

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

No.	Title of course	HC/SC/ open elective	No. of credits			
			L	T	P	Total
<b>I Semester</b>						
1	Food Science and Food Processing- I	Hard [16 credits]	2	1	2	5
2	Nutritional Biochemistry		2	1	2	5
3	Human Nutrition- I		2	1	-	3
4	Community nutrition		2	1	-	3
5	Research Methods	Soft core [to choose 4 credits]	2	-	-	2
6	Food Hygiene and Sanitation		2	-	-	2
7	Food Microbiology		2	-	-	2
8	Assessment of Nutritional status		2	-	-	2
<b>II Semester</b>						
1	Food Science and Food Processing- II	Hard core [14 credits]	2	1	2	5
2	Human Nutrition- II		2	1	2	5
3	Food laws and food safety		2	1	-	3
4	Seminar*		-	1	-	1
5	Term work in Nutritional assessment *	Soft core [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 [10 credits]	2	1	2	5
2	Functional properties of foods		2	3	-	5
3	Statistical Methods & computer applications	Soft [to choose 6 credits]	1	1	-	2
4	Entrepreneurship and Marketing		2	-	-	2
5	Quality control in food industries		2	-	-	2
6	Food Additives		2	-	-	2
7	Principles of Clinical Nutrition		2	2	-	4
8	Term paper*		-	2	-	2
9	Culinary Science- Principles & Techniques	Open elective	2	2	-	4
<b>IV Semester</b>						
1	Product Development & sensory evaluation	Hard core [8 credits]	2	3	-	5
2	Advances in Nutritional Science		2	1	-	3
3	Diet in diseases	Soft core [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

\*: 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.

## 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.  
**Biological membranes**-structure and membrane transport, membrane receptors, fundamentals of signal transduction.
2. **A. Proteins and amino acids:** a. Amino acids- Classification and structure, properties, reactions and identification techniques. Formation of peptide linkages, amide plane and biologic activity. b. Proteins- Structure and organization, physico-chemical properties, classification and functional diversity of proteins, techniques of protein purification. Estimation of protein – Kjeldhal method.  
**B.Enzymes:** Classification, nomenclature, general properties- stereo and reaction specificity, kinetics and mechanisms of enzyme action, regulation of enzyme activity. Coenzymes and cofactors, their structure and functions. Enzyme inhibition, isoenzymes, immobilized enzymes, estimation of enzyme activity, clinical significance of enzymes and enzyme assays.
3. **Carbohydrates:** Classification, structural features, stereoisomerism and optical activity, chemical properties. Monosaccharide and related compounds, disaccharides, polysaccharides. Inter conversion of hexoses, sugar derivatives of biomedical importance, hetero-glycans. Methods to estimate sugars and starch.
4. **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.
5. **Nucleic acids:** Components, structure and level of organization, Physico chemical properties, biological importance, DNA replication and enzymes in DNA replication.

6. **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 Krebs'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, flourimeter (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 –I

[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:

### RESEARCH METHODS

[2+0+0]

1. Scientific method and its goals- research process- criteria of good research- research problem- criteria for selecting the problem – defining the research problem –hypotheses- types of hypotheses-testing the hypotheses and their limitations. Basic assumptions. Non-neutrality interval estimation and evaluation of statistical model. Interval estimation and its importance. Replacing traditional hypothesis test with interval estimations
2. Research design- meaning, needs for research design-importance relating to research design- different research designs- exploratory, descriptive and diagnostic. Sampling designs- steps in sampling designs- characteristics of good sampling design – sampling techniques-sample size and its determination – the approach based on precision rate, confidence level and on Bayesian statistics. Power analysis and sample size calculation in experimental design. Power calculations. Different research designs-, Hypothesis testing research.
3. Research methods- survey- experimental, exploratory- case study – cross sectional and longitudinal methods- selection of tools- criteria for selection of tools- different types of tools- observation, home visits, interview, questionnaire, checklist, inventories- rating list, attitude scale, criteria for good research tool- reliability, validity, objectivity, and practicability- standardization of test and item analysis.
4. Measurement- concept of hypothesis testing- procedure for hypothesis testing, important parametric tests- hypotheses testing - hypotheses testing using 't' tests correlation. ANOVA
5. Research proposal- meaning of interpretation, significance of report writing. Steps in report writing, types of reports. Role of computers in research

### 6. Soft core:

### FOOD HYGIENE AND SANITATION

[2+0+0]

1. General principle of food hygiene, Hygiene in rural and urban areas in relation to food preparation, personal hygiene and food handling habits. Place of sanitation in food plants. Sanitary aspects of building and equipment: Plant layout and design.
2. A. Safe and effective insect and pest control: Extraneous materials in foods, Principles of Insects and pets control.  
B. Physical and chemical control. Effective control of micro-organisms: micro-organisms important in food sanitation, micro-organisms as indicator of sanitary quality.
3. Sanitary aspects of water supply: Source of water, quality of water, water supply and its uses in food industries. Purification and disinfection of water preventing contamination of potable water supply.



## 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:

### HUMAN NUTRITION - II

[2+1+2]

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.

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

## PRACTICAL - 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, phosphorus.
- f) Vitamin estimation – Ascorbic acid, thiamine, riboflavin and  $\beta$  carotene.

### 3. 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.

### 4. Hard Core:

### SEMINAR

[0+1+0]

One seminar to be presented by each student as per the guidelines provided by department.

### 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.



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.
3. Technology of fortifying beverages, candies, snack products.
4. Other special fortified products - salt, sugars, oils, Nutri-bars, Granola bars, health foods.

**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: STATISTICAL METHODS AND COMPUTER APPLICATIONS [1+1+0]

1. Sampling- data collection and recording.
2. Analysis of data- Graphical and diagrammatic presentation. Central tendency- concept, arithmetic mean, mode, median for ungrouped and grouped data. Qualitative methods of data analysis.
3. Measures of dispersion- absolute and relative measures; range, standard deviation (grouped and ungrouped data), variance, quartile deviation, coefficient of variability, skewness, kurtosis.
4. Probability- normal, Poisson and binomial.
5. Statistical methods- hypothesis testing, significance and correlation,. Correlation. Linear models and regression, Pearson and other correlation coefficient. Multiple regression.
6. Distribution- normal, t and chi square test for comparing variance, Conversion of  $X^2$  into phi coefficient and coefficient by contingency
7. Different among means: F- test, 1 way ANOVA; T-test: 2 ways ANOVA. Linear regression, validation and forecasting,
8. Matrices, simultaneous linear equations; tests of hypotheses and significance.
9. Time series analysis- moving averages (3 and 5 unit cycles)
10. Interpretation – Meaning of interpretation, Technique of interpretation, Precaution in interpretation- Interpretation of tables and figures.  
b) Reporting – 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.



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.

### **8.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**

#### **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**

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.

## 2.Hard Core: ADVANCES IN NUTRITIONAL SCIENCE [2+1+0]

1. Methods of research used in human and animal studies related to nutrition ( cross sectional Longitudinal, Retrospective, Prospective, cohort etc.) Available sources of information to review the literature for research).
2. Nutrition and mental development
3. Nutrition and work performance including exercise and sports
4. Nutrition for space, mines, underwater
5. Nutrition and Infection
6. Recent concepts in Human Nutrition: Nutrigenomics, Metabolomics.

### 3.Soft core:

#### DIET IN DISEASES

[2:2:0]

1. **Overweight & Obesity**- classification, causative factors (behavioral risk factors), overview of approaches to treatments and interventions.
2. **Cardiovascular disease** --aetiology, 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 malabsorption, sprue and tropical sprue, Crohn’s disease, diarrhoea, constipation, ulcerative colitis, diverticular disease and colon cancer.
7. **Cancer, HIV/AIDS**: Diagnosis, Nutrition in the etiology of cancer, Nutritional implications of cancer therapy. Stages of HIV infection. Medical and nutritional therapy, complications with the Nutrition impact.
8. **Case studies** – Select any two conditions and collect patient’s details and feeding care offered in hospital.

### 4.Soft Core:

#### Project work

[0+8+0]

An independent research project work undertaken by student under the guidance of an advisor, can either be a survey or Laboratory oriented research. 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.

### 5.Soft core-Self study paper:

#### STORAGE AND HANDLING OF FRESH PRODUCE

[0+4+0]

1. Storage and handling of food grains.
2. Storage and handling of fruits and vegetables.
3. Storage and handling of milk and milk products
4. Storage and handling of flesh and marine foods.

### **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