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UNIVERSITY OF MYSORE



Estd. 1916

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Dated: 24-05-2014

No.AC.2(S)/401/13-14

**NOTIFICATION**

**Sub:** Changes in the Hard Core / Soft Core / Syllabus and distribution of credits.

**Ref:** 1. Proceedings of Faculty of Science & Technology Meeting held on 14-02-2014.  
2. Proceedings of the Meeting of Academic Council held on 29-03-2014.

The Board of Studies in Food Science & Nutrition (PG) at its meeting held on 07-12-2013 has resolved to Changes in the Hard Core / Soft Core / Syllabus and distribution of credits from the academic year 2014-15

The Faculty of Science and Technology and the Academic Council at their meetings held on 14-02-2014 and 29-03-2014 respectively approved the above proposals and the same is hereby notified.

The copy of the modified syllabus of Food Science & Nutrition (PG) is annexed herewith.

*J. S. Sampath*  
**REGISTRAR.** 24/5/2014  
University of Mysore  
MYSORE

To

1. The Registrar (Evaluation), University of Mysore, Mysore.
2. The Chairperson, BOS/DOS in Food Science & Nutrition /MGM
3. The Dean, Faculty of Science & Technology, DOS in Zoology, MGM.
4. The Principals of the Affiliated Science Colleges.
5. The Deputy/Assistant Registrar (Evaluation), University of Mysore, Mysore.
6. Sri Narasimha Murthy, Statistician, E. B. UOM, Mysore.
7. The Supdt AC.1 & AC.2, A.B., Academic Section / P.MEB, UOM., Mysore.
8. The P.A. to the Vice-Chancellor/Registrar/Registrar (Evaluation), UOM., Mysore.
9. The Case Worker, AC.7, Academic Section, University of Mysore, Mysore.
10. The Section Guard File(Supdt.AC.2), A.B., A.C., UOM.
11. The Schedule File.

**DEPARTMENT OF FOOD SCIENCE AND NUTRITION  
UNIV. OF MYSORE, MANASAGANGOTRI, MYSORE**

**1. M.Sc. Degree in FOOD SCIENCE AND NUTRITION**

**2. M.Sc. Degree in FOOD SCIENCE AND NUTRITION [with specialization in  
CLINICAL NUTRITION]**

**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.

**ELIGIBILITY CRITERIA**

1. B.Sc. - cognate subjects: Home science/ any one of the following subjects as one option at B.Sc. – Food Science and Nutrition / Human nutrition/ Nutrition & Dietetics/ Clinical Nutrition & Dietetics/ Food science & Quality control / Integrated Home science.
2. Candidates with Biochemistry / microbiology/ Biotechnology as majors /hard cores are also eligible for admission. (Non cognate subjects)
3. 50% of the seats are reserved for candidates with cognate subjects. Preference at every stage of seat matrix allocation will be given to students who have studied COGNATE subjects.
4. Candidates with Clinical Nutrition & Dietetics / Human nutrition/ Nutrition & Dietetics / Food Science & Nutrition/ Home science as one option at UG are eligible to opt for specialization in CND from 2<sup>nd</sup> semester onwards in PG program, while others will continue with Food science and Nutrition.



**Choice-Based Credit System Syllabi of  
M.Sc. Degree Program in Food Science and Nutrition**

| No.   | Paper Code | Title of course  | HC/SC/ open elective               | No. of credits |   |   |       |
|---|------------|--|------------------------------------|----------------|---|---|-------|
|   |            |  |                                    | L              | T | P | Total |
| <b>I Semester</b>                           |            |  |                                    |                |   |   |       |
| 1*  | 17601      | Food Science and Food Processing- I  | Hard<br>[16 credits]               | 2              | 1 | 2 | 5     |
| 2*  | 17602      | Nutritional Biochemistry   |                                    | 2              | 1 | 2 | 5     |
| 3*  | 17603      | Human Nutrition  |                                    | 2              | 1 | - | 3     |
| 4*  | 17604      | Community nutrition  |                                    | 2              | 1 | - | 3     |
| 5*  | 17605      | Basics of research designs in nutrition                                      | Soft core<br>[to choose 4 credits] | 2              | - | - | 2     |
| 6*  | 17606      | Food Hygiene and Sanitation  |                                    | 2              | - | - | 2     |
| 7*  | 17607      | Food Microbiology  |                                    | 1              | 1 | - | 2     |
| 8*  | 17608      | Assessment of Nutritional status   |                                    | 1              | 1 | - | 2     |
| <b>STREAM 1. FOOD SCIENCE AND NUTRITION</b> |            |  |                                    |                |   |   |       |
| <b>II Semester :</b>                        |            |  |                                    |                |   |   |       |
| 1*  |            | Food Science and Food Processing- II   | Hard core<br>[14 credits]          | 2              | 1 | 2 | 5     |
| 2*  |            | Vitamins in Nutrition  |                                    | 1              | 1 | 2 | 4     |
| 3*  |            | Minerals in Nutrition  |                                    | 1              | 1 | - | 2     |
| 4   |            | Food laws and food safety  |                                    | 2              | 1 | - | 3     |
| 5*  |            | Term work in Nutritional assessment **                                       | Soft core<br>[to choose 4 credits] | -              | 2 | - | 2     |
| 6   |            | Food packaging technology  |                                    | 2              | - | - | 2     |
| 7*  |            | Neutraceuticals and health foods   |                                    | 2              | - | - | 2     |
| 8   |            | Enzymes in food processing (self study)                                      |                                    | -              | 2 | - | 2     |
| 9   |            | Food fortification (self study)  | -                                  | 2              | - | 2 |       |
| 10  |            | Healthy lifestyles and nutrition   | Open elective                      | 2              | - | - | 2     |
| <b>III Semester</b>                         |            |  |                                    |                |   |   |       |
| 1   |            | Food Preservation  | Hard<br>[10 credits]               | 2              | 1 | 2 | 5     |
| 2   |            | Functional properties of foods   |                                    | 2              | 3 | - | 5     |
| 3   |            | Entrepreneurship and Marketing   | Soft<br>[to choose 6 credits]      | 2              | - | - | 2     |
| 4*  |            | Quality control in food industries and foodservice institutions (self-study) |                                    | -              | 2 | - | 2     |
| 5   |            | Food Additives   |                                    | 2              | - | - | 2     |
| 6   |            | Principles of Clinical Nutrition   |                                    | 2              | 2 | - | 4     |
| 7   |            | Term paper**   | -                                  | 2              | - | 2 |       |
| 8   |            | Culinary Science- Principles & Techniques                                    | Open elective                      | 2              | 2 | - | 4     |
| <b>IV Semester</b>                          |            |  |                                    |                |   |   |       |
| 1   |            | Product Development & sensory evaluation                                     | Hard core<br>[8 credits]           | 2              | 3 | - | 5     |
| 2   |            | Advances in Nutritional Science  |                                    | 2              | 1 | - | 3     |
| 3   |            | Diet in diseases   | Soft core<br>[to choose 6 credits] | 2              | 1 | - | 3     |
| 4   |            | Project work   |                                    | -              | 6 | - | 6     |
| 5   |            | Storage and handling of fresh produce (self study)                           |                                    | -              | 3 | - | 3     |
| 6   |            | Food Biotechnology (self study)  |                                    | -              | 3 | - | 3     |
| 7   |            | Foods in Indian Tradition  | Open elective                      | 2              | - | - | 2     |

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

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

| No.   | Paper Code | 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*  |            | Food Science and Food Processing- II   | Hard core<br>[14 credits]          | 2              | 1 | 2 | 5     |
| 2*  |            | Vitamins in nutrition  |                                    | 1              | 1 | 2 | 4     |
| 3*  |            | Minerals in nutrition  |                                    | 2              | 1 | - | 2     |
| 4   |            | Basics of Human Physiology   |                                    | 2              | 1 | - | 3     |
| 5*  |            | Term work in Nutritional assessment **                                       | Soft core<br>[to choose 4 credits] | -              | 2 | - | 2     |
| 6   |            | Nutrient metabolism  |                                    | 2              | - | - | 2     |
| 7*  |            | Neutraceuticals and health foods   |                                    | 2              | - | - | 2     |
| 8   |            | Endocrinology  |                                    | 2              | - | - | 2     |
| 9   |            | Public health nutrition (Self –study)  |                                    |                | 2 | - | 2     |
| <b>III Semester</b>   |            |  |                                    |                |   |   |       |
| 1   |            | Principles of diet therapy   | Hard<br>[10 credits]               | 1              | 1 | - | 2     |
| 2   |            | Clinical nutrition & dietetics-I   |                                    | 2              | 1 | 2 | 5     |
| 3   |            | Food service management  |                                    | 2              | 1 | - | 3     |
| 4*  |            | Quality control in food industries and foodservice institutions (self study) | Soft<br>[to choose 6 credits]      | -              | 2 | - | 2     |
| 5   |            | Sports nutrition   |                                    | 2              | - | - | 2     |
| 6   |            | Food and nutrition services in hospitals                                     |                                    | -              | 2 | - | 2     |
| 7   |            | Drug and nutrient interactions and Nutrigenomics                             |                                    | 2              | - | - | 2     |
| 8   |            | Preparation of Audio-visual Aids **  |                                    | -              | 2 | - | 2     |
| 9   |            | Nutrition and health problems of vulnerable population (self-study)          | -                                  | 2              | - | 2 |       |
| <b>IV Semester</b>  |            |  |                                    |                |   |   |       |
| 1   |            | Clinical nutrition & dietetics-II  | Hard core<br>[10 credits]          | 1              | 1 | 2 | 4     |
| 2   |            | Internship ***   |                                    | -              | 6 | - | 6     |
| 3   |            | Nutrition counseling   | Soft core<br>[to choose 4 credits] | 1              | 1 | - | 2     |
| 4   |            | Nutrition in critical care   |                                    | 2              | - | - | 2     |
| 5   |            | Medical ethics & laws  |                                    | 1              | 1 | - | 2     |
| 6   |            | Inborn errors of metabolism  |                                    | 2              | - | - | 2     |
| 7   |            | Nutrition in emergencies (Self-study)  |                                    | -              | 2 | - | 2     |

\*: Papers common to two 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 per semester 18, Maximum, credit per semester - 24. Open elective papers equal to 8 credits to be chosen from other courses during II, III, IV Semesters.

\*\*\*Internship in Hospitals / Foods service institutions + hospital / clinics.

**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 entirely devoted to Internship, for which students need to go outside the department for five days a week. Accordingly C1 and C2 component marks will be submitted at the end of IV semester.

## I SEMESTER

### 1. Hard core: FOOD SCIENCE AND FOOD PROCESSING- I \* [2+1+2/week]

1. A. Processing of foods: Primary, secondary and tertiary processing, historical perspective, traditional technologies used in food processing.  
B. Effects of processing on components, properties and nutritional value of foods.
2. Processing of wheat: Structure, composition, primary processing, functionality in food system, study of preparation/ manufacture of common unleavened and leavened products like chapathi, bread, cake etc.
3. A. Rice: Structure, composition, primary and secondary processing, rice 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, effect of cooking on colour and texture of vegetables.

### 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

### 2. Hard Core: NUTRITIONAL BIOCHEMISTRY \* [2+1+2/week]

1. **Cell Structure and Function:** Components, cell membrane composition, fluid mosaic model, membrane lipids, proteins and carbohydrates, membrane receptors, functional role of sub cellular organelles and membrane systems.
2. **Biological membranes:-** Structure and membrane transport, membrane receptors, fundamentals of signal transduction.
3. **Enzymes:** Classification, nomenclature, general properties, mechanisms of enzyme action, regulation of enzyme activity. Role of Coenzymes and cofactors in enzyme activity. Enzyme inhibition, Isoenzymes, immobilized enzymes, clinical significance of enzyme assays.
4. **Proteins and amino acids:** a. Amino acids- Classification and structure, properties and functions. Formation of peptide linkages b. Proteins- Structure and organization, physico-chemical properties, classification and functions.
5. **Carbohydrates:** Classification, structural features, physico-chemical properties. Monosaccharide and related compounds, disaccharides, polysaccharides. Inter conversion of hexoses, sugar derivatives of biomedical importance.
6. **Lipids:** Classification, chemical structure, and properties of fatty acids, Triglycerides, phospholipids and derivatives, cholesterol and derivatives. Dietary fats, biological functions of lipids, glycolipids. Methods to determine crude fat and fatty acids. Lipoproteins: Types, Structure and physicochemical properties.
7. **Nucleic acids:** Components, structure and level of organization, Physico chemical properties, biological importance, DNA replication and enzymes in DNA replication.
8. **Bioenergetics and oxidative metabolism** – energy producing and utilizing systems, thermo dynamic relationships and energy-rich components. Sources of and fates of

acetyl co A, The Kreb's cycle, structure of mitochondria , Electron transport chain, oxidative phosphorylation.

## PRACTICAL SESSIONS

### Techniques used in biochemical analysis:

- **Determination of PH:** in acids, alkalis and buffers using PH meter and indicators.
- **Colorimeters:** use of colorimeter in UV and visual range, Flame Photometer, fluorimeter (principle to be explained and demonstrated with one example for each).
- **Separation techniques:** Chromatography- paper and column. Centrifugation, Electrophoresis and Dialysis. (One example for each may be demonstrated).
- **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.

### 3. Hard Core:

### HUMAN NUTRITION \*

[2+1+0]

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 balance.
3. Body composition- Methods of study, compositional changes during life cycle, nutritional disorders and their effect body composition.
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- Occurrence and physiological functions, factors influencing metabolism. Lactose intolerance. Dental caries. Artificial sweeteners. Role of dietary fiber in health and disease. Disorders related to carbohydrate metabolism. Glycemic index of foods and its uses
6. Lipids – Concepts of visible and invisible fats. EFA, SFA, MUFA, PUFA- sources and physiological functions. Role of lipoproteins and cholesterol, triglycerides in health and disease.
7. Proteins- Concepts of essential and non-essential amino acids- their role in growth and development. Physiological functions of proteins. Requirements, nitrogen balance concept. Methods for evaluating protein quality. Protein energy malnutrition-clinical features and biochemical changes.
8. Regulation of food intake- role of hunger and satiety centers, effect of nutrients.

### 4. Hard core Paper:

### COMMUNITY NUTRITION \*

[2+1+0=3]

#### 1. Nutrition during life span-

- 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 requirements. Feeding pattern, compositional differences between human milk and milk substitute and their suitability for infant feeding. Weaning practices, weaning and supplementary foods.
- d. Preschool age- Growth and development, nutritional requirements, special care in feeding them, nutritional problems specific to this age.

- e. School age and adolescent children- Growth and development, nutritional requirements, special care in feeding preschoolers, nutritional problems specific to this age.
  - f. Young adults- Nutritional requirements, Nutrition status of Indian adult population, nutritional problems common to this age.
  - g. Elderly- Nutritional requirements, Special needs, Nutritional problems
2. **Major nutritional problems prevalent in India-** prevalence, causes, manifestation and prevention.
  3. **Nutrition policy and programs-**
    - a. National nutrition policy- need for nutrition policy, policy strategies and their implementation.
    - b. Nutrition programs – National anemia prevention, Prevention of night blindness, National iodine prophylaxis program, ICDS,
    - c. National nutrition surveillance system. Food for work etc.
    - d. NGO in community development operations.
  4. **Nutrition Education-** Rationale, planning, execution and evaluation.

**5. Soft Core: BASICS OF RESEARCH DESIGNS IN FOOD AND NUTRITION \* [2+0+0]**

1. Research Methodology- Meaning, objectives and Significance of research. Types of research, research approaches and scientific methods. Research process and criteria of good research.
2. Definition and identification of a research problem- Selection of research problem, Justification, development of hypothesis, basic assumptions. Limitations and delimitations of the problem.
3. Research design- Meaning and needs, Features of a good design, important concepts relating to research design, variables, experimental and control groups. (Use examples from epidemiology and clinical trials). Different research designs- exploratory, descriptive and diagnostic (epidemiology and clinical trials). Pilot studies. Qualitative vs quantitative research.
4. Sampling design- Population and sample, Steps in sampling design, Criteria for selecting a sampling procedure, Different types of sampling techniques- probability sampling and non-probability sampling. Merits and demerits of sampling. Power analysis and sample size calculation in experimental design.
5. Methods of data collection- Schedules and questionnaires; Interview, Case study, Home visits, scaling methods, Reliability and validity of measuring instruments.
6. Statistical issues: effect of measures- formulation of hypothesis and testing of hypothesis, Confidence level and Bayesian statistics. Concepts and characteristics of a normal distribution
7. Basic principles and regulations in humans and animal research.
8. Analysis and reporting of data-
  - a. Graphical and diagrammatic presentation, Measures of central tendencies (Mean, median and mode), Measure of dispersion (Range, Mean deviation and standard deviation) and their relative measures. Qualitative and quantitative methods of data analysis.
  - b. Interpretation of – Meaning of interpretation, Technique of interpretation,
  - c. Precaution in interpretation- Interpretation of tables and figures.
  - d. Report writing – Significance of report writing, Different steps in writing report, Types of reports, Mechanics of writing reports and precautions to be taken while writing research reports.

**6. Soft core: FOOD HYGIENE AND SANITATION \* [2+0+0]**





1. Fats and oils: Properties, manufacture, uses in food systems (as cooking media and shortening). Rancidity- types, mechanism and prevention. Uses of fat replacers 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 creams.  
B. Eggs: Quality grading, structure, composition, functional properties and products.
3. A. Flesh foods: Types, composition, structure of muscle, conversion of muscle to meat- physico -chemical changes, cooking and processing.  
B. Marine foods: Types, composition, cooking and processing.
4. A. Sugar and jaggery: Principles of sugar crystallization, stages of cookery and role in Indian traditional sweet preparations, manufacturing of candies and sweets.  
B. Brief manufacturing process of coffee, tea, cocoa, alcoholic beverages (fruit wines). Ready to serve beverages.

## 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

### 2. Hard Core:

### VITAMINS IN NUTRITION \*

[1+1+2/week]

1. **Fat soluble Vitamins:** Vitamin A, Vitamin D, E & K.
2. **Water soluble vitamins:** Vitamin C, Thiamine, Riboflavin, Niacin, Pantothenic acid, Biotin, Folic acid, Vitamin B<sub>12</sub>, Vitamin B<sub>6</sub>

**Note:** All the nutrients will be dealt with Digestion, absorption and transport and excretion, functions, interaction with other nutrients (if any), RDA, Deficiency and toxicity, major sources, Assessment of nutriture and analysis in food material.

## PRACTICAL - For Stream 1. FOOD SCIENCE AND NUTRITION

### FOOD ANALYSIS

- a) Determination of moisture, Ash - total, acid soluble and insoluble.
- b) Determination of Protein in foods.
- c) Determination of Fat – Crude fat.
- d) Carbohydrates – Free sugars, Starch (Total & available), Dietary fiber.
- e) Mineral estimation – Dry and wet ashing, calcium, iron, phosphorous.
- f) Vitamin estimation – Ascorbic acid, thiamine, riboflavin and  $\beta$  carotene.

## PRACTICAL – For Stream 2. SPECIALIZATION IN CLINICAL NUTRITION AND DIETETICS

### Diagnostic Techniques : BLOOD AND URINE ANALYSIS

- a) Collection and storage of biological samples for clinical use. Commonly used tests for diagnosis of various diseases and their interpretation (Indices will have to be calculated using analyzed values of each student for interpretation)

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

**3. Hard Core: MINERALS IN NUTRITION \* [1+1+0/week]**

1. **Macro minerals:** Calcium, Phosphorus Magnesium, Sodium, Potassium chloride.
2. **Micro minerals:** Iron, Zinc, copper, selenium, chromium, iodine, manganese, Molybdenum and fluoride.
3. **Ultra trace minerals:** Arsenic, Boron, Nickel, Silicon, Vanadium & cobalt: Digestion & absorption, Functions, Toxicity, interaction with other nutrients. RDA and food sources.

**Note:** All the nutrients will be dealt with Digestion, absorption and transport and excretion, functions, interaction with other nutrients (if any), RDA, Deficiency and toxicity, major sources, Assessment of nutriture and analysis in food material.

**4. Hard Core: FOOD LAWS AND FOOD SAFETY [2+1+0]**

1. A. Concept and meaning of Food quality and food Safety, food adulteration, food hazards.  
B. Natural toxins.
2. Food laws and regulations – National and international food laws, Governing bodies.
3. Exposure, estimation, toxicological requirements and risk assessment.
4. Safety aspects of water and beverages such as soft drinks, tea, coffee, cocoa.
5. A. Safety assessment of food contaminants and pesticide residues.  
B. Safety evaluation of heat treatments and related processing techniques.

**5. Soft core: Term Work in Nutritional Assessment \* [0+2+0]**

1. Tools and Techniques of nutritional and dietary assessments:
  - Preparation of assessment schedules
  - Nutritional anthropometry, Use of Reference standards.
  - Standardization of raw and cooked weights, use of nutritional composition tables.
  - Dietary survey techniques-intakes of individual/ family /inmates of institutions.
2. The candidate has to undertake a minor project work in aspects related to assessment of nutritional status (field work / laboratory-based work) and submit a report.

**6. Soft core Paper: FOOD PACKAGING TECHNOLOGY [2+0+0]**

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, semirigid, 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, 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.

**7.Soft core Paper: NEUTRACEUTICALS AND HEALTH FOODS \* [2+0+0]**

1. **Nutraceuticals:** (a) Use of nutraceuticals in traditional health sciences. Their role in preventing /controlling diseases.  
(b) Definition, Classification, food and non food sources, mechanism of action. Role of omega-3,fatty acids, carotenoids, dietary fiber, phytoestrogens; glucosinates; organosulphur compounds as nutraceuticals.
2. **Prebiotics and probiotics:** Usefulness of probiotics and prebiotics in gastro intestinal health and other benefits. Beneficiary microbes; prebiotic ingredients in foods; types of prebiotics and their effects on gut microbes.
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.

**8.Self –study soft core : ENZYMES IN FOOD PROCESSING [0+4+0]**

1. Enzymes- Review of classification, specifications, factor affecting rate of enzyme catalyzed reactions, enzyme inhibitors, enzymic browning, immobilized enzymes.
2. A. Application of enzymes in food processing: Need for enzyme usage, sources of enzymes.  
B. Application of enzyme in industrial production of starch, high fructose corn syrup, enzymes in sucrose industry.
3. Use of enzyme in beverages- fruit juices, beer, wine, and distilleries; dairy, baking, oils and fats, plantation products, animal products.
4. Malting and germination of grains – process, characteristics, nutritional benefits and uses.

**9.Self –study soft core : FOOD FORTIFICATION [0+4+0]**

1. Food fortification – Needs, objectives, principles and rationale, selection and basis of fortificants.
2. Technology of fortifying cereal products.
  - Characteristics of nutrients used in cereal fortification
  - Types and levels of micronutrients to be added
  - Fortification methods
  - 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, Selection of nutrients for fortification, Levels to be added, Characteristics of fortificants and method of fortification, Bioavailability, Organic Vs inorganic salts.

b). Technology of fortifying candies - Product formulation, Factors to be considered in selecting fortificants, Nutrient bioavailability and its interactions, Packaging, storage, shelf life and cos.,

c) Snack products - Rationale for micronutrient fortification of snack products, Merits and demerits of fortification, Choice of products and selection of micronutrients, Setting level of fortification, Safety limits, Technological and cost limits, Challenges in fortifying snack products, Nutrient interaction and bioavailability.

### 4. Other special fortified products - salt, sugars, oils, Nutri-bars, Granola bars, health foods.

a). Salt :- Technology of fortifying salt with iron and iodine, Iodine stability and quality of double fortified salt, Safety issues, Levels to be added.

b). Sugars :- Fortification with iron and vitamin A, Premix formulation, Fortification level, Packaging.

c) Oils:- Fortification with vitamin A, Rationale of vitamin A fortification, Stability of vitamin A in oil during storage and cooking, Effects of frying on Vitamin A content, Efficacy and safety of vitamin A added to oil, Technology of fortifying, Packaging.

d). Nutri bars :- Selection of nutrient, Advantages and disadvantages of fortification, Technology of fortification, Packaging.

e) Granola bars:- Production of the product, Physical parameters of bars, Incorporation of fortificants, Technology of fortification, Packaging.

f) Health foods:- Selection of nutrients, Technology of incorporation, Bioavailability, Packaging.

## OPEN ELECTIVE FOR OTHER STUDENTS

### 10. HEALTHY LIFESTYLES AND NUTRITION

[2+0+0]

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 –
  - Energy and macronutrients – Carbohydrates, Protein, Fat - functions, sources deficiency disorders and recommended intakes.
  - Micronutrients: Minerals – calcium, Iron, Iodine, and other elements.
  - 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 life span.
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.

### III SEMESTER

**1.Hard Core: FOOD PRESERVATION [2+1+2]**

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 : sterilization, pasteurization, blanching, canning.
3. Cold preservation ; refrigeration, freezing, freeze drying, refrigerated gas storage.
4. A. Food irradiation: technology, application and safety assessments  
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.

**2.Hard Core: FUNCTIONAL PROPERTIES OF FOODS [2+3+0]**

1. Physico-chemical properties of foods- Organic food components, colloids, osmotic pressure, food dispersions (sols, gels, emulsion, foam), Hydrogen ion concentration etc.
2. Role of water in foods, free water and bound water, functional properties, water activity and intermediate moisture foods.
3. Functional properties of proteins, modified proteins, application in product formulation
4. A. Carbohydrates: Starch, cellulose, hemicelluloses, hydrocolloids and gums: occurrence, functions in food systems, properties, gelatinization, retrogradation and modified starches.  
B.Browning in foods: Enzymatic and non enzymatic- mechanism, method of prevention, relationship to health.

#### PRACTICAL TUTORIAL SESSIONS

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.

**3.Soft Core: ENTREPRENEURSHIP AND MARKETING [2+0+0]**

1. Starting and managing an enterprise :

(A) Need for and Enterprise, Developing an Enterprise – Idea generation and thought process, Steps in preparing a business plan, Feasibility planning, Preparing a feasibility plan, Customer analysis.

(B) Components of management, Managerial skills, Developing managerial skills, Managing a food industry.

2. Entrepreneurship : Entrepreneur and entrepreneurship, Decision making for the enterprise, Qualities of an entrepreneurial individual.
3. Marketing and advertising : Marketing basics, Product basics, Competitor analysis, Market analysis, Advertising.
4. Changing food trends and marketing- influencing factors: Life style changes : economic, socio-cultural, psychological influences and marketing influences.

**4.Soft core : QUALITY CONTROL IN FOOD INDUSTRIES AND FOODSERVICE INSTITUTIONS \*  
[0+2+0]**

1. Concept of quality: Quality attributes – physical, chemical, nutritional, microbial, and sensory. Quality control in Food industry : Concepts of quality management: Objectives, importance and functions of quality control; Principles of quality control.
2. Quality management systems in India; Sampling procedures and plans; Food Safety and Standards Act, 2006; Domestic regulations; Global Food safety Initiative; Various organizations dealing with inspection, traceability and authentication, certification and quality assurance (PFA, FPO, MPO, AGMARK, BIS); Labeling issues; International food standards.
3. Use of hazard analysis and critical control points in processing of foods.
4. Quality assurance, Total Quality Management; GMP/GHP; GLP, GAP; Sanitary and hygienic practices; Quality manuals, documentation and audits; Indian & International quality systems and standards like ISO and Food Codex; Export import policy, export documentation; Laboratory quality procedures and assessment of laboratory performance; Applications in different food industries.
5. Quality control in foodservice institutions.

**5.Soft core paper:**

**FOOD ADDITIVES**

**[2+0+0]**

1. Food additives: Definitions, functions and uses in processed food products.
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: Artificial sweeteners, composition, uses.  
B.Natural and synthetic colors
4. Food Flavors: Spices and flavoring constituents, flavors in food industries.

**6.Soft core:**

**PRINCIPLES OF CLINICAL NUTRITION**

**[2:2:0]**

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, Regulation of food intake-hunger, satiety, role of neurotransmitters.
2. Role of dietician in hospital- 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. Assessment of nutritional status - in clinical situations and development of nutrition care plan for hospitalized and out patients. Somatic, biological, clinical and dietary assessment, environmental and behavioural data analysis and interpretation.
4. Principles of planning a normal diet: characteristics of a normal diet, meeting nutrient requirements of individuals and family. Use of Dietary guidelines for Indians.
5. A. Objectives of diet therapy- Regular diet and rationale for modifications in energy and other nutrients, texture, fluid, soft diets etc.  
B. Enteral and parenteral feeding-principles, types, methods of administration, monitoring and complications.
6. Dietary principles and management of special conditions
  - a. Surgical conditions, burns and organ transplants
  - b. Protein and energy malnutrition (hospital and domiciliary treatment)
  - c. Nutrient deficiencies – Vitamin A, iodine, osteoporosis.
  - d. Children with special needs- spastic, polio affected
  - e. Food allergy- causes, methods of detection and preventive measures
  - f. Febrile diseases- tuberculosis, typhoid, pneumonia, measles, malaria and chicken pox.
  - g. Nutrition counseling: definition, concept, role of clinical dietician, the recipient and counseling environment and goals of counseling. An overview of systems approach to nutritional care and its components (planning, implementation and evaluation).
7. **Drug and nutrient interaction** – drug – drug / drug-nutrient interaction – effect on ingestion, digestion, absorption and metabolism of nutrients, effect on nutritional status, effect on organ function, drug dosage and efficacy, drug abuse and drug resistance.

**7.Soft core:**

**TERM PAPER**

**[0+2+0]**

The term paper shall be submitted at the end of semester as project report and evaluated. The topic will be selected by the student under the guidance of an advisor, can either be an independent study based on research [experimental, clinical, survey, case study, etc] or a term paper based on exhaustive review of literature.

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

#### **8. CULINARY SCIENCE- PRINCIPLES AND TECHNIQUES**

**[2+2+0]**

1. Introduction to cookery, Culinary history, aims and objectives of cooking.
2. 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.
3. Methods of cooking – Pre-processing of foods, cooking, roasting, frying, grilling, baking, boiling, microwaving, solar, infra-red cooking.
4. 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 flavouring ingredients
- Baked products,
- Egg cookery, meat and fish
- Indian sweets and snacks
- Preserved products.

### **PRACTICAL TUTORIAL 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.

## **IV SEMESTER**

### **1.Hard Core: PRODUCT DEVELOPMENT AND SENSORY EVALUATION**

**[2+3+0]**

#### **1. Sensory evaluation of foods:**

- a. Importance and application for product formulation,
- b. Basic tastes, threshold tests for basic tastes,
- c. Requirements for sensory analysis,
- d. Sensory panel, type, selection and training,
- e. Subjective and objective sensory evaluation,
- f. Different types of sensory tests
- g. Instrumental tests for sensory attributes – colour, texture and odour.

#### **2. Product Development**

- a. Designing new product – types and drawing forces
- b. Need for product development
- c. Stages of product development
- d. Success in product development
- e. Consumer research
- f. Role of sensory evaluation in consumer product acceptance

#### **3. Consumer Behavior** in purchasing foods, Factors influencing product acceptance and purchasing trends. Market place changes in processed foods.

#### **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.

### **PRACTICAL TUTORIAL SESSIONS**



affiliated research institutions, quality control laboratories, food industries or other institutions with prior approval.

**5.Soft core-Self study paper: STORAGE AND HANDLING OF FRESH PRODUCE [0+4+0]**

1. Storage and handling of food grains.
  - Foodgrains and their characteristics, Commercial importance of grains, and standards for foodgrains.
  - Marketing and handling of grains, cleaning, grading, weighment, conveying equipment, and mechanical conveyers. Grain sampling, segregation, moisture migration. Moisture determination – drying and aeration.
  - Insects and mites of food gains - types, and control measures [storage facility, warehousing practices, physical, chemical, biological, and other methods of insect control]
  - Storage structures of grains.
2. Storage and handling of fruits and vegetables - Vegetables as living products- Respiration and heat production.
  - Harvesting practice and equipment, Preparation for market, Shipping containers and Consumer package
  - Commodity requirements – leafy vegetables, unripe fruits, ripe fruits, underground structures
  - Treatment prior to shipment and storage, Ventilated storage, refrigerated storage
  - Transportation by Rail, Highway, Air and Sea
  - 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
  - Milk – sources, contamination, chemical composition, keeping quality, grading of milk, microbiology of milk and its products.
  - Milk products – Butter, cheese, curds, fermented dairy products.
  - Spoilage and preservation of dairy products.
  - Microbial changes and types of spoilage – souring, gas formation, proteolysis, ropiness, alkali production, changes in butter fat, flavor changes, colour changes.
  - Preservation techniques – pasteurization, UHT, cooling, chilling and freezing, use of preservatives – added and developed.
4. Storage and handling of flesh and marine foods.
  - 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.
  - 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 shell fish.

**6.Soft core-Self study paper: FOOD BIOTECHNOLOGY [0+4+0]**

1. A. Use of Biotechnology for food processing.

- B. Indian fermented foods – Historical perspective, Mechanism of fermentation, effect on nutritional value.
- 2. Genetically modified foods - Need for GM foods – The food challenges, Potential benefits in agriculture, Crop engineered for input and output traits, nutritional improvement, animal foods, issues of concern – safety of GM foods.
- 3. Technology for production of alcoholic beverages
- 4. A. Fermented cereal and legume based products, traditional and yeast leavened products.  
B. Fermentation of vegetables and fruits – lactic acid fermentation.  
C. Fermented milk products – yoghurt, butter- milk, cheese.  
D. Fermentation of meat and fish.

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

#### **7. FOODS IN INDIAN TRADITION**

**[2+0+0]**

- 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

## STREAM 2. SPECIALIZATION IN CLINICAL NUTRITION AND DIETETICS II SEMESTER

1. **Hard Core:** **FOOD SCIENCE AND FOOD PROCESSING- II \*** [2+1+2]  
[Common paper]
2. **Hard Core:** **VITAMINS IN NUTRITION \*** [1+1+2/week]  
[Common paper]
3. **Hard Core:** **MINERALS IN NUTRITION \*** [1+1+0/week]  
[Common paper]

**4. Hard Core:** **BASICS OF HUMAN PHYSIOLOGY** [2+1+0/week]

1. **Cell physiology-** Overview: molecular structure of cell and its components; chemical nature, type of cells and their functions. Different tissues and their characteristics.
2. **Organ systems- over view of physiological functions.**
  - a. Digestive system: structural and functional characteristics of parts of digestive organ, accessory organs, process of digestion and absorption of carbohydrates, protein, fats. Pancreas- role in digestion and absorption and glucose regulation. Liver- structure and role in digestion and absorption.
  - b. Nervous system: nervous system - peripheral and autonomic nervous system, structure and functions of neurons, excitatory and inhibitory process, generation and propagation of action potential.
  - c. Respiratory system: breathing mechanism, respiratory systems, homeostasis and gas exchange
  - d. Renal system: organs in the urinary system, nephrons, formation of urine, maintaining fluid and electrolyte balance.
  - e. Cardiovascular system: structure, function, and electrical conduction, circulatory system, pulmonary and systemic circuit. Blood- components, RBC, WBC, Platelets, serum and plasma, blood coagulation and blood groups. Lymphatic system.
  - f. Muscular system: types of muscle system and their importance, chemical, electrical and molecular involvement in muscle contraction.
  - g. Skeletal system: structure- macroscopic and microscopic, osteocytes, osteoclasts and osteoblasts, functions, metabolism, role of hormones.
  - h. Senses- physiology and function: chemoreception- olfactory and gustatory system, vision, hearing and touch.
3. **Reproductive system-**
4. **Immune system: immune response, CMI and Humoral immunity**

5. **Soft core:** **Term Work in Nutritional Assessment \*** [0+2+0]  
[Common paper]

**6. Soft core:** **NUTRIENT METABOLISM** [2+0+0]

1. **Metabolic pathways of macronutrients:**
  - **Carbohydrates:** Aerobic and anaerobic degradation, glycogenesis, glycogenolysis, gluconeogenesis, HMP shunt pathway. Alcoholic fermentation. Hormonal regulations of blood glucose.
  - **Protein and amino acids:** protein degradation, metabolism of aromatic, sulfur containing, BCAA and other amino acid pool, fate of nitrogen (urea cycle). Glutamine and alanine cycle, protein biosynthesis.

- **Lipids:** Metabolic pathways of triacylglycerol, fatty acids, cholesterol and lipoproteins. Regulation of lipid metabolism and ketone bodies.
- 2. **Bioenergetics and oxidative metabolism – Concept of energy and its conversion,** energy producing and utilizing systems, thermo dynamic relationships and energy-rich components. Sources of and fates of acetyl co A, The Krebs's cycle, structure and role of mitochondria, Electron transport chain, oxidative phosphorylation.
- 3. **Nucleic acid, Iron and Heme Metabolism:** metabolism of nucleic acid components, biosynthesis of nucleotides. Iron metabolism, iron containing proteins, intestinal absorption of iron, heme biosynthesis.
- 4. **Integration and regulation of metabolism:** Interrelationship of carbohydrate, protein and lipid metabolism, importance of Krebs cycle, role of liver, muscle and adipose tissues; Metabolic adaptation during starvation, exercise, stress and diabetes mellitus.
- 5. **Oxidative stress and Antioxidants:** Free radicals: definition, formation in biological Systems. Natural anti-oxidants, defense against free radicals. Role of free radicals and antioxidants in health and disease. Determination of free radicals, lipid peroxides and antioxidants.

**7. Soft core Paper: NEUTRACEUTICALS AND HEALTH FOODS \* [2+0+0]**  
[Common paper]

**8. Soft core: ENDOCRINOLOGY [2+0+0]**

1. **Hormones:** Introduction to endocrinology, messengers- neuronal and chemical signals. General characteristics - Neuroendocrine relationship, mechanisms of hormonal action, control of hormone secretion.
  2. **Classification –** Basis and types of classification – i) Paracrine, Autocrine, Intracrine, ii) Anatomical and iii) chemical nature
  3. **Steroid hormones**
  4. **Peptide hormones**
  5. **Derivatives of amino acids**
- Note: for chapter 3, 4 and 5 to cover structure, biosynthesis, metabolism, regulation, functions and disturbances in synthesis and functions.

**9. Soft core (Self Study): PUBLIC HEALTH NUTRITION (Self-study) [0+2+0]**

1. Concept of public health nutrition- relationship between health and nutrition, role of public health nutritionists in the health care delivery.
2. Public health and nutrition policies- plan of action and programs.
3. Food and nutrition security- food production, distribution, access, availability and consumption. Socio cultural aspects and dietary patterns: their implication for nutrition and health.
4. Health care facility- primary health care of the community, health care delivery system.
5. Determinants of nutrition and health status- socio cultural, biologic, environmental and economic factor, indicators of health and malnutrition. Economics of malnutrition- impact on productivity and national development.
6. Socio demographic, health and nutrition transitions
7. Approaches and strategies for improving nutritional status and health: national and international contributions, role of government and non government organizations. Case studies of selected strategies and programs: their rationale and context- health based, intervention, food based interventions including fortification, genetic improvement of foods, supplementary feeding, and nutrition education for behavior change.

## III Semester

### 1. Hard Core:

### PRINCIPLES OF DIET THERAPY

[1+1+0/wk]

1. **Introduction to Clinical Nutrition and Dietetics;** Definition and history of dietetics. Dietetics in contemporary medical management. Inter relationship between food, nutrition and health. Factors affecting food choices. **Basic principles of planning a normal diet:** characteristics of a normal diet, meeting nutrient requirements of individuals and family. Use of Dietary guidelines for Indians.
2. **Objectives of diet therapy-** Regular diet and rationale for modifications in energy and other nutrients, texture, fluid, soft diets. Principles of enteral and parenteral nutrition
3. **Assessment of nutritional status in clinical situations and development of nutrition care plan:** Assessment nutritional status in hospital setup-dietary, clinical, biological, somatic, behavior methods. Psychological factors affecting food intake. Data analysis and interpretation. Medical records-types, uses. Factors to be considered for counseling –Nutritional and health conditions including body care- skin, hair, face, hands, feet etc. Aging, gender related and other problems. Medical terminology.
4. **Dietary management for nutritional disorders-**
  - a. Protein and energy malnutrition (hospital and domiciliary treatment), Vitamin A deficiency, Other deficiencies- osteoporosis, iodine and iron deficiency disorders etc
5. **Feeding of Special groups-** spastic, polio affected children, preterm infants and other conditions.
6. **Dietary management of febrile diseases** – Fever-acute and chronic (Tuberculosis, poliomyelitis, typhoid, pneumonia, measles, chicken pox, malaria) problem with resistance virus, chikungunea, H1N1.
7. **Food allergy and poisoning-**Definition, development, causes, methods of detection and preventive measures and course of nutritional management.
8. **Nutritional factors in tooth development:** dental caries, pathophysiology and dental decay, effect of fluoride and preventive care

### 2. Hard Core:

### CLINICAL NUTRITION AND DIETETICS- I

[2+1+2/week]

1. **Dietary principles and management Gastro-Intestinal Disorders** –Etiology, symptoms, treatment and prevention of the following: a.Gastritis b. Peptic ulcer c. Diarrhoea d. Constipation e. Malabsorption syndromes- Sprue/ Tropical sprue f. Ulcerative colitis and Crohn's disease g. Diverticulosis h. Hernia. Irritable bowel syndrome.
2. **Upper gastrointestinal diseases:** Gastroesophageal reflux and esophagitis. **Disorders of stomach-** indigestion, dyspepsia, gastritis, (causes, pathology, management).
3. **Nutritional management in pulmonary diseases:** Chronic obstructive Pulmonary disease, cystic fibrosis, pneumonia, tuberculosis; causes, pathology, effect of malnutrition, nutritional management.
4. **Rheumatic disorders:** Arthritis- osteo and rheumatoid arthritis, Gout: Symptoms, causes, treatment, prevention.
5. **Liver diseases:** Hepatitis (A, B, C). Cirrhosis, Cholecystitis, Cholelithiasis. alcoholic liver disease, cholestatic liver disease, inherited disorders
6. **Pancreatitis.** Functional tests and dietary management.
7. **Neurological diseases:** [Stroke, epilepsy, migraine, Parkinson's' neurotrauma myasthenia gravis], causes, effect of malnutrition, feeding problems, effect of nutrients.  
**Note:** each chapter should be dealt under cause, etiology, symptom and management.

### PRACTICAL SESSIONS

[4 hrs/wk]

1. Visit to the hospitals- learn to use medical record and obtain required information.
2. Identify and collection of case studies- at least 3-4 cases in every condition.





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

**6.Soft core: FOOD AND NUTRITION SERVICES IN HOSPITAL [0+2+0]**

1. Scope for food and nutrition services in hospitals- importance of nutritional care and foods service in hospitals.
2. Role of nutrition support team- dietetic interns, dietitians (therapeutic, administrative and consultant dietitian) medical doctors and nurses. Team approach in patient care, Psychological considerations in patient care, Inter personal relationship with patients.
3. Types of services- services in primary, secondary and tertiary health care setup, patients in different critical care centers, Post natal, pediatric and geriatric patients.
4. Basic quality management in nutrition services- total quality, structuring quality program in health care, assessment of quality of services.
5. Patient satisfaction- meeting patient needs and wants, managing customer's expectations, assessing patient's satisfaction as a mark of quality.
6. Continuous quality improvement- strategies, training and monitoring.

**7. Soft Core: DRUG NUTRIENT INTERACTION AND NUTRIGENOMICS [2+0+0/wk]**

1. **Drugs and pharmaceutical compounds-** natural and synthetic, use of excipients.
2. **Characteristics of drugs ACTION:** Pharmacodynamics, pharmacokinetics, route and form of excretion. Drug abuse and drug resistance
3. **Drug-nutrient interactions** – effect of drugs on ingestion, digestion, absorption and metabolism of nutrients, effect on nutritional status, effect on organ function, drug dosage and efficacy.
4. **Nutrient effects on drug therapy** – effects of dietary composition, interactions between medication and milk, iron, fruit juices, antacids.
5. Nutrigenomics- definition, concepts and theories.
6. Genetic materials, gene expression and inheritance.
7. Molecular mechanisms of genetic variations linked to diet- role of diet, macro and micro nutrients. Role of animal foods.
8. Evolution of human disease.

**8.Soft Core: PREPARATION OF AUDIO VISUAL AIDS (Self-study) [0+2+0]**

1. Audio-Visual Aids : Meaning, importance and Types;
2. Need for Audio-Visual Aids: Audio-Visual Aids as a Means of Communication, as a Means for Retention; as a Means to Save Time.
3. Audio Aids : Importance and Types- Record Player; Radio Programmes; Non-electronic Equipment; Other Equipments. Printed materials, charts, pamphlets, etc.
4. Preparation of audio visual aids for nutrition counselling for
  - Specific disease conditions
  - Public health programs.

**Students are expected to prepare different types of materials, demonstrate and submit a report which will be valued internally.**

**9.Soft core: NUTRITION & HEALTH PROBLEMS OF VULNERABLE POPULATION [2+0+0/wk]**

1. **Nutrition during early years:** Physical Growth and Maturation, Nutritional Assessment, Pediatric formula preparation, Prenatal Nutrition, Nutrition for Premature Infants, Normal Nutrition During Infancy, Food Hypersensitivities, Growth Failure, Childhood Obesity and Eating Disorders, Nutrition Support for Inborn Errors, Developmental Disabilities, Pulmonary Diseases, Gastrointestinal Disorders.
2. **Normal nutrition throughout the life cycle:** Nutrition in adolescence, diet, Adolescent pregnancy, eating disorders, food consumption patterns in women, nutritional needs of elderly women, Nutrition for female athlete.
3. **Nutrition and reproduction:** Diet, menstrual cycle and sex steroid hormones, nutrition concern during pregnancy and lactation, nutritional concerns in pre and post menopausal phase, hormone replacement therapy, use of oral contraceptives and nutrition.
4. Psychosocial aspects of woman's health
5. **Preventive nutrition throughout the life cycle:** Preventive nutrition in adolescent girls, obesity, cardiovascular disease, osteoporosis, diabetes, cancer.

## IV Semester

**1. Hard Core**

**CLINICAL NUTRITION and DIETETICS- II**

**[1+1+2/week]**

NOTE: theories, etiology, symptoms, assessment and dietary management of each disease condition to be included.

- **Dietary management of diseases of renal system:** etiology, symptoms, nephritis and nephrosis-metabolic and Nutritional implications in acute/ chronic renal failure, kidney, transplant. Renal calculi.
- **Dietary management of Cardio vascular diseases:** Role of specific nutrients in cardiac efficiency-aetiology, incidence, symptoms, 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, dyslipidemia (genetic hyperlipidemia).
- **Obesity:** genetics, diet and physical activity, control of body weight, risk of diabetes and cardiovascular diseases.
- **Dietary principles and management of Diabetes mellitus:** Incidence, aetiology, classification, therapy, diagnostic/monitoring criteria, long term and short-term management. **Hypoglycemia of non-diabetic origin.**
- **General principles of diet for the following conditions:** gout, Cancer (home/ hospital management), Effect of cancer therapy on nutrition of the patient. AIDS (home/ hospital management).

### PRACTICAL SESSION -

- **Identifying a specialty care unit: diabetic clinic/ weight management center/ health clubs/ hospitals/ nursing homes- select at least 3-4 patients**
- **Case studies:** Obtaining patient's medical history, planning for assessment and counseling for the following conditions (at least 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-chronic and acute.
- **Diet planning and preparation.**
- **Preparation of enteral feeds**

**2. Hard Core :****INTERNSHIP****[0+6+0/week]**

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.

**3. Soft Core :****NUTRITION COUNSELING****[1+1+0/week]**

1. **Nutrition Counseling:** Definition, concept, the role of clinical dietician, the recipients, counseling environment.
2. **A systems approach to nutritional care:** overview of the system, components of the system.
3. **Factors to be considered for counseling:** Nutritional and health conditions, including body care, skin, hair, face, hands, feet etc. Psychological conditions, food allergies, aging, gender related and other problems.
4. **Assessment component:** Methods of interview – verbal and nonverbal techniques. Counseling models – data analysis (dietary, biological, environmental, behavioral data). Facilitator resource analysis – Culmination of the assessment process.
5. **Planning component:** Designing of counseling plans – goals & objectives, classifying objections, resource planning – client care plan and designing evaluation instruments.
6. **Implementation component:** counseling the client/patient – client concurrence, co-ordination of care plans-the provision of learning experience.
7. **Evaluation component:** Measuring the success of performance of client and evaluating the counseling process.
8. Hand on experience: Preparation of counseling aids for any two disease conditions and conduct counseling sessions.

**4. Soft core :****NUTRITION IN CRITICAL CARE****[2+0+0]**

- **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.
- **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.
- **Planning, monitoring and management of Enteral and parenteral feeding:** Designer feeds, commercial feeds, techniques, applications and complications.
- Management of high risk conditions: including patho-physiological clinical and metabolic aspects in the following conditions: Burns, CV complications and surgery, cancer, AIDS, multiple organ failure, chronic renal failure (CRF), dialysis, transplant, GI tract surgery, hepatic failure and transplants, neuro surgery, fractures and other conditions of stress, trauma and sepsis, dumping syndrome.
- **Home care for critically ill and requiring long term nutrition support.**
- **Complications of nutritional support systems:** including re-feeding syndrome, palliative care, rehabilitation diets (stages).

**Practical Experience:**

Visits to hospitals (special units- ICU)/ emergency relief camps and health oriented camps and presenting as seminar/ report.

**5. Soft Core: MEDICAL ETHICS AND LAWS [1+1+ 0/wk]**

1. Meaning and definition of clinical nutritionists and dietetic practices
2. Registered dietitians- rights and duties of medical professionals and dietitians.
3. Rights and obligations of patients.
4. Medical profession and consumer protection- medical negligence, standards of proof, individual and joint liability.
5. Health care workers and the law- pharmacist, nurses and other paramedical staff.
6. Nutritional and medical ethics- autonomy of the patients, medical confidentiality of medical records, patients and physician interaction and decision making- judicial trends.
7. Role of Indian dietitians Association (IDA) and its power and functions- registration as registered dietitian.
8. Ethical issues in human and animal research.

**6. Soft Core: INBORN ERRORS OF METABOLISM [2+0+ 0/wk]**

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

**7. Soft Core: NUTRITION MANAGEMENT DURING EMERGENCIES [Self-study] [2+0+0]**

1. **Natural/man made disasters:** resulting in emergency situations-Famine, drought, flood, earthquake, cyclone, war, civil and political emergencies, Factors contributing to the rise and development of emergency situations (Use illustrations from Indian case studies).
2. **Nutritional problems and communicable diseases:** Causes, major deficiencies and communicable diseases, (PEM and other specific deficiencies) (Cholera, typhoid, measles, TB, plague).Control and prevention, role of immunization and sanitation.
3. **Assessment and surveillance of nutritional status:** in emergency affected populations- Scope for malnutrition assessment, indicators and simple screening methods. Organization for nutritional surveillance.
4. **Nutritional relief and rehabilitation:** Assessment of food needs, food distribution strategy, targeting food aid, mass and supplementary feeding, special foods/ rations for nutritional relief, organizations for mass feeding/ food distribution, transportation and storage, feeding centers, sanitation and hygiene and public nutrition approach to tackle nutritional and health problems in emergencies, ethical considerations .