

## **COURSE 7 - RESEARCH METHODS IN CLINICAL NUTRITION**

**Course outcome:** Will be capable of describing and evaluating the most appropriate research method in the field of experimental and clinical nutrition research

**Preamble:** To acquire skills to undertake systematic research in the area of food science and nutrition

**Pedagogy:** Teaching- ppt and OHP presentation and planning research studies

### **Course Content**

**1. Principles of research** – Introduction to research and evidence-based practice, scientific literature and peer-review process. Research problem: Definition, selection of research problem, Justification and Limitations. Hypothesis : Definition, sources, characteristics, importance, formation of hypothesis. Research terminologies - Subjects: control and experimental group. Placebo, placebo effect. Variables, correlation and validity. Formulation of research proposal.

### **2. Research methods** –

a. Descriptive: correlation, case-control, cross-sectional surveys,

b. Experimental : clinical/intervention trials, randomized controlled, single- blind and double blind,

c. Analytical studies : observational, case-control, cohort studies-retrospective and prospective. Sampling methods and sample size.

**3. Nutrition Intervention studies** – pilot study, randomized controlled trial, nutritional biomarkers.

**4. Regulations and guidelines-** Indian Good Clinical Practice guideline (GCP), Clinical Trials Registry of India (CTRI). Ethical guidelines of ICMR (risks and benefits, informed consent). Best practices for Food clinical trials.

### **REFERENCES**

Nutrition Research Methodologies Julie A. Editors- Lovegrove , Leanne Hodson , Sangita

Sharma 2015, Wiley-Blackwell

Foundations of clinical research: applications to practice (3rd ed.) by Leslie Gross Portney; Mary P. Watkins

Research: successful approaches in Nutrition and Dietetics by Linda Van Horn (Editor), Judith A Beto (Editor) 4<sup>th</sup> edition, 2019

## **COURSE 6 – PEDIATRIC& GERIATRIC NUTRITION**

**Course outcome:** Acquire skills to identify and manage the nutritional needs of high risk infants To address the nutritional needs of age related nutritional deficiencies and disorders

**Preamble:**

To understand normal paediatric nutrition and growth pattern, nutrition support in high risk infants

To learn the demographics of aging and its impact on physiological and metabolic changes in geriatric population

**Pedagogy:** PPT and OHP presentations, case studies and institutional visits, surveys

**Course Content**

**1. Nutritional assessment of pediatric patients:** Growth and anthropometric measurements, obesity assessment, assessment for malnutrition, nutrition requirements of infants, Nutritional management in growth failure and developmental disabilities. Preterm infants, Growth parameters and related complications. Nutrition needs and feeding of high risk infants. New born screening ( NBS) for genetic disorders, Nutrition support for inborn errors of metabolism (phenylketonuria, galactosemia, maple syrup disease, homocysteinuria).

**2. Nutritional management of preterm and low birth weight infants:** Parenteral and Enteral feeding protocol for high risk/preterm infants. Guidelines for Pediatric formula preparation. Factors affecting protein & energy requirement in critically ill, re-feeding syndrome. Nutritional management of Food hypersensitivities (Milk, egg, soybean, fish and wheat).

**3. Health status of the elderly:** Physiological changes in aging (CVD, endocrine, GIT, musculoskeletal, nervous, renal, respiratory, hepatic,), chronic health concerns and disease prevention, age related pharmacokinetic changes. Eating disorders, PEM, immune deficiencies. Health related Quality of life, specific exercises for general health

**4. Nutritional considerations of the elderly:** Food choices, Smell, taste and somato sensation, oral health, Swallowing problems and management, food safety, feeding strategies, indications for nutrition support, oral supplements ( dietary and commercial), Energy and nutrient intake, Enteral and Parenteral nutrition, home nutrition support.

**REFERENCES**

1. Ronni Chernoff. (2006).Geriatric Nutrition. The Health professional's handbook,3rd edition, Jones and Bartlett Publisher
2. Patricia Queen S, Kathy King H, Carol EL .(1999). Handbook of Pediatric nutrition 2nd edition Jones and Bartlett Publisher

**FOURTH SEMESTER**

**HARD CORE**

## **COURSE 1: CLINICAL NUTRITION AND DIETETICS-II**

**Course outcome:** Acquire skills in planning and preparation of therapeutic diets for various disease conditions

**Preamble:** Acquire knowledge about the pathophysiology of diseases, changes in nutrient metabolism

**Pedagogy:** PPT and OHP presentations, assignments, case studies

### **Course content:**

- 1. Medical nutrition therapy of renal disease:** functions of kidney, Diseases of the kidney- Nephritis, Nephrotic syndrome, Acute and chronic renal failure, stages of chronic kidney disease, Nutritional requirements in hemodialysis, transplant. Malnutrition in renal disease Nephrolithiasis (calculi) – types, dietary principles and prevention
- 2. Medical nutrition therapy of Cardiovascular diseases:** Role of specific nutrients in cardiac efficiency, CVD bio markers and interpretation. Metabolic syndrome, long-term and short- term treatment in Coronary disease. Myocardial infarction, cerebral infarction (atherosclerosis as one of the causative factor). **Other acute and chronic conditions:** congestive heart failure, hypertension, stroke, dyslipidemia (genetic hyperlipidemia).
- 3. Medical nutrition therapy in Obesity:** Interrelationships of NCD, Role of genetics, Regulation of body weight, –hunger, satiety, role of neurotransmitters. Hormones Weight management in adults - common problems, diet and physical activity, Childhood obesity and management, Prevention programs. Nutrition in Eating disorders.
- 4. Medical Nutrition therapy in Diabetes mellitus:** classification, therapy, diagnostic/monitoring criteria, long term and short-term management. Drugs in diabetes, calorie counting. Ketoacidosis, Hypoglycemia of non-diabetic origin.
- 5. Medical nutrition therapy in Cancer :** stages of cancer, Nutrition impact symptoms of cancer therapy. Management of Cancer cachexia. Palliative care.
- 6. Medical nutrition therapy in HIV:** classification, manifestations and stages of HIV. Opportunistic infections and complications, relationship between malnutrition and AIDS, Lipodystrophy syndrome. Dietary supplements and palliative care.

**NOTE:** Patho-physiology , incidence, symptoms of each disease condition to be covered in brief .

### **PRACTICAL SESSION-**

- 1. Identifying a specialty care unit:** diabetic clinic/ weight management center/health clubs/hospitals/nursing homes-select at least 3-4 patients
- 2. Case studies:**
  - a.** Obtaining Development of tools for assessment of in- patients and out

- patients. Screening of patients and interpretation of medical history.
- b. NCP, dietary prescription and counseling of patients with following conditions (a minimum of 2 to 3 cases to be taken up by each student). Obesity, diabetes mellitus (NIDDM and IDDM), hepatitis and cirrhosis, myocardial/cerebral infarction, renal failure, calculi and nephritic syndrome, fever- acute and chronic.
3. Preparation of enteral feeds and demonstration of different types of tube feeding
  4. Demonstration of an equipment to measure body composition.

## REFERENCES:

1. Advancing Dietetics and clinical nutrition Anne Payne, Helen Barker Churchill Livingstone publishers
2. Bao, Y., & Fenwick, R. (Eds.). (2004). Phytochemicals in health and disease. CRC Press.
3. Cresci, P. D. (Ed.). (2015). Nutrition support for the critically ill patient: A guide to practice. CRC Press.
4. Escott-Stump, S. (2008). Nutrition and diagnosis-related care. Lippincott Williams & Wilkins.
5. Gopalan C and Shetty P.(1998). Diet nutrition and chronic disease – An Asian perspective Smith-Gordon-Nishimura.
6. IDA.(2018).Clinical dietetics manual 2<sup>nd</sup> edition ELITE publishing house, New Delhi.
7. Mahan, L. K., & Raymond, J. L. (2016). Krause's food & the nutrition care process. Elsevier Health Sciences.
8. Nelms, M., & Sucher, K. (2015). Nutrition therapy and pathophysiology. Nelson Education.
9. Robinson, Lawler: Normal & Therapeutic Nutrition (17th ed.) Macmillan Publishing Co.
10. Robinson. HC et al., (1986) Normal and therapeutic nutrition (17th edition), Macmillan publishing company.
11. Shills and Young. Modern Nutrition in Health and Disease
12. Whitney, E. N., Cataldo, C. B., & Rolfes, S. R. (1998). Understanding normal and clinical nutrition . Wadsworth Publishing Company, Inc.

## COURSE 2: INTERNSHIP

**Course outcome:** Enable them to offer need-based nutrition therapy in various disease conditions

**Preamble:** Acquire skills in nutrition screening, diagnosis, planning and preparation of therapeutic diets in clinical setting

**Pedagogy:** 16 week hospital internship with various rotations to increase practice

complexity. Nutrition screening and assessment, case studies, Nutrition counseling and education

**Course content:**

1. Internship in hospitals or Food Service Institutions & Hospitals/Clinics
2. Submission of project work/report on case studies on a minimum of 10 patients in any disease condition
3. Report on internship will be evaluated as stated under project work regulations.

**SOFT CORE**

**COURSE 3: NUTRITION COUNSELING**

**Course outcome:** To use current information technologies to locate and apply evidence-based guidelines and protocols.

**Preamble:** To learn nutrition counseling skills and principles of NCP and disease specific counseling approaches

**Pedagogy :** PPT and OHP presentations, case studies and preparation of counseling tools

**Course content:**

1. **Foundation of Nutrition Counseling and education:** Definition, concept, history of nutrition counseling, Fundamentals of food behavior, Effective counseling relationship – characteristics of nutrition counselors, Understanding the client, the counseling environment
2. **Theories of nutrition counseling:** Theories influencing clients – Attitudes and beliefs about the counseling, self image, nutrition and health in general. Theories influencing counselors – Health belief model, Trans theoretical model (motivational stages), family therapy, social- cognitive theory and theory of planned behavior.
3. **Communication skills:** A. Essential skills – Active listening, Responding and making helpful interventions, B. Model of communication – interpersonal communication model, verbal and non verbal communication, listening, action, sharing and teaching responses.
4. **Systems approach to nutritional counseling:** (A) Components of the system–Assessment Diagnosis, Intervention, Monitoring and Evaluation. (B) Nutrition counseling model  
(C) General approach to counseling – Five A’s approach (D) Factors to be considered while counseling- Nutritional & health conditions, personal hygiene, psychological conditions, food allergies, aging and gender related problems.
5. **The counseling Interview:** Assessment of client’s readiness for change, Stages of change. Phases of a counseling interview-Involving, Exploration, Education, Resolving. Self-evaluation of the counselor.

6. **Nutrition counseling in the management of diseases/disorders:** Obesity, Diabetes mellitus, Renal diseases, Hypertension, Cardiovascular diseases, Liver Diseases and Cancer.
7. **Hands on experience:** Preparation of counseling aids for any two disease conditions and conduct counseling session.

**REFERENCE:**

1. Nutrition counseling and education skill development, By Kathleen Bauer and Liou, 3<sup>rd</sup> edition, Cengage Learning
2. Nutrition counseling skills for the Nutrition care process. By Linda Snetselaar, 4<sup>th</sup>edn, Jones and Bartlett Publishers
3. Ronni Chernoff. (2006). Geriatric Nutrition. Health professionals handbook, 3<sup>rd</sup> edition, Jones and Bartlett Publisher
4. Gable, J., & Herrmann, T. (2015). Counselling skills for Dietitians. John Wiley & Sons.

**COURSE 4: NUTRITION IN CRITICAL CARE**

**Course outcome:** They will be able to manage parenteral & enteral nutrition in ICU setup

**Preamble:** To assess the critically ill & calculate nutritional requirements

**Pedagogy:** PPT-OHP presentations and demonstration of enteral and parenteral feeding methods

**Course content:**

1. **Nutritional care of hospitalized patients-**Hospital malnutrition, impetus for improved Nutritional care of patients, nutritional screening, assessment of the critically ill. Preparation of nutritional care plan.
2. **Nutritional support systems:** and other life saving measures for the critically ill- Monitoring nutrient intake and providing nutrition support service, role of immuno enhancers, conditionally essential nutrients, immuno suppressants and special diets.
3. **Planning, monitoring and management of Enteral and parenteral feeding:** Designer feeds, commercial feeds, techniques, applications and complications.
4. **Management of high risk conditions:** including patho-physiological, clinical and metabolic aspects in the following conditions: Burns, CV complications, surgery, cancer, AIDS, multiple organ failure, chronic renal failure (CRF), dialysis, transplant, trauma and sepsis, Dumping syndrome.
5. **Home care for critically ill and requiring long term nutrition support**
6. **Complications of nutritional support systems:** including re-feeding syndrome, palliative care, rehabilitation diets (stages).

**ASSIGNMENT:**

Visits to hospitals (special units- ICU)/ emergency relief camps and

health oriented camps and presenting as seminar/report.

## REFERENCES:

1. Advancing Dietetics and clinical nutrition Anne Payne, Helen Barker  
Churchill Livingstone publishers
2. Bao, Y., & Fenwick, R. (Eds.). (2004). Phyto chemicals in health and disease. CRC Press.
3. Cresci, P. D. (Ed.). (2015). Nutrition support for the critically ill patient: A guide to practice. CRC Press.
4. Escott-Stump, S. (2008). Nutrition and diagnosis-related care. Lippincott Williams & Wilkins.
5. Gopalan C and Shetty P.(1998). Diet nutrition and chronic disease – An Asian perspective Smith-Gordon-Nishimura.
6. IDA.(2018).Clinical dietetics manual 2<sup>nd</sup> edition ELITE publishing house, NewDelhi.
7. Mahan, L. K., & Raymond, J. L. (2016). Krause's food & the nutrition care process. Elsevier Health Sciences.
8. Nelms, M., & Sucher, K. (2015). Nutrition therapy and pathophysiology. Nelson Education.
9. Robinson, Lawler: Normal & Therapeutic Nutrition (17th ed.) Macmillan Publishing Co.
10. Robinson. HC et al., (1986) Normal and therapeutic nutrition (17th edition), Macmillan publishing company.
11. Shills and Young. Modern Nutrition in Health and Disease
12. Whitney, E. N., Cataldo, C. B., & Rolfes, S. R. (1998). Understanding normal and clinical nutrition. Wadsworth Publishing Company Inc.

## COURSE 5 : IN BORN ERRORS OF METABOLISM

**Course outcome:** Enable to acquire skills for nutrition diagnosis and apply appropriate NCP for dietary management

**Preamble:** To study the prevalence, causes and metabolic errors and its clinical manifestations. To understand the dietary management of these inborn errors of metabolism

**Pedagogy:** PPT-OHP presentations and assignments

**Course content:**

1. **Introduction-** definition, occurrence, types, causes, detection techniques - newborn screening (NBM), goals of nutrition therapy, role of nutritionist. Prevention strategies – genetic counseling.
2. **Carbohydrate metabolism** – G6PD deficiency, galactosemia, fructose intolerance, glycogen storage disease, pentosuria – prevalence, clinical and biochemical features, dietary management.
3. **Amino acid metabolism** – Phenylketonuria, tyrosinemia, homocystinuria,



BCAA Maple syrup urine disease argininemia- prevalence, clinical and biochemical features, dietary management

4. **Lipid metabolism** – disorders of fatty acid oxidation medium-chain acyl CoA (MCAD) long-chain acyl CoA deficiency (LCAD). - prevalence, clinical and biochemical features, dietary management.
5. **Other disorders** – hypothyroidism, sickle cell anemia, cystic fibrosis, lysosomal storage disease (Tay-Sachs, Gaucher's) and gout - prevalence, clinical and biochemical features, dietary management

6.

## REFERENCES:

1. Advancing Dietetics and clinical nutrition Anne Payne, Helen Barker  
Churchill Livingstone publishers
2. Bao, Y., & Fenwick, R. (Eds.). (2004). Phyto chemicals in health and disease. CRC Press.
3. Cresci, P. D. (Ed.). (2015). Nutrition support for the critically ill patient: A guide to practice. CRC Press.
4. Escott-Stump, S. (2008). Nutrition and diagnosis-related care. Lippincott Williams & Wilkins.
5. Gopalan C and Shetty P.(1998). Diet nutrition and chronic disease – An Asian perspective Smith-Gordon-Nishimura.
6. IDA.(2018).Clinical dietetics manual 2<sup>nd</sup> edition ELITE publishing house, NewDelhi.
7. Mahan, L. K., & Raymond, J. L. (2016). Krause's food & the nutrition care process. Elsevier Health Sciences.
8. Nelms, M., & Sucher, K. (2015). Nutrition therapy and patho physiology. Nelson Education.
9. Robinson, Lawler: Normal & Therapeutic Nutrition (17th ed.) Macmillan PublishingCo.
10. Robinson. HC et al., (1986) Normal and therapeutic nutrition (17th edition), Macmillan publishing company.
11. Shills and Young. Modern Nutrition in Health and Disease
12. Whitney, E. N., Cataldo, C. B., & Rolfes, S. R. (1998). Understanding normal and clinical nutrition. Wadsworth Publishing Company, Inc.

## COURSE 6: NUTRITION & HEALTH ISSUES OF WOMEN

**Course outcome:** To provide personalized diet and nutrition advice for women, children and adolescent girls to improve the quality of life and reduce the burden of health issues impacting the national productivity

**Preamble:** To understand the health problems related to nutrition in various stages of women's life

**Pedagogy:** PPT and OHP presentations and preparation of nutrition education materials

## Course content:

- 1. Women and Nutrition in India:** socio-economic and cultural influences on women's nutritional status. Food consumption determinants and dietary patterns (NNMB data). Significance of preventive nutrition throughout the lifecycle.
- 2. Health Concerns in Pre-menopausal phase:** menstrual cycle, hygiene during menstrual cycle, effect of menstrual cycle on food intake and nutrient requirement, role of diet on sex steroid hormones. Diet and premenstrual syndrome. Oral contraceptives and nutrition. Effect of under and over nutrition on fertility.
- 3. Health Concerns in Post-menopausal phase:** Menopause, body composition transition in menopause, dietary supplements for menopausal issues, Adequacy of nutritional intake, hysterectomy, hormone replacement therapy, Non-communicable diseases (obesity, CVD, Osteoporosis, Diabetes and cancer).
- 4. Nutrition concerns in female athletes** ideal body fat, guidelines for fat loss, Menstrual dysfunctions, Nutrient needs, competition diets , carbohydrate loading diet, Fluid and food intake , Female athlete triad

## REFERENCE:

1. Debra AK and Penny NK.(1996). Nutrition in women's health
  2. Bao, Y., & Fenwick, R. (Eds.). (2004). Phyto chemicals in health and disease. CRC Press.
  3. KE Elizabeth (2015). Nutrition and child development. 5<sup>th</sup> Paras Medical Publisher
  4. Mahan, L. K., & Raymond, J. L. (2016). Krause's food & the nutrition care process
  5. Mark L and Tony W (2008). Public health nutrition from principles to practice, Library of congress cataloging, First south Asian edition.
  6. Sheila ChanderVir (2011).Public health nutrition in developing countries (Part I &II). Wood head publishing, India ltd.
  7. Shills and Young. Modern Nutrition in Health and Disease
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