**Syllabus & Curriculum**

**(CBCS -2019)**

***M. Sc. Nutrition & Dietetics***

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***SGT University, Gurgram, Delhi-NCR.***

**PREAMBLE**:

Nutrition and Dietetics is a subject of growing importance in many aspects of healthcare, lifestyle and industry. It focuses on the interface between human nutrition and food science, an area of increasing importance to educators, health department, consumers, government and the food industry. It builds on major concepts of human biochemistry and physiology, nutrition and food science to discuss the roles of all nutrients, nutritional contents of food and diet in health and disease. The program includes all the units of study to ensure that the students acquire competence including public health, medical nutrition therapy, food service management, communication, management, research and evaluation.

**GOALS:**

The overall goal of the department of is to contribute to the health and wellbeing of the Human across the globe. The primary goal of the department is to train Nutrition experts with the latest knowledge, leadership and skills to become active partner in healthcare development and provide professional Nutrition services in a wide variety of settings including academic, government, corporate and military & community based organizations.

**SUBJECT SPECIFIC OBJECTIVES:**

1. To impart knowledge and develop capacities of the students through higher education in the areas of human nutrition viz. food science, food safety quality control and food product developm*e*nt.
2. To develop students to become health care professionals for services in various fields of clinical nutrition and medical nutrition management and related areas such as hospitals academics, research, industry, clinical nutrition department, training, extension and community service.
3. To develop capacities and abilities and enable them to pursue higher education and research in Nutrition and Dietetics.
4. To enable the understanding of etiology, physiology and metabolic anomalies of acute and chronic diseases and patient needs.
5. To demonstrate competence in basic concepts of research methodology used in clinical and public health nutrition; and therapeutic aspect of various diseases.

1. To enable the understanding the basis of human nutritional requirements and recommendations through the life cycle and translate the knowledge into practical guidelines for dietary needs.
2. To practice evidence based therapeutic nutritional care and management backed by scientific knowledge.
3. Be familiar with the special nutritional support techniques and feeding formulations essential for nutritional care and support.

1. To exercise empathy and a caring attitude and maintain professional integrity, honesty and high ethical standards. Plan and deliver comprehensive therapeutic nutritional support using the principles of dietetics.
2. To enable the understanding of basis of human nutritional requirements and recommendations through the life cycle and translate the knowledge into practical guidelines for dietary needs.
3. Be familiar with the recent advances in nutrition and dietetics and applies this knowledge in planning for public health programmers.

1. Be well versed with various aspects of food science, product modification and product development enriched with multiple nutrients and evaluating its nutritive and sensory qualities.
2. Be familiar with the use of information technology tools and carry out research work– field, laboratory and clinical, with the aim of publishing the work and presenting the findings at indexed national and international scientific journals.

No limit can be fixed and no fixed number of topics can be prescribed as course contents. The student is expected to know his subject in depth; however, emphasis should be on the nutritional assessment/care in relation to health and diseases most prevalent in that area of nutrition & dietetics. Knowledge of recent advances in nutrition sciences as applicable to his/her specialty should get high priority.

**Examination Scheme (M.Sc. Nutrition and Dietetics)**

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| --- |
| **Semester I** |
| **Paper** |  **Subject** | **Course Code** | **Theory Examination** | **Practical Examination** | **Total Marks** | **Credits** |
| Univ. Exam. | Int. Assess-ment | Univ. Exam. | Int. Assess-ment |
| 1 | Nutritional Biochemistry | C-ND-01 | 60 | 40 | 30 | 20 | 150 | 4+2 |
| 2 | Advanced Nutrition –I | C-ND-02 | 60 | 40 | 30 | 20 | 150 | 4+2 |
| 3 | Nutritional Management-I | C-ND-03 | 60 | 40 | 30 | 20 | 150 | 4+2 |
| 4 | Physiology  | DSE-ND-01 | 60 | 40 | - | - | 100 | 4 |
| 5 | Human Value & Professional Ethics | SEC-ND-01 | 60 | 40 | - | - | 100 | 4 |
|  | **Total** | **300** | **200** | **90** | **60** | **650** | **26** |
| **Semester II** |
| 1 | Advanced Nutrition –II | CND-04 | 60 | 40 | 30 | 20 | 150 | 4+2 |
| 2 | Applied Food Science and Product Modification | CND-05 | 60 | 40 | 30 | 20 | 150 | 4+2 |
| 3 | Nutritional Management –II | CND-06 | 60 | 40 | 30 | 20 | 150 | 4+2 |
| 4 | Research Methodology & Biostatistics | DSE-ND-02 | 60 | 40 | - | - | 100 | 4 |
| 5 | Internship | SEC-ND-02 | - | - | 60 | 40 | 100 | 4 |
| **-----------------------------------------------------------------------------------------------------------------------------------** | **Total** | **240** | **160** | **150** | **100** | **650** | **26** |
| **Semester III (\*Choose any one DSE paper )** |
| 1 | Nutrition Management-III | CND-07 | 60 | 40 | 30 | 20 | 150 | 4+2 |
| 2 | Food Service Management | CND-08 | 60 | 40 | 30 | 20 | 150 | 4+2 |
| 3 | Food Microbiology & Biotechnology | CND-09 | 60 | 40 | 30 | 20 | 150 | 4+2 |
| 4 | Management of Health and Fitness | SEC-ND-03 | - | - | 30 | 20 | 50 | 2 |
| 5 | Food processing & preservation technology | DSE-ND-03 | 60 | 40 | 30 | 20 | 150 | 4+2 |
| 6 | Food packaging  | DSE-ND-04 | 60 | 40 | 30 | 20 | 150 | 4+2 |
|  | **Total** | **240** | **160** | **150** | **100** | **650** | **26** |
| **Semester IV[\*Choose any one out of 3 or 4 DSE paper ]** |
| 1 | Public Nutrition and Health | C –ND-10 | 60 | 40 | 30 | 20 | 150 | 4+2 |
| 2 | Functional Foods and Nutraceuticals | DSE-ND-05 | 60 | 40 | 30 | 20 | 150 | 4+2 |
| 3 | Nutrition in Emergencies | DSE-ND-06 | 60 | 40 | - | - | 100 | 4 |
| 4 | Sports Nutrition | DSE-ND-07 | 60 | 40 | - | - | 100 | 4 |
| 5 | Dissertation/Project (continued from 3rd semester) | SEC-ND-04 | - | - | 90 | 60 | 150 |  6 |
|  | **Total** | **180** | **120** | **150** | **100** | **550** | **22** |

**SEMESTER-I**

**PAPER I-NUTRITIONAL BIOCHEMISTRY Credit-4**

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| **S. No.** | **TOPICS TO BE COVERED** | **DOMAIN** | **TEACHING HOURS** |
| Module 1 | 1. Introduction to membrane structures
2. Composition of membrane structures
3. Transport process across cell membranes
 | **Must Know**Membrane structure and transport process across it.**Desirable to Know**Composition of membrane structures. | 2 |
| Module2 | 1. Introduction ,Acid, Base & pH
2. Acid base balance and its regulation in human body
 | **Must Know** | 2 |
| Module 3 | 1. Introduction to Carbohydrate
2. Intestinal transport of carbohydrates.
3. Transport of glucose across various cells.
4. Cellular metabolism of carbohydrates.
5. Glycogen metabolism
6. Regulation of carbohydrate metabolism at substrate level, enzyme level, hormonal level and organ level.
7. Disorders of carbohydrate metabolism.
8. Definition, classification, structure and properties of glycoprotein & Proteoglycans.
 | **Must Know**Carbohydrate and its transport, cellular metabolism pathways, regulation.**Desirable to Know**Disorder of carbohydratemetabolism.**Nice to Know**Classification & structural properties. | 6 |
| Module4 | 1. Intestinal transport of lipids.
2. Cellular uptake & metabolism of lipids (beta-oxidation, synthesis and breakdown of unsaturated fatty acids, cholesterol, phospholipids & triacylglycerol)
3. Lipoprotein metabolism, VLDL and LDL (‘Forward’ Cholesterol transport) VLDL and LDL (Endogenous TAG transport), HDL (‘Reverse’ Cholesterol transport)
4. Regulation of lipid metabolism at substrate level, enzyme level, hormonal level and organ level.
5. Disorders of lipid metabolism, Dyslipidemia, Lipid storage diseases.
 | **Must Know**Lipids and its transport, cellular metabolism pathways, regulation.**Desirable to Know**Metabolism of lipoproteins&disorders of lipid metabolism.**Nice to Know**Classification & structural properties. | 6 |
| Module6 | 1. Metabolism of amino acids.
2. Biosynthesis & catabolism glucose and ketone bodies, protein, amino acids, non-protein amino acids (urea cycle, transamination, one-carbon metabolism)
3. Creatine and creatinine
4. Plasma proteins – Nature, properties and functions.
5. Biologically active peptides, polypeptides and transport proteins
6. Inborn errors of amino acid metabolism.
 | **Must Know**Protein and its transport, cellular metabolism pathways, regulation.**Desirable to Know**Inborn error of protein metabolism.**Nice to Know**Classification & structural properties. | 8 |
| Module7 | 1. Introduction to intermediary metabolism
2. Starve-feed cycle.
3. Caloric homeostasis & futile cycles.
4. Tricarboxylic acid cycle
5. Biological Oxidation
6. Electron transport chain
7. Oxidative phosphorylation.
 | **Must Know**Biological Oxidation, Oxidative phosphorylation. Tricarboxylic acid cycle, Electron transport chain.**Desirable to Know**Starve-feed cycle. Caloric homeostasis & futile cycles. | 4 |
| Module8 | 1. Biochemical aspects of purine and pyrimidines
2. Role of purine & pyrimidine nucleotides in metabolism
 | **Must Know** | 4 |
| Module9 | 1. Biochemistry of DNA&RNAs
2. DNA replication,Mutation, repair & recombination
3. Disorders of nucleic acid metabolism
 | **Must Know**Biochemistry of DNA&RNAs replication,Mutation, repair & recombination.**Desirable to Know**Disorders of nucleic acid metabolism. | 4 |
| Module10 | 1. Introduction to enzyme & its synthesis
2. Kinetics of mono-substrate and bi-substrate catalyzed reactions Enzyme specificity
3. Regulation of enzyme activity
4. Enzymes in clinical diagnosis
5. Enzyme detoxification in the body
6. Metabolism of xenobiotics, free radicals, ROS & oxidative damage
 | **Must Know**Enzyme, its synthesis and regulation, detoxification in the bodyand enzymes in clinical diagnosis.**Desirable to Know**Metabolism of xenobiotics, free radicals, ROS & oxidative damage | 4 |

**Practical Credit-2**

* Determination of pH (in acids, alkalis and buffers using pH meter and indicators).
* Colorimeter-calibration graph
* Separation Technique-Chromatography(paper and column),Centrifugation and Electrophoresis
* Estimation of Hb by Cyanmethoemoglobin method or Sahl’s method.
* Estimation of ascorbic acid(titrimetric/ colorimetric method/)
* Estimation of calcium (titrimetric method/)
* Estimation of iron(wong’s method)
* Lipid profile in given blood sample
* Study the principle and working of Glucometer

**References:**

1. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2000): 25th Ed. Harpers Biochemistry. Macmillan Worth Publishers.
2. Nelson, D.L. and Cox, M.M. (2000): 3rd Ed. Lehninger’s Principles of Biochemistry, Macmillan Worth Publishers.
3. Devlin, T.M. (1997): 4th Ed. Text book of Biochemistry with Clinical Correlations, Wiley Liss Inc
4. Stryer, L. (1998): 4th Ed. Biochemistry, WH Freeman and Co.
5. Conn, E.E., Stumpf, P.K., Bruening, G. and Doi, R.H. (2001): 5th Ed. Outlines of Biochemistry, John Wiley and Sons.
6. Voet, D. Voet, J.G. and Pratt, C.W. (1999). Fundamentals of Biochemistry.
7. Tietz, N.W. (1976) Fundamentals of Clinical Chemistry. WB Saunders Co.
8. King, E.J. and Wootton, I.D.P. (1956). 3rd ed. Micro-Analysis in Medical Biochemistry. J and A Churchill Ltd.
9. Plummer, D.T. (1987). 3rd ed. An Introduction to Practical Biochemistry. McGraw-Hill

**SEMESTER-I**

**PAPER II-ADVANCED NUTRITION-I Credit-4**

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| **S. No.** | **TOPICS TO BE COVERED** | **DOMAIN** | **TEACHING HOURS** |
| Module 1 | **Human Nutritional Requirements** 1 Human Nutritional Requirements, methods determining human nutrient needs.1. Description of basic terms and concepts in relation to human nutritional requirements, guidelines and recommendation.
2. Development of International and National Nutritional Requirements.
3. Translation of nutritional requirements into Dietary Guidelines.
 | **Must Know**Methods of determining human nutrition need, human nutritional requirements, guidelines and recommendation, Translation of nutritional requirements into Dietary Guidelines**Desirable to Know** Description of basic terms and concepts in relation to human nutritional requirements and development of International & National Nutritional Requirements. | 4 |
| Module2 | **Body Composition** 1. Significance of body composition and changes through the life cycle.
2. Methods for assessing body composition (both classical and recent) and their applications.
 | **Must Know** | 3 |
| Module3 | **Energy**1. Components of energy requirements: BMR, RMR, thermic effect of feeding, physical activity.
2. Factors affecting energy requirements, methods of measuring energy expenditure.
3. Estimating energy requirements of individuals and groups.
4. Regulation of energy metabolism and body weight: Control of food intake – role of leptin and other hormones.
 | **Must Know** Estimating human energy requirements,BMR, RMR, thermic effect of feeding, physical activity, methods of measuring energy expenditure.**Desirable to Know** Regulation of energy metabolism and body weight: Control of food intake – role of leptin and other hormones. | 5 |
| Module4 | **Carbohydrates**1. Dietary fibre Types, sources, role and mechanism of action.
2. Resistant starch, fructo-oligosaccharides, other oligosaccharides: Chemical composition and physiological, Significance.
3. Glycemic Index and glycemic load.
4. Carbohydrates and gene expression.
 | **Must Know**Role in human nutrition. Glycemic Index and glycemic load, physiological, significance of carbohydrate,requirement.**Desirable to Know** Structure and chemical composition of carbohydrate. Carbohydrate and gene expression. | 6 |
| Module5 | **Proteins**(1) Role of muscle, liver and G.I tract in protein metabolism.(2)Amino acid and peptide transporters. (3)Therapeutic applications of specific amino acids.(4) Peptides of physiological significance.(5) Proteins, amino acids and gene expression. | **Must Know**Significance of proteins in human nutrition,its transport & metabolism in human body, therapeutic applications of specific amino acids, requirement.**Desirable to Know** Proteins, amino acids and gene expression. | 6 |
| Module6 | **Lipids**1. Nutritional significance of fatty acids – SFA, MUFA,PUFA functions and deficiency.
2. Role of n-3 and n-6 fatty acids and Prostaglandins.
3. Trans Fatty Acids Conjugated linoleic acid, Nutritional Requirements and dietary guidelines (International and National) for visible and invisible fats in diets.
4. Lipids and gene expression.
 | **Must Know**Nutritional significance of lipids in humanbody,transport,metabolism, EFA, role, deficiency, requirements.**Desirable to Know**Lipids and gene expression. | 6 |
| Module 7 | **For each of the vitamins** Vitamin A, Vitamin E, Vitamin K, Vitamin D History, structure, sources, absorption, transport, utilization, storage, excretion, functions, bioavailability, requirements and RDA, deficiency, toxicity, assessment of status and alteration in requirements in various clinical and metabolic disorders.  | **Must Know**Functions, sources, absorption, transport, utilization, storage, excretion, , bioavailability, requirements and RDA, deficiency, toxicity and alteration in requirements in various clinical and metabolic disorders.**Desired to Know**History &Structure. | 4 |
| Module 8 | **Nutrition in Special Conditions**:Nutrition in Special Conditions, Space Travel, High Altitudes, Low Temperature and Submarines.  | **Desirable to Know**  | 2 |

**Practical Must Know**

 **Credit-2**

1. Calculate Calorific Value of raw & Cooked Preparations of all food groups
2. Methods of estimation of protein quality.
3. Quantitative analysis of macronutrients..
4. Assessment of body composition by using various tools and methods.
5. Methods of calculating energy expenditure for assessing energy requirement.
6. Enlisting high and low glycemic index rich foods.
7. Planning and preparation of nutritional menu for specific conditions like space travel, high altitudes, low temperature and submarines.

**References:**

1. Annual Reviews of Nutrition. Annual Review Inc, California, USA.

2. Shils, M.E.; Olson, J.; Shike, M. and Roos, C. (1998): Modern Nutrition in Health and

Disease. 9th edition. Williams and Williams. A Beverly Co. London.

3. Bodwell, C.E. and Erdman, J.W. (1988) Nutrient Interactions. Marcel Dekker Inc. New

York

4. World Reviews of Nutrition and Dietetics.

5. WHO Technical Report Series.

6. Indian Council of Medical Research. Recommended Dietary Intakes for Indians - Latest

Recommendations.

7. Indian Council of Medical Research. Nutritive Value of Indian Foods – Latest Publication.

**SEMESTER-I**

 **Paper III- NUTRITION MANAGEMENT-I Credit-4**

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| **S. No.** | **TOPICS TO BE COVERED** | **DOMAIN** | **TEACHING HOURS** |
| Module 1 | 1. Nutritional care Process for people at various activity levels and socioeconomic status.
2. Nutritional screening/ assessment and identification of nutritional problem.
3. Nutritional Intervention and Diet Modification based on interpretation nutrition Education and Counselling
4. Nutrition Monitoring and Evaluation.
 | **Must Know**Nutritional screening and identification of nutritional problem, nutrition education &Counselling,Dietary Intervention, monitoring and evaluation.**Desirable to Know**Nutrition care process for different people with different activity level &socioeconomic groups**.** | 3 |
| Module 2 | 1. Recommended dietary allowance (RDA)
2. Food pyramid
3. Use of exchange list
4. Advantages and limitations of exchange list
 | **Must Know**RDA,Food Pyramid,Use of Food exchange list**.****Desirable to Know**Advantages and limitations of exchange list. | 2 |
| Module3 | 1. Nutrition for weight management, etiology and disorders of energy Balance
2. Obesity Components of body weight Adipose tissue structure, regional distribution and storage.
 | **Must Know**Etiology of obesity, nutrition &weight management.**Desirable to Know**Components of body weight Adipose tissue structure, regional distribution and storage.  | 5 |
| Module4 | (1)Types of obesity, Assessment of obesity Health risks, causes of obesity: neural, hormonal, and psychological, Management of obesity(2)Dietary Modification: past and present approach.(3)Maintenance of Reduced weight.(4)Underweight/Excessive Leanness**-**Causes and assessment.(5) Health risks and Dietary Management.(6) Eating disorder not otherwise specified (EDNOS): Anorexia Nervosa and Bulimia Nervosa.(7)Nutritional management of eating disorders | **Must Know**Assessment, Nutritional management of obesity and other eating disorders.**Desirable to Know**Types of obesity, other eating disorders and associated health risks. | 7 |
| Module5 | (1)Defence mechanism of the body, Nutrition and infection.(2)Classification and etiology of fever/infection, Metabolic changes during infection (3)Acute and chronic fever nutritional management: Typhoid,Tuberculosis andMalaria. | **Must Know**Metabolic changes in Fever, Infections and nutritional care. **Desirable to Know**Classification and etiology of fever, infections. Defence mechanism of body& nutrition. | 3 |
| Module 6 |  (1)Physiology and Nutritional care and diet therapy in(i) Diseases of esophagus; esophagitis, Hiatus hernia (ii) Disorders of stomach: Gastritis, Gastric and duodenal ulcers(2)Management: associated with H. pylori infection, NSAIDS, Dietary management: traditional approach and liberal Approach | **Must Know**Nutrition therapy for Upper Gastrointestinal tract Diseases.**Desirable to Know**Physiology of Upper Gastrointestinal tract and symptoms of dysfunctions. | 2 |
| Module 7 |  (1) Common Symptoms of Intestinal dysfunction- Flatulence, constipation and Diarrhoea.(2) Diseases of the large intestine-Diverticulosis,irritable bowel syndrome,inflammatory bowel disease.(3)Malabsorption Syndrome/ Diseases of Small intestine- Celiac (Gluten –induced) sprue, tropical sprue, intestinal brush border enzyme deficiencies, Lactose intolerance, protein- losing enteropathy(4) Intestinal surgery- Short bowel syndrome,Ileostomy, Colostomy,Rectal surgery. | **Must Know**Nutrition therapy for Lower gastrointestinal tract Diseases. **Desirable to Know**Physiology oflower Gastrointestinal tract and symptoms of dysfunctions. | 5 |
| Module 8 |  (1) Nutritional care in liver disease in context with results of specific function tests liver-Dietary care and management in viral hepatitis (different types), cirrhosis of liver, hepatic encephalopathy, Wilson’s disease. (2) Dietary care and management in diseases of the gall bladder and pancreas i.e. billary dyskinesia, cholelithiasis, cholecystitis, cholecystectomy, pancreatitis, Zollinger- Ellison syndrome | **Must Know**Nutrition therapy for Diseases of the Hepato - Biliary Tract **Desirable to Know**Physiology of Hepato - Biliary Tract & diagnostic test for dysfunctions. | 5 |
| Module 9 | Delivery of Nutritional Support-Meeting nutritional needs (1) Enteral tube Feeding (2) Parenteral Nutrition | **Must Know** | 2 |

**Practical (Must Know)**

 **Credit-2**

1.Market survey of commercial nutritional supplements and nutritional support substrates

2.Nutritional (and dietary) care Process A) in health depending on the state of growth & development of the individual at various activity levels and socioeconomic status.

3.Exchange list as a tool in planning diets :

 -Interpretation of patient data and diagnostic tests and drawing up of patient diet prescription, using a case study approach.

 - Follow up – acceptability of diet prescription, compliance, discharge diet plan for each of the diseases listed below.

4Nutrition for weight management: Disorders of energy balance

 A. Obesity, Assessment of obesity, Management of obesity

 B. Underweight– Assessment, - Dietary Management

5.Nutrition in Fever and Infectious Diseases

 Nutritional management: typhoid, tuberculosis

6.Nutrition therapy for Upper Gastrointestinal tract Diseases /Disorders

 a) Physiology and Nutritional care and diet therapy in

 b) Disorders of stomach: Gastric and duodenal ulcers

7. Nutrition therapy for Lower gastrointestinal tract Diseases/Disorders

a) Intestinal dysfunction – Constipation

 b) Diseases of large intestine: Irritable bowel syndrome

8. NT for Diseases of the Hepato - Biliary Tract

 - Dietary care and management in viral hepatitis (different types) , cirrhosis of liver,

-Dietary care and management in diseases of the gall bladder and pancreas i.e. cholelithiasis, pancreatitis,

**References:**

1. Mahan, L.K. and Escott-Stump, S. (2000): Krause’s Food Nutrition and Diet Therapy,

10th Edition, W.B. Saunders Ltd.

2. Shils, M.E., Olson, J.A., Shike, M. and Ross, A.C. (1999): Modern Nutrition in Health

and Disease, 9th Edition, Williams and Wilkins.

3. Escott-Stump, S. (1998): Nutrition and Diagnosis Related Care, 4Th Edition, Williams

and Wilkins.

4. Garrow, J.S., James, W.P.T. and Ralph, A. (2000): Human Nutrition and Dietetics, 10

Th Edition, Churchill Livingstone.

5. Williams, S.R. (1993): Nutrition and Diet Therapy, 7th Edition, Times Mirror/Mosby College Publishing.

6. Davis, J. and Sherer, K. (1994): Applied Nutrition and Diet Therapy for Nurses, 2 Nd Edition, W.B. Saunders Co.

7. Walker, W.A. and Watkins, J.B. (Ed) (1985): Nutrition in Pediatrics, Boston, Little, Brown & Co.

**Journals and Other Reference Series**

1. Nutrition Update Series

2. World Review of Nutrition and Dietetics

3. Journal of the American Dietetic Association

4. American Journal of Clinical Nutrition

5. European Journal of Clinical Nutrition

6. Nutrition Reviews

**SEMESTER-I**

**PAPER IV- PHYSIOLOGY Credit-4**

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| **S.No.** | **Contents** | **DOMAIN** | **Lectures** |
| Module 1. | Basic concepts of Physiology * Cell structure and function , fluid and electrolyte
* Brief review of transport across cell membrane
* Genetics, applied genetics
* Musculo skeletal system , disorders of skeletal system
* Immunity
* Homeostasis
 | Must Know | 4 hours |
| Module 2. | Haematology * Blood, formation , composition
* Erythropoesis
* Haemostasis
* Blood grouping, cross matching , Rh incompatibility
* Anemia’s and clinical manifestations
* Thallesemia and haemoglobinopathies
* Jaundice
 | Must Know | 5 hours |
| Module 3. | Cardiovascular system * Structure and function of heart, blood vessels
* Cardiac output
* Blood pressure
* Alteration of cardiovascular functions
* Heart failure , hypertension
 | Must Know | 5 hours |
| Module 4 | Respiratory system * Transport of gases
* Mechanics of respiration
* Cardio respiratory response to exercise and effects of training.
* Alteration of pulmonary function –signs and symptoms of pulmonary diseases, asthma, ILD
 | Must Know | 4 hours |
| Module 5. | GIT * Secretory , digestive & absorptive functions
* GI hormones
* Role of liver, pancreas & gall bladder
* Manifestations of GI dysfunction
* Malabsorption syndrome
* Inflammatory bowel diseases
 | Must Know | 5 hours |
| Module 6. | Excretory system * Urine formation
* Role of kidney in maintaining acid base balance
 | Must Know | 3 hours |
| Module 7. | Endocrine system * Mechanisms of hormone regulation
* Endocrine glands and their disorders
* Emphasis on physiology of diabetes and stress hormones
 | Must Know | 5 hours |
| Module 8. | Nervous system * Conduction of nerve impulse synapse
* Organisation of CNS & PNS
* Hypothalamus and its role in body functions- obesity, sleep, memory
* Evoked potentials
* Disorders CNS
* Cerebellum & basal ganglia
 | Must Know | 9 hours |

**References:**

1. . Guyton, A.C. and Hall, J.E. (1999): Textbook of Medical Physiology, 9th Edition, W.B. Saunders Co.
2. Concise medical Physiology - Chaudhari
3. API textbook of medicine
4. Textbook of Gynaecology - Datta
5. Winwood (1988) - Sear’s Anatomy and Physiology for nurses- London, Edward Arnold.
6. Wilson (1989) –Anatomy and Physiology in Health and illness, Edinburgh, Churchill Livingstone.
7. Chatterjee Chandi Charan (1988) – Textbook of Medical Physiology, London, W.B. Saunder’s Co.

**SEMESTER-I**

 **Paper V- Human Value &Professional Ethics**

 **Credit-4**

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| **S.No.** | **TOPICS TO BE COVERED** | **DOMAIN** | **TEACHING HOURS** |
| Module 1 | Definition and Nature of Ethics- Its relation to Religion, Politics, Business, Legal, Medical and Environment. Need and Importance of Professional Ethics - Goals - Ethical Values in various Professions.  | **Must Know** Need and Importance of Professional EthicsGoals - Ethical Values in various Professions.  | 6 |
| Module **2.** | Value Education- Definition - relevance to present day - Concept of Human Values - self introspection – Self-esteem - Family values-Components, structure and responsibilities of family- Neutralization of anger - Adjustability - Threats of family life - Status of women in family and society - Caring for needy and elderly - Time allotment for sharing ideas and concern. | **Must Know** Concept of Human Values - self introspection – Self-esteem - Family values-Components, structure and responsibilities of family-**Desirable to Know**Time allotment for sharing ideas and concern. | 8 |
| Module **3.** | Meaning and definition of clinical nutritionists and dietetic practices. Registered dieticians- rights and duties of medical professionals and dieticians. Role of Indian dietetic Association (IDA) and its power and functions- registration as registered dietician. | **Must Know** Registered dieticians- rights and duties of medical professionals and dieticians. | 10 |
| Module **4.** | Medical profession and consumer protection- medical negligence, standards of proof, individual and joint liability.  |  **Desirable to Know**medical negligence, standards of proof, individual and joint liability.  | 5 |
| Module **5** | Nutritional and medical ethics- autonomy of the patients, medical confidentiality of medical records, patients and physician / dietician interaction and decision making- judicial trends.  | **Must Know** Autonomy of the patients, medical confidentiality of medical records, patients and physician / dietician interaction and decision making- | 8 |
| Module **6.** | Ethical issues in human and animal research. | **Must Know** Ethical issues in human and animal research. | 8 |

**References:**

1. John S Mackenjie: A manual of ethics.
2. The Ethics of Management" by Larue Tone Hosmer. Richard D. Irwin Inc.
3. "Management Ethics' integrity at work' by Joseph A. Petrick and John F. Quinn. Response Books: New Delhi.
4. "Ethics in Management" by S.A. Sherlekar, Himalaya Publishing House.
5. Harold H. Titus: Ethics for Today .
6. Maitra, S.K: Hindu Ethics.
7. William Lilly: Introduction to Ethics .
8. Sinha: A Manual of Ethics.
9. Text Book for Intermediate First Year Ethics and Human Values. Board of Intermediate Education- Telugu ~ Akademi, Hyderabad.

**SEMESTER-II**

 **PAPER I-ADVANCED NUTRITION-II Credit-4**

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| **S.NO.** | **TOPICS TO BE COVERED** | **DOMAIN** | **Teaching Hours** |
| Module 1 | **Water Soluble Vitamins** 1. Ascorbic acid 2. Thiamin3. Riboflavin4. Niacin5. Pyridoxine6. Folic acid7. Vitamin B12 8. Biotin,History, structure, sources, absorption, transport, utilization, storage, excretion, functions, bioavailability, requirements and RDA, deficiency, toxicity, assessment of status and alteration in requirements in various clinical and metabolic disorders. | **Must Know**Functions, sources, absorption, transport, utilization, storage, excretion, bioavailability, requirements and RDA, deficiency, toxicity and alteration in requirements in various clinical and metabolic disorders.**Desirable to know**History and structure. | 10 |
| Module 2 | **Quasi vitamins (in brief)** 1.Choline/ Betaine2.Myo Inositol3.Carnitine 4.BioflavinoidsHistory, structure, metabolism bioavailability, requirements and RDA, deficiency, toxicity, assessment of status and alteration in requirements in various clinical and metabolic disorders. | **Must Know**Functions, sources, absorption, transport, utilization, storage, excretion, , bioavailability, requirements and RDA, deficiency, toxicity and alteration in requirements in various clinical and metabolic disorders.**Desirable to know**History and structure | 5 |
| Module 3 | (**Macrominerals**   1. Calcium and phosphorus 2. Magnesium , 3.Sodium, Potassium and Chloride1) Magnesium(2) Sodium(3)Potassium (4)Chloride (3)SulfurHistory, structure, sources, absorption, transport, utilization, storage, excretion, functions, bioavailability, requirements and RDA, assessment of status and alteration in requirements in various clinical and metabolic disorders. | **Must Know**Functions, sources, absorption, transport, utilization, storage, excretion, , bioavailability, requirements and RDA, deficiency, toxicity and alteration in requirements in various clinical and metabolic disorders.**Desirable to know**History and structure. | 5 |
| Module 4 |  **Microminerals**  1. Iron2. Copper3. Manganese4. Iodine5. Fluoride6: Zinc7. Selenium 8. Cobalt 9. Chromium 10 MolybdneumHistory, structure, sources, metabolism, functions, bioavailability, requirements and RDA, deficiency, toxicity, assessment of status and alteration in requirements in various clinical and metabolic disorders. | **Must Know**Functions, sources, absorption, transport, utilization, storage, excretion, , bioavailability, requirements and RDA, deficiency, toxicity and alteration in requirements in various clinical and metabolic disorders.**Desirable to know**History and structure. | 10 |
| Module 5 |  **Ultra Trace Elements**   (1)Arsenic( 2)Vanadium(3) Silicon(4) Boron(5)Nickel(6)Lithium, Lead, Cadmium,History, structure, sources, metabolism, functions, bioavailability, requirements and RDA, assessment of status and alteration in requirements in various clinical and metabolic disorders. | **Must Know**Functions, sources, absorption, transport, utilization, storage, excretion, , bioavailability, requirements and RDA, deficiency, toxicity and alteration in requirements in various clinical and metabolic disorders.**Desirable to know**History and structure. | 10 |

**Practical (Must Know)**

 **Credit-2**

1. Critical review of dietary allowances of micronutrients for all age groups
2. Critically evaluate national and international dietary guidelines
3. Critical evaluation of toxicity and deficiency of micronutrients
4. Quantitative analysis of micronutrients
5. Critical study of methods for estimating requirements for micronutrients
6. Study of nutrient interaction

**References:**

1. Annual Reviews of Nutrition. Annual Review Inc, California, USA.

2. Shils, M.E.; Olson, J.; Shike, M. and Roos, C. (1998): Modern Nutrition in Health and

Disease. 9th edition. Williams and Williams. A Beverly Co. London.

3. Bodwell, C.E. and Erdman, J.W. (1988) Nutrient Interactions. Marcel Dekker Inc. New

York

4. World Reviews of Nutrition and Dietetics.

5. WHO Technical Report Series.

6. Indian Council of Medical Research. Recommended Dietary Intakes for Indians - Latest

Recommendations.

7. Indian Council of Medical Research. Nutritive Value of Indian Foods – Latest Publication.

8. Berdanier, C.D. and Haargrove, J.L. (ed) (1996): Nutrients and Gene Expression:

Clinical Aspects. Boca Raton, FL CRC Press.

9. Baeurle, P.A. (ed) (1994) Inducible Gene Expression. Part I: Environmental Stresses

and Nutrients. Boston: Birkhauser.

10. Chandra, R.K. (ed) (1992): Nutrition and Immunology. ARTS Biomedical. St. John’s

Newfoundland.

**Journals:**

1. Nutrition Reviews

2. Journal of Nutrition

3. American Journal of Clinical Nutrition

4. British Journal of Nutrition

5. European Journal of Clinical Nutrition

6. International Journal of Vitamin and Nutrition Research

7. International Journal of Food Science and Nutrition

8. Nutrition Research

**SEMESTER-II**

**Paper II-Applied Food Science and Product Modification Credit-4**

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| --- | --- | --- | --- |
| **S.NO.** | **TOPICS TO BE COVERED** | **DOMAIN** | **TEACHING HOURS** |
| Module1 | **Introduction to sensory analysis and uses of sensory tests**Recognition tests for 4 basic tastes, odour and aroma. Tests with other senses. Threshold tests | **Must Know** | 6Hrs |
| Module 3 | **Energy density** & Applications of fermentation, germination, malting  | **Desirable to Know** | 4hrs |
| Module 4 |  **New Food Products**  1. Definition, Classification, Characterization Factors shaping new product development-Social concerns, health concerns impact of technology and market place influence. 2.Planning, standardizing, nutritional content and testing the product. | **Must Know** | 10 hrs |
| Module 5 | **Specialty food products** **Use of different food ingredients for development of health foods** – artificial sweeteners, modified starches, fat replacers, increasing fibre content, low sodium food adjuncts, protein concentrates, whey. Health foods-Medical foods-Therapeutic foods-Herbal foods-Fortified foods.  Infant foods- Geriatric foods-Sports drinks.  Functional foods- Designer foods and Neutraceuticals.  Prebiotics and probiotics.  | **Must Know** | 10 hrs |
| Module 6 | **Product Commercialization and Marketing** -  Entrepreneurship – Financial review, Costing and Pricing, Test Market, Product launching and Commercialization. -  Ethics in food product development. -  Intellectual property/ Patents. | **Must Know** | 12 hrs |

**Practical (Must Know)**

 **Credit-2**

* Sensory analysis: Different types of sensory tests for basic taste and sensory attributes of products.
* Project on different sensory techniques and responses utilizing prepared products analysis and presentation of sensory data.
* Stepwise development of a new food product, standardization, acceptability studies and submission of project report.
* Market Survey to identify Repositioning of Existing Products, New form, Nutrition products, Therapeutic products, Specialty products, Technology Driven products New form, Reformulation, New packaging, Innovative products and Creative Products.

**References:**

1. Lyon, D.H.; Francombe, M.A.; Hasdell, T.A.; Lawson, K. (eds) (1992): Guidelines for

Sensory Analysis in Food Product Development and Quality Control. Chapman and Hall, London.

2. Amerine, M.A.; Pangborn, R.M.; Roessler, E.B. (1965): Principles of Sensory Evaluation. Academic Press, New York.

3. Kapsalis, J.G. (1987): Objective Methods in Food Quality Assessment. CRC Press, Florida.

4. Martens, M.; Dalen, G.A.; Russwurm, H. (eds) (1987): Flavour Science and Technology. John Wiley and Sons, Chichester.

5. Moskowitz, H.R. (eds) (1987): Food Texture: Instrumental and Sensory Measurement.

Marcel Dekker Inc. New York.

6. Lawless, H.T. and Klein, B.P. (1991): Sensory Science Theory and Applications in Foods. Marcel Dekker Inc.

7. Jellinek, G. (1985): Sensory Evaluation of Food Theory and Practice. Ellis Horwood,

Chichester.

8. Piggott, J.R. (ed) (1988): Sensory Analysis of Foods. Elsevier Applied Science, London.

9. Meilgaard, M.; Civille, G.V.; Carr, B.T. (1987): Sensory Evaluation Techniques, Vols. I

and II, CRC Press, Florida.

**SEMESTER-II**

**Paper III -Nutrition Management-II Credit-4**

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| **S.NO.** | **TOPICS TO BE COVERED** | **DOMAIN** |
| Module1 | 1. Long term complication- pathophysiology, diagnosis, types, and treatment, Macrovascular , Microvascular.
 | **Must Know** |
| Module 2 | 1. Nutrition in Diseases of other Endocrine organs -Adrenal gland, Thyroid, Parathyroid gland.
2. Functions of the adrenal cortex, thyroid and parathyroid gland, their insufficiencies, clinical symptoms and metabolic implications.
3. Dietary treatment as supportive to other form of therapy
4. Hyper and Hyperthyroidism (goiter)
5. Hypocalcaemia
 | **Must Know**Clinical symptoms, metabolic implications and nutritional care in different endocrine gland disorders.**Desirable to Know**Physiology and functions of different endocrine glands. |
| Module 3. | 1. Nutrition in Cardiovascular Diseases-Hypertension, Blood pressure.
2. Regulation, Short-term (sympathetic nervous system) and long-term (kidneys)
3. Hypertension – classification (secondary and essential),Risk Factors for hypertension
4. Dietary management-DASH approach
 | **Must Know**Clinical symptoms, metabolic implications,regulation and nutritional care in hypertension.**Desirable to Know**Risk factors and of hypertension. |
| Module 4. | 1. Hyperlipidemia and Hyperlipoproteinemia
2. Atherosclerosis
3. Coronary Heart Disease
4. Angina Pectoris and Myocardial Infarction
5. Classifications and Dietary management
6. Atherosclerosis - Etiology and understanding the pathogenesis
7. Coronary Heart Disease /Congestive Heart Failure
8. Clinical manifestation and importance of cardiac enzymes to aid in the detection of CHD
9. Dietary management
 | **Must Know**Clinical symptoms, metabolic implications and nutritional care in different cardiovascular diseases.**Desirable to Know**Physiology of cardiovascular system. |
| Module 5. | 1. Nutrition in Renal Diseases
2. A.GlomeruloNephritis
3. B. Nephrotic Syndrome
4. C. Uremic Renal Failure
5. D.Acute renal failure
6. E.Chronic Renal Failure
7. F. Types of dialysis
8. G. Nephrolithiases
9. H. Renal Transplant
10. Chronic renal disease in Children
11. Physiology and function of normal kidney – A brief review
12. Classification of kidney diseases
13. Etiology, characteristics Objectives, Principles of dietary treatment and management
14. History, General importance of protein nutrition in renalfailure and uremia
15. Causes and Dietary management in Acute Renal Disease
16. Causes and Dietary management in Chronic Renal Disease
17. Dietary modification in chronic renal disease with Complications
18. Sodium and Potassium Exchange list
19. Types of dialysis and their nutritional care –Haemodialysis, CAPD, Continuous Ambulatory peritoneal dialysis)
20. Renal Transplant and its nutritional care
21. Nephrolithiases- etiology, types of stones and nutritional

care (acid & alkaline ash diet)1. Chronic renal disease in Children (in brief)
 | **Must Know**Clinical symptoms, metabolic implications and nutritional care in different renal diseases/renal implant condition.**Desirable to Know**Physiology of renal system and classification of diseases, etiological factors, diagnosis and disease care process.**Nice to Know**Historical perspectives. |
| Module 6. | 1. NT for Rheumatic disorders (of the musculoskeletal system)
2. Physiology of inflammation inRheumatic Diseases
3. Osteoarthritis
4. Rheumatoid Arthritis,
5. Gout
6. Pharmacologic therapy and Nutritional Care
 | **Must Know**Clinical symptoms, metabolic implications and nutritional care in different rheumatic disorders.**Desirable to Know**Physiology of musculoskeletal system and disease care process.s |

**Practical (Must Know)**

 **Credit-2**

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| **1. Nutrition for Diabetes Mellitus and hypoglycaemia** Management of DM - Nutritional managementi) Diet planning for Type1, Type2ii) For Special conditionsa) Pregnancy b) Elderly c) Physical activitiesAcute complications – Pathophysiology, diagnosis, types, |
| **2. Nutrition in Cardiovascular Diseases and Hypertension** i) Dietary management of Hypertension-DASH approachii) Dietary management of Hyperlipidemia and Hyperlipoproteinemiaiii)Congestive Heart Failure,- Nutritional Care |
| **3.Nutrition Management for Rheumatic disorders (of the musculoskeletal system)** Physiology of inflammation ini)Rheumatic Diseases ii) Osteoarthritis iii) Rheumatoid Arthritis, iv)GoutPharmacologic therapy and Nutritional Care |
| **4.Nutrition in Renal Diseases** Principles of dietary treatment and ManagementA. GlomeruloNephritisB. Nephrotic SyndromeC. Uremic Renal Failureii) Causes and Dietary management in Acute Renal Diseaseiii) Causes and Dietary management in Chronic Renal DiseaseD) Types of dialysis and their nutritional care –Haemodialysis, CAPD, Continuous Ambulatory peritoneal dialysis)G) Chronic renal disease in Children (in brief) |

**References:**

1. Mahan, L.K. and Escott-Stump, S. (2000): Krause’s Food Nutrition and Diet Therapy,10th Edition, W.B. Saunders Ltd.

2. Shils, M.E., Olson, J.A., Shike, M. and Ross, A.C. (1999): Modern Nutrition in Health

and Disease, 9thEdition, Williams and Wilkins.

3. Escott-Stump, S. (1998): Nutrition and Diagnosis Related Care, 4thEdition, Williams and Wilkins.

4. Garrow, J.S., James, W.P.T. and Ralph, A. (2000): Human Nutrition and Dietetics, 10th Edition, Churchill Livingstone.

5. Williams, S.R. (1993): Nutrition and Diet Therapy, 7th Edition, Times Mirror/Mosby College Publishing.

6. Davis, J. and Sherer, K. (1994): Applied Nutrition and Diet Therapy for Nurses, 2 nd Edition, W.B. Saunders Co.

7. Walker, W.A. and Watkins, J.B. (Ed) (1985): Nutrition in Pediatrics, Boston, Little, Brown & Co.

8. Guyton, A.C. and Hall, J.E. (1999): Textbook of Medical Physiology, 9th Edition, W.B.

Saunders Co.

9. Ritchie, A.C. (1990): Boyd’s Textbook of Pathology, 9th Edition, Lea and Febiger, Philadelphia.

10. Fauci, S.A. et al (1998): Harrison’s Principles of Internal Medicine, 14th Edition, McGraw Hill.

11. World Cancer Research Fund (1997). Food, Nutrition and the Prevention of Cancer- A

Global perspective, Washington E.D.WCRF.

**Journals and Other Reference Series**

1. Nutrition Update Series

2. World Review of Nutrition and Dietetics

3. Journal of the American Dietetic Association

4. American Journal of Clinical Nutrition

5. European Journal of Clinical Nutrition

6. Nutrition Reviews

**SEMESTER-II**

**Paper IV-Research Methodology and Biostatistics (Theory) Credit-4**

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| **S.No.** | **Contents** | **DOMAIN** | **Lectures** |
| Module **1** | **-The Research Process** * Scientific approach to enquiry in comparison to native, common sense approach
* Knowledge, theory and research
* Role, need and scope of research in Nutrition andDietetics
* Introduction to Statistics
* Definition, conceptual understanding of statistical measures, popular concepts and misuse of statistics

**- Steps in the Research Process** * . Identifying interest areas and prioritizing
* Selection of the topic and considerations in selection
* Review of related literature and research
* Concepts, hypotheses and theories
* Research Design
* Research questions, objectives and assumptions (with examples to be brought by students as exercise)
 | Must Know | **10** |
| Module **2** |  **Types of Research** * Basic and applied research, Qualitative and Quantitative research (brief review of differences)
* Historical research
* Descriptive research methods – survey, case study, correlation study, content analysis, causal-comparative resea
* rch
* Analytic studies- pre-experimental, experimental research, quasi experimental research
* Qualitative research, ethnography
* Evaluative research- general characteristics, use of qualitative methods in enquiry (Exercise to be based on actual research papers published in accredited journals)
* Results, Discussion, Conclusion, Summary, Abstract, Bibliography and Appendices
 | Must Know | **5** |
| Module **3** |  **Test of Significance*** Hypothesis- meaning, attributes of a sound hypothesis, Stating the hypothesis and types of hypothesis, Hypothesis testing- null & alternative hypotheses, sampling distribution, standard errors, level of significance, critical regions, Type-I and Type II errors (Hypothesis formations and research questions from Research readings – students identify hypothesis/research questions –Discussion)
* Variables- types of variables including discrete and continuous variable**(**
* **Tools for Data Collection** Primary and secondary methods of data collection
* Different types of questionnaires, rating scales, check lists, schedules, attitude scales, inventories, standardized tests, interviews, and observation validity of tools.
 | Must Know | **5** |
| Module **4** | **- Probability Distributions and its Properties** 1* Normal distribution
* Binomial distribution

Probability, use of normal probability tables, area under normal distribution curve | Must Know | **3** |
| Module **5** | **-** Sampling **2-3*** Concept ofpopulation and sample, and utility.
* . Types of sampling methods and generalizability of results
* Probability sampling- simple random sample, systematic random sample, stratified random sampling etc.-random and non-random samples, random numbers and use
* Non-probability sampling-purposive samples, incidental samples, quota samples, snowball samples (Based on Journal contents discuss types of Research with Examples)
* Unit-5.General consideration in determination of sample size
 | Must Know | **5** |
| Module **6** | **Data Management and Analysis** 3-4Quantitative analysis, descriptive statistics, inferential statistics: Uses and limitations Summation sign and its properties**Method of scaling**Measures of central tendency-mean, median, mode arithmetic mean and its uses, mid – range, geometric mean, weighted mean, measures of dispersion /variability- range, variance, standard deviation, standard error, coefficient of variation, Kurtosis, Skewness (practical aspects of grouped data-frequency distribution, histogram, frequency polygons, percentiles . | Must Know | 5 |
| Module **7** | **Data Analysis** Coding of dataUse of statistical computation toolsPractical approach : Use of statistical programsSpread sheets: MS Excel and R-Spread sheet Introduction to R programming language for statistical analysis and graphics / SPSS | Must Know | **3** |
| Module **8** | **Large and Small Sample tests, its interpretation and** practical approach  Z-test for single proportions and difference between proportions  Large sample test for single mean and difference between meanSmall sample tests- One & Two – Sample t-tests, Paired t – test, F – test. | Must Know | **3** |
| Module **9** | **Chi square test and its interpretation** practical approach General features of Chi-square tests, goodness of fit Test for Independence of attributes | Must Know | **3** |
| Module **10** | **Correlation and Regression, its interpretation** and practical approach  Basic concepts Correlation1. Pearson’s correlation
2. Rank Correlation,

 Linear regression 1. Simple and Multiple Linear Regression, and its interpretations.

Calculation of regression coefficint and Prediction | Must Know | **5** |
| Module **11** | **Analysis of Variance and its interpretation,** practical approach One-way analysis of varianceIntroduction Randomized DesignsIntroduction to Factorial design | Must Know | **3** |

**References**

1. Bell, J. (1997): Doing Your Research Project: A Guide for First-time Researchers in

Education and Social Science, Viva Books, New Delhi

2. Bell, J. (1997): How to Complete Your Research Project Successfully: A Guide for

First-time Researchers, UBSPD, New Delhi.

3. Bulmer, M.C. (1984): Sociological Research Methods: An Introduction, Macmillan,

Hong Kong.

4. Festinger, L. and Katz, D. (ed.) (1977): Research Methods in the Behavioral Sciencess,

Amerind Publishing, New Delhi.

5. Holloway, I. (1997): Basic Concepts of Qualitiative Research, Blackwell Science, London.

6. Jain, G. (1998): Research Methodology: Methods and Techniques, Mangal

**Statistics**

1. Gupta, S. (2001) “Research Methodology and Statistical Techniques”,Deep and Deep, New Delhi,

2. Hooda, R.P. (2003) “Statistics for Business and Economics”, 3rd ed., Macmillan India

Ltd., Delhi,.

3. Dey, B.R. (2005) “Textbook of Managerial Statistics”, Macmillan India Ltd., Delhi,

4. Fleming, M.C. & Nellis, Joseph G. (1997) “The Essence of Statistics for Business”,

Prentice-Hall of India, New Delhi,

5. Sarma, K.V.S. (2001) “Statistics made Simple: Do it yourself on PC”, Prentice-Hall,

New Delhi.

**SEMESTER-II**

**Paper V-Internship Credit-4**

1. To gain hands on experience of working in various institutions related to food nutrition & Dietetics.
2. The student could work with governmental /private /hospital /food & nutrition related industry etc.
3. They would be required to present and submit a report of their internship in their

Department.

**SEMESTER-III**

 **Paper-I Nutritional Management III Credit-4**

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| **S.NO.** | **TOPICS TO BE COVERED** | **DOMAIN** | **TEACHING HOURS** |
| Module 1. | 1. Nutritional Anaemia
2. Erythropoiesis
3. Classifications of Anemias , Erythropoiesis and haemoglobin synthesis, nutrients involved in Erythropoiesis
4. Classifications of Anemias and Nutritional Care
5. Normocytic anemia – aplastic anemia
6. Megaloblastic anemia
7. Microcytic anemia
8. Sickle cell anemia and Thalassemia
9. Hemolytic anemia
 | **Must Know**Erythropoiesis&Anaemia,etiology,classification and Nutritional Care. Megaloblastic anemiaMicrocytic anemiaHemolytic anemia | 7 |
| Module 2. | 1. **Food Allergies**
2. Definition, Symptoms and mechanism of food Allergy
3. Diagnosis – Biochemical, immune testing (brief), history and food record, Elimination diets, Food Selection.
4. Food allergy in infancy (milk sensitive enteropathy, colic prevention of food allergy)
 | **Must Know**Food allergies,symptoms,mechanism and dietary management. **Desirable to Know**Diagnosis of food allergies. | 7 |
| Module 3. | **Nutrition in Pulmonary Disease** (1) Effects of Malnutrition on Respiration 2-31. Chronic Obstructive Pulmonary Disease
2. Etiology and Pathogenesis
3. Nutritional Management
4. Respiratory Failure
5. Nutritional Care
 | **Must Know**Nutrition therapy in various pulmonary diseases. | 5 |
| Module 4. | **Nutrition and Cancer** 1. Carcinogens in foods
2. Chemoprevention of Cancer: nutrient and non-nutrient dietary components
3. Etiology and Pathogenesis of carcinogenesis
4. Metabolic and Nutritional Alterations in Malignancy
5. Interrelationships of nutritional status and systemic effects of cancer
6. Nutritional impacts of cancer therapy, Types of therapy
7. Nutritional support of the Cancer patient
 | **Must know**Etiology of carcinogenesis, metablic alteration&nutrition support in malignancy. **Desirable to Know**Chemoprevention &types of chemotherapy. | 5 |
| Module 5. | **Nutritional Care in Hyper metabolic Conditions**1. Burns
2. Sepsis
3. Surgery
 | **Must Know** | 4 |
| Module 6. | **Drug- Nutrient Interactions** 1. Effects of diet and nutritional status on drug absorption, disposition metabolism and action
2. Effects of drugs on food intake, body weight, nutrient requirements and growth.
3. Drug induced maldigestion and malabsorbption
4. Effects of drugs on vitamin and mineral status, requirements and activity, demographics, disease state and risk of drug-nutrient and drug- nutritional status interactions.
 | **Must Know** | 10 |

**PRACTICAL (Must Know)**

 **Credit-2**

**Topics**

**1. Nutritional Anaemia**

**2. Food Allergy**

**3. Nutrition in Pulmonary Disease**

**4. Nutrition and Cancer**

**5. Nutritional Care in Hyper metabolic Conditions**

**References:**

1. Mahan, L.K. and Escott-Stump, S. (2000): Krause’s Food Nutrition and Diet Therapy,

10th Edition, W.B. Saunders Ltd.

2. Shils, M.E., Olson, J.A., Shike, M. and Ross, A.C. (1999): Modern Nutrition in Health

and Disease, 9th Edition, Williams and Wilkins.

3. Escott-Stump, S. (1998): Nutrition and Diagnosis Related Care, 4th Edition, Williams and Wilkins.

4. Garrow, J.S., James, W.P.T. and Ralph, A. (2000): Human Nutrition and Dietetics, 10

Th Edition, Churchill Livingstone.

5. Williams, S.R. (1993): Nutriion and Diet Therapy, 7th Edition, Times Mirror/Mosby College Publishing.

6. Davis, J. and Sherer, K. (1994): Applied Nutrition and Diet Therapy for Nurses, 2nd Edition, W.B. Saunders Co.

7. Walker, W.A. and Watkins, J.B. (Ed) (1985): Nutrition in Pediatrics, Boston, Little, Brown & Co.

8. Guyton, A.C. and Hall, J.E. (1999): Textbook of Medical Physiology, 9thEdition, W.B. Saunders Co.

9. Ritchie, A.C. (1990): Boyd’s Textbook of Pathology, 9th Edition, Lea and Febiger, Philadelphia.

10. Fauci, S.A. et al (1998): Harrison’s Principles of Internal Medicine, 14th,Edition, McGraw Hill.

11. World Cancer Research Fund (1997). Food, Nutrition and the Prevention of Cancer- A

Global perspective, Washington E.D. WCRF.

**Journals and Other Reference Series**

1. Nutrition Update Series

2. World Review of Nutrition and Dietetics

3. Journal of the American Dietetic Association

4. American Journal of Clinical Nutrition

**SEMESTER-III**

**PAPER-II: FOOD SERVICE MANAGEMENT Credit-4**

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| **S. No.** | **Topics to be covered** | **Domain** | **Teaching Hours** |
| Module1 | 1. Introduction, Definition of food service industry, principles of food service industry, objectives, types of food service industry
2. Hospitals, school meals, hostels, Industrial canteens, commercial hotel, canteens Institutions catering to different types of handicapped personnel.
 | **Must Know**Definition &types of foodservice institutions. | 3 |
| Module2 | Theories of management and approaches -Classical or traditional theory,Neoclassical approach, Quantitative approach, MBO approach, System approach, Behavioural and Human relations, Contingency approach, JIT approach, Total quality management approach, Management science or operation research. | **Must Know**Theories of management. | 3 |
| Module 3 | Developing objectives and goals -Definition, importance, types of goals, Policies, procedures, rules. | **Must Know**Developing goals, policies, rules and procedures for food service institution. | 3 |
| Module 4  | Principles and procedures of management-Definition of management, organization & interaction at work •principles of management, functions of management , Managerial roles & responsibilities, the manager& leadership quality. | **Must Know**Principles, function and procedures of management, managerial roles and responsibilities. | 3 |
| Module 5 | Tools of management –Definition, classification:- tangible tools, intangible tools, Organization chart,structure,function, work improvement techniques.  | **Must Know**Definition, functions and tools of management and work improvement techniques. | 3 |
| Module 6 | Personnel management -Definition, scope, concept of personnel management, approaches of personnel management, personnel policies, staff employment, training, placement, promotion, personnel records, and work appraisals. | **Must Know** Management of staff employment, training, placement, promotion and work appraisals.**Desirable to Know**Scope of personal management. | 5 |
| Module 7 | 1. Material management, Quantity food preparation and service- Definition. Principles of quantity food purchase- selection, buying and accounting of different foods.
2. Inventory management- assessing requirements, receiving of stock, release of stocks. Record maintenance.
3. Factors in menu planning for large groups, systems for maintaining quality in food preparation and service
4. Kitchen control and maintenance of Kitchen records.
 | **Must Know**Methods of food purchasing, inventory management, and maintaining quality in food production and services.**Desirable to Know**Factors involved in planning a system for maintaining large group quality food preparation.**Nice to Know**Kitchen control | 8 |
| Module 8 | 1. Financial management-Definition, scope of financial management, financial accounting, management accounting, budgeting, costing, cost control, accounting.
 | **Must Know**Financial management in food service institutions. | 6 |
| Module 9 | Hygiene and sanitation in preparation and serving area - Personal hygiene, types, sourcesof contamination, prevention, safety measures, methods of controlling infestation, methods of dish washing. | **Must Know**Sources of food contamination, hygiene, sanitation & safety measures in food production. **Desirable to Know**Infestation control.**Nice to Know**Methods of dish washing. | 6 |

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| **PRACTICAL (Must Know)** **Credit-2**\*Report submission (internal valuation) 1. Standardization of recipes- costing of recipes.  Cereal and cereal products  Vegetables.  Fruits.  Meat, chicken and other fleshy foods.  Sugar and jaggery  Milk and its products.  Pulses.  Nuts and Oil seeds. 1. Survey of hostels and cafeteria to assess various aspects of food service management. Submit a report.

Reference Books:(1) Sathe, A.Y., A First Course in Food Analysis,1999.(2) Sethi, Mohini, Catering Management :An Integrated Approach,2015.(3) Sethi, Mohini, Fasting and Feasting - Then and Now,2008.(4) Sethi, Mohin, Institutional Food Management,2004. |

**SEMESTER-III**

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| **Paper III- Food Microbiology & Biotechnology Credit-4**

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| **S.No.** | **Contents** | **DOMAIN** | **Lectures** |
| Module **1.** |  Micro-organisms of importance in food - Factors affecting the growth of micro organisms in food - Intrinsic and Extrinsic parameters that affect microbial growth. | Must Know | 3 |
| Module **2.** | Contamination and spoilage of cereal, pulses and their processed products  | Must Know | 4 |
| Module **3.** | Contamination and spoilage of vegetables & fruits and their products , eggs and poultry, milk and milk products  | Must Know | 4 |
| Module **4.** | Food borne illness : bacterial and non-bacterial Investigation of food borne disease outbreaks and preventive measures | Must Know | 6 |
| Module **5** | Use of Biotechnology for food preservation and processing.  | Must Know | 3 |
| Module **6.** | Indian fermented foods – Historical perspective, mechanism of fermentation, fermented products: bread, Beer, Wine, Vinegar and Cheese. Oriental fermented products and fermented vegetables | Must Know | 8 |
| Module **7.** |  Genetically modified foods- Need for GM foods – The food challenges, - Potential benefits in agriculture, nutritional improvement, -issues of concern, safety of GM foods. | Must Know | 5 |
| Module **8.** | Good manufacturing practices, HACCP, Food control agencies : FDA, USDA, NMFSMicrobiological criteria for foods  | Must Know | 2 |
| Module **9.** | Microorganisms as food : SCP, production of microbial enzymes: amylases, invertase, proteolytic enzymes, cellulose, lactase  | Must Know | 5 |

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**Practical (Must Know)**

 **Credit-2**

1. Study of common equipments in a microbiology lab.

2. Preparation of media and culturing, sub culturing of bacteria.

3. Staining of bacteria: gram-staining and study of colony morphology

4. Isolation of spoilage microbes from bread

5. Study of Shelf life of specific food item- raw, cooked, packaged.

6. Study of food borne bacteria and viruses – morphology and structure (Photographic)

7. Preparation of Dahi/curd using specific starter culture.

8. Microbiological identification of important molds and yeasts.

9. Visit (at least one) to food processing units or any other organization dealing with

 advanced methods in food microbiology.

**References:**

1. Banwart GJ. (1987) *Basic Food Microbiology* . CBS Publishers and Distributors.
2. Frazier WC, Westoff DC. (1998*). Food Microbiology. 4th ed*. Tata McGraw-Hill Publishing  Co. Ltd.
3. Garbutt J. (1997). *Essentials of Food Microbiology*. Arnold London.
4. Jay JM, Loessner DA, Martin J. (2005) *Modern Food Microbiology. 7th ed*. Springer
5. Speck, Marvin, (1984). Compendium of Methods for Microbiological examination of  Foods. American Public Health Association
6. Harry W. Seeley, Paul J. VanDemark (1962). Microbes in action.
7. **SEMESTER-III**

 **IV- Management of Health and Fitness (Practical) Credit-4**

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No.** | **TOPICS TO BE COVERED** | **DOMAIN** | **TEACHING HOURS** |
| Module1 | 1. Introduction to Fitness and Training Benefits of Exercise.
2. Components of physical fitness.
3. Assessment of nutritional status.
4. Holistic approach to management of health and fitness including diet and exercise (Aerobic and anaerobic).
5. Alternative systems for Health and fitness.
6. Effect of anaerobic exercise on musculoskeletal system, Endurance , strength/ Power, Speed, Coordination, agility, balance etc.
 | **Must Know**Assessment of nutritional status.Training benefits on health & fitness**Desirable to Know**Component of physical fitness& holistic approach of health & fitness.**Nice to Know**Alternative system of Health and fitness. | 10 |
| Module2. | 1. Introduction of Cardio--respiratory System.
2. Effect of aerobic exercise on heart rate, blood pressure and lung function.
3. Assessment of Cardio-respiratory fitness using Maximum aerobic capacity (VO2 max).
4. Assessment of coronary risk profile- RISKO factor.
5. Recognizing symptoms to stop any exercise, Emergency procedures.
 | **Must Know**Assessment of cardiorespiratory fitness, coronary risk profile and emergency procedures during exercise.**Desirable to Know**Introduction of Cardio respiratory system and effect of exercise on it. | 8 |
| Module3. | 1. Substrate for exercise.
2. Utilization of lipid and carbohydrate in relation to exercise type, intensity and duration.
 | **Must Know**Utilization of carbohydrate and lipids in exercises of different types and intensity. | 2 |
| Module4 | 1. Introduction of Water and Electrolyte Balance- Regime of hydration and dehydration.
2. Symptoms and effect of dehydration.
3. Sports Drink.
 | **Must Know**Water and electrolyte balance and symptoms & effect of dehydration. **Desirable to Know**Sports Drinks | 2 |
| Module5 | 1. Effect of Specific nutrients on Work Performance, Physical Fitness and Training.
2. Diets for physical fitness & training.
3. Consumption pattern of nutragenic aids &supplements.
4. Merits and demerits of nutragenic aids and supplements.
 | **Must Know**Dietary prescriptions for physical fitness & training**.****Desirable to Know**Consumption pattern of nutragenic aids & supplements& their merits /demerits.  | 4 |
| Module6 | 1. Exercise prescriptions in Special Conditions.
2. Exercise regime for pre and post-natal fitness.
3. Exercise prescriptions for obesity and weight control, diabetes, hypertension and coronary heart disease, osteoarthritis and osteoporosis, spondylitis, back aches.
 | **Must Know**Exercise prescription for physical fitness during normal and different disease conditions. | 10 |
| Module 7 | 1. Formulating dietary guidelines for fitness, health & disease conditions.
2. Critically analyzing different established weight reduction diet plans.
3. Management of obesity and CVDs.
 | **Must Know**Formulating dietary guidelines for fitness & health.**Desirable to Know**Critically analyzing different established diet plans for health and fitness. | 4 |

**References:**

1. Mahan, L.K. & Ecott-Stump, S. (2000): Krause’s Food, Nutrition and Diet Therapy, 10th Edition, W.B. Saunders Ltd.

2. Sizer, F. & Whitney, E. (2000): Nutrition – Concepts & Controversies, 8Th Edition, Wadsworth Thomson Learning.

3. Whitney, E.N. & Rolfes, S.R. (1999): Understanding Nutrition, 8th Edition, West Wadsworth, An International Thomson Publishing Co.

4. Ira Wolinsky (Ed) (1998): Nutrition in Exercise and Sports, 3rdEdition, CRC Press.

5. Parizkova, J. Nutrition, physical activity and health in early life, Ed. Wolinsky, I., CRC

Press.

6. Shils, M.E., Olson, J.A., Shike, N. and Ross, A.C. (Ed) (1999): Modern Nutrition in Health & Disease, 9th Edition, Williams & Wilkins.

7. McArdle, W. Katch, F. and Katch, V. (1996) Exercise Physiology. Energy, Nutrition and Human Performance, 4th edition, Williams and Wilkins, Philadelphia.

**Journals:**

1. Medicine and Science in Sports and Exercise.

2. International Journal of Sports Nutrition.

**SEMESTER-III**

**PAPER- V Food processing & preservation technology Credit-4**

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| --- | --- | --- | --- |
| **S.No.** | **TOPICS TO BE COVERED** | **DOMAIN** | **TEACHING HOURS** |
| **Module-1**  | Principles of fresh food storage: Nature of harvested crop, plant product storage; effect of cold storage and quality – storage of grains. | **Must Know**Nature of harvested crop, plant, animal; product storage; effect of cold storage and quality – storage of grains. | 4 |
| **Module-2** | Processing and preservation by heat: Blanching, pasteurization, sterilization and UHT processing, canning, extrusion cooking, dielectric heating, microwave heating, baking, roasting and frying. Retort processing of Ready to eat (RTE) products. Drying – water activity, microbial spoilage due to moisture. Dehydration of fruits, vegetables, milk, animal products Newer methods of thermal processing – batch and continuous | **Must Know**Pasteurization, sterilization and UHT processing, canning, extrusion cooking, dielectric heating, microwave heating, baking, roasting and frying. **Desirable to Know**Newer methods of thermal processing – batch and continuous. |  8 **10 hours** |
| **Module-3** |  Processing and preservation by low Temperature – refrigeration, freezing, CA, MA , and dehydro-freezing. Food irradiation, history and mechanism, the electro-magnetic spectrum, forms of radiant energy. Principles of using electromagnetic radiation in food processing, ionizing radiations and non ionizing radiations, advantages and disadvantages. Controlling undesirable changes in food during irradiation. | **Must Know**Refrigeration, freezing, CA, MA , and dehydro-freezing. Food irradiation, history and mechanism, the electro-magnetic spectrum, forms of radiant energy. **Desirable to Know**Controlling undesirable changes in food during irradiation. |  8 |
| **Module-4** | Processing and preservation by drying, concentration and evaporation : Various methods employed in production of dehydrated commercial products, selection of methods based on characteristics of foods to be produced, advantages and disadvantages of different methods, sun-drying, tray or tunnel drying, spray drying, drum drying, freeze drying, fluidized bed drying. Physical and chemical changes during drying control of chemical changes, desirable and undesirable changes. Packaging and storage of dehydrated products. Ultra-filtration, reverse osmosis, Freeze drying and freeze concentration. | **Must Know**Selection of methods based on characteristics of foods to be produced, advantages and disadvantages of different methods, sun-drying, tray or tunnel drying, spray drying, drum drying, freeze drying, fluidized bed drying.. |  10 |
| **Module-5** | Processing and preservation by non-thermal methods: High pressure, pulsed electric field, hurdle technology. GRAS and permissible limits for chemical preservatives and legal aspects for gamma irradiation. Use and application of enzymes and microorganism in processing and preservation of foods; food fermentations, pickling smoking etc; Food additives; Definition, types and functions, permissible limits and safety aspects. | **Must Know**High pressure, pulsed electric field, hurdle technology.Definition, types and functions, permissible limits and safety aspects. | 10  |

 **Practical (Must Know)**

 **Credit-2**

* Blanching and browning control
* Preparation of fruit preserves (jam, jelly).
* Preparation of vegetable preserves (pickle)
* Preservation by chemicals
* Preservation and bottling of fruits & vegetables
* Sensory analysis of preserved/ processed food
* Dehydrated products – vegetables dices tray drying, of seasonal fruit.
* Tomato processing
* Fruit pulping / juice / beverage preparation
* Preparation and standardization of traditional Indian fermented foods
* Bread making - texture.
* Confectionery
* Visit to food processing and preservation unit.

**References:**

1. Desrosier NW & James N. (2007). Technology of food preservation. AVI. Publishers
2. Fellows P J (2002), *Food Processing Technology- Principles and Practices*, 2nd Edition. Woodhead Publishing Ltd
3. Earle RL. 1985*. Unit Operations in Food Processing*. Pergamon Press.
4. Heldman DR & Singh RP.1995. *Food Process Engineering*. AVI Publ.
5. McCabe WL & and Smith JC. 1971. *Fundamental of Food Engineering*. AVI Publ.
6. Sahay KM & Singh KK. 1994. *Unit Operation of Agricultural Processing* Vikas Publ.  House.
7. Singh RP & Heldman DR. 1993. *Introduction to Food Engineering*. Academic Press.

 **SEMESTER-III**

 **PAPER VI-FOOD PACKAGING Credit-4**

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| **S. No.** | **Topics to be covered** | **Domain** | **Teaching Hours** |
| Module 1 | Food packaging - Need and role in extending shelf life of foods. Design and testing of package materials, package performance.1. - Principles in the development of safe and protective packing, safety assessment of food packaging materials.
 | **Must Know**Designing and development of safe food packaging material.**Desirable to Know**Role of packaging in extending shelf life of food. | 8 |
| Module 2 | 1. Food packaging systems, product characteristics and package requirements.
2. Introduction of food packaging system.
3. Different forms of packaging.
4. Rigid, semi-rigid, flexible forms of packaging.
5. Different packaging system for-Dehydrated foods, Frozen foods, Dairy products, Fresh fruits, Vegetables, Meat, Poultry, Sea foods.
 | **Must Know**Packaging requirement of food product and different types of food packaging system.  | 10 |
| Module 3 | 1. Introduction of packaging materials, Types of packaging materials their characteristics and uses.
2. Use of paper as a packaging material-Pulping

Fibrillation, Beating, Types of papers ,Testing methods.1. Use of glass as a packaging material-Composition, Properties, Types,Methods of bottle making.
2. Use of metals as a packaging material- Tinplate containers, Tinning process, Components of tinplate, Tin free steel (TFS), Types of cans, Aluminum containers, Lacquers.
3. Use of plastics as a packaging material-Types of plastics, Plastic films, laminated plastic materials, Co-extrusion.
 | **Must Know**Various packaging materials used in packaging industry. | 12 |
| Module 4 | 1. Package accessories and advances in Packaging technology-Introduction, Active packaging, Modified atmosphere packaging, Aseptic packaging, Packages for microwave ovens, Biodegradable plastics, Edible gums, Coatings.
2. Packaging equipment and machinery- Vacuum packaging machine, CA & MA packaging machine, Gas packaging machine, Seal and shrink packaging machine. Form & fill sealing machine, Aseptic packaging systems, Retort pouches, Bottling machines, Carton making machines, Package printing machines.
 | **Must Know**Packaging technology and equipments/machinery used in packaging. | 10 |

**Practical (Must Know)**

 **Credit-2**

1.Identification of different types of packaging and packaging materials.

2. Identify the latest trends in packaging consulting the web

 sites and magzines.

3. To study the health claims of packaged food.

4. Identify the packaged food labelling and their advantages.

5 Visit to relevant industries and prepare report.

**References:**

1. Bhatia S.C. Canning and Preservations of Fruits and Vegetables – New Delhi, India
2. Bureau of G and Multon J.K Food Packaging Technology (vol. 1and2) – VCH,  publishers, INC, New York
3. Dalzett J.M. Food Industry and The Environment – Chapmann and Hall, London.
4. Darry, R.andT, Blackle: Principles and Application MAP – Academic and Professions.
5. Hotchikess Food and Packaging Interaction – American Chemical Society.
6. Madhavaiah M and RV Goramma;( 1996). *Food Packaging Materials* , Tata Mcoraw –  Hill publishing company limited,New Delhi.
7. Robertson G.L. Food Packaging – New York, Marcell Dekker, Inc.
8. Sacharow and Grifin, Food Packing – AVI Publications.
9. Sood. S.K. and MridulaSaxena.(2002). *Food Packaging,* NLERT – Booklet – New  Delhi.
10. Stanley and Sacharow Food Packaging.

**SEMESTER-IV**

**PAPER I-PUBLIC NUTRITION AND HEALTH Credit-4**

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| **S. No.** | **TOPICS TO BE COVERED** | **DOMAIN** | **TEACHING HOURS** |
| Module 1 | 1. Concept of public nutrition
2. Introduction to public nutrition & health.
3. Relationship between health and nutrition.
4. Role of public nutritionists in the health care Delivery.
 | **Must Know**Public health Nutrition and nutritionists in the delivery of health care services. | 5 |
| Module 2 | 1. Sectors and Public Policies relevant to nutrition &health.
 | **Must Know**Various sectors /policies relevant to nutrition. | 5 |
| Module 3 | 1. Primary Health Care of the Community
2. National Health Care Delivery System.
3. Determinants of Health Status.
4. Indicators of Health.
 | **Must know**Health care delivery system& indicators of health.**Desirable to Know**Determinants of Health. | 5 |
| Module 4 | Approaches for improving nutrition and health status of the community 1.Programmatic options- their advantages and demerits, Feasibility Political support Available resources (human, financial, infrastructural)2.Health based interventions including immunization, provision of safe drinking water/ sanitation, prevention and management of diarrhoeal diseases 3. Food based interventions including food fortification, dietary diversification, supplementary feeding and biotechnological approaches. 4. Education based interventions including growth monitoring and promotion (GMP), health nutrition related social and behaviour change communication. | **Must Know**Population policy, structure and its dynamics.**Desirable to Know**Fertility behavior. | 6 |
| Module 5 | **Food and nutrition Security** 1. Food Security2.Food production Access, Distribution, Availability, Losses consumption3.Socio-cultural aspects and Dietary Patterns: Their implications for Nutrition and Health | **Must Know**Concept of Food & nutrition security and its component.**Desirable to Know**Socio cultural aspects of nutrition and its implication for health. | 4 |
| Module 6 | Nutritional Status 1.Determinants of nutritional status of individual & populations2.Nutrition and Non-nutritional indicators, Socio-cultural, Biological Environmental, Economic1. Assessment of nutritional status of individuals of different ages- MUAC, Wt for age, Ht for age, Wt for ht, Ponderal index, BMI
 | **Must Know**Assessment of nutritional status of individual & population.**Desirable to Know**Determinants of nutritional status.Applications & limitations/choice of of indicators in different field situation. | 5 |
| Module 7 | Major nutritional Problems Etiology, prevalence, clinical manifestations, preventive and therapeutic measures for:1. Macro and micro nutrient deficiencies2. Other nutritional problems like lathyrism, dropsy, aflatoxicosis and fluorosis.1. 3. Overweight, obesity and chronic degenerative diseases
 | **Must Know** | 5 |
| Module 8 | National Food , Nutrition and Health Policies 1. - Plan of action and programmes
 | **Must Know** | 5 |

**Practical Credit-2**

1. Study of various public health nutrition problems trend of the Nation and review it critically.
2. Study of various existing programmes of public health nutrition and review it critically.
3. Assessment of nutritional status of a group of students based of anthropometry
4. Study about various clinical sign and symptoms used in nutritional assessment
5. Study of various dietary approaches used in nutritional assessment
6. Study about various software and applications used in nutritional assessment
7. To study existing national food security system and report writing

**References:**

1. Owen, A.Y. and Frankle, R.T. (1986): Nutrition in the Community, The Art of Delivering Services, 2nd Edition Times Mirror/Mosby.

2. Park, K. (2000): Park’s textbook of preventive and social medicine, 18th Edition, M/s.

Banarasidas Bhanot, Jabalpur.

3. SCN News, UN ACC/SCN Subcommittee on Nutrition.

4. State of the World’s Children, UNICEF.

5. Census Reports.

6. Berg, A. (1973): The Nutrition Factor, the Brookings Institution, Washington.

7. Beaton, G.H. and Bengoa, J.M. (Eds) (1996): Nutrition in Preventive Medicine, WHO.

8. Bamji, M.S., Rao, P.N., Reddy, V. (Eds) (1996): Textbook of Human Nutrition, Oxford

and IBH Publishing Co. Pvt. Ltd., New Delhi.

9. Gopalan, C. and Kaur, S. (Eds) (1989): Women and Nutrition in India, Nutrition Foundation of India.

10. Gopalan, C. and Kaur, S. (Eds) (1993): Towards Better Nutrition, Problems and Policies, Nutrition Foundation of India.

**SEMESTER-IV**

 **Paper II- Functional Foods and Nutraceuticals Credit-4**

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| **S.No.** | **TOPICS TO BE COVERED** | **DOMAIN** | **TEACHING HOURS** |
| Module 1 | 1. Functional Food and Nutraceuticals- Definition, history, types and classification.
2. Perceived effect of diet on disease prevention
3. Understanding benefits of functional foods and nutraceuticals
 | **Must Know**Definition & classification of functional foods, nutraceuticals and its role in disease prevention.**Desirable to Know**History of Functional foods & Nutraceuticals. | 4 |
| Module 2 | 1. Probiotics- Taxonomy and important features of probiotic micro- organisms.
2. Health effects of probiotics including mechanism of action.
3. Probiotics in various foods: fermented milk products, non-milk products etc.
4. Quality Assurance of probiotics and safety.
 | **Must Know**Definition of probiotics,its beneficial health effects,mechanism of action, various sources quality and safety concern.**Desirable to Know**Taxonomy and features of probiotics. | 8 |
| Module 3 | 1. Prebiotics- Definition, chemistry, sources, metabolism and bioavailability, effect of processing, physiological effects, effects on human health and potential applications in risk reduction of diseases.
2. perspective for food applications for the - Non-digestible carbohydrates/oligosaccharides, Dietary fibre, Resistant starch, Gums.
 | **Must Know**Definition of prebiotics,its beneficial health effects,mechanism of action, various sources quality and safety concern.**Desirable to Know**Chemistry and metabolism of prebiotics. | 8 |
| Module4 | 1. Perspective for food applications for the - Polyphenols: Flavonoids, catechins, isoflavones,tannins, Phytoesterogens, Phytosterols, Glucosinolates, Organo sulphur compounds,Other components – Phytates, Protease.
2. Definition, chemistry, sources, metabolism and bioavailability, effect of processing, physiological effects, effects on human health and potential applications in risk reduction of diseases.
 | **Must Know**Role of Polyphenols, Flavonoids, catechins, isoflavones,tannins, Phytoesterogens, Phytosterols, Glucosinolates, Organo sulphur Phytates, Protease in humn nutrition, sources, bioavailability and potential application for health.**Desirable to Know**Chemistry, metabolism, effect of processing on above mentioned components. | 15 |
| Module5 | 1. Proteins, Peptides and nucleotides, Conjugated linoleic acid and n-3 fatty acids, Vitamins and Minerals.
 | **Must Know** | 5 |

**Practical (Must Know)**

 **Credit-2**

1. Identification of various nutraceuticals and functional foods available in the market

2. Preparation and sensory evaluation of probiotic/prebiotic/synbiotic foods

3. Preparation and sensory evaluation of antioxidant&dietary fiber rich foods.

4. Estimation of crude fibre/dietary fibre content in cereals and their products.

5. To conduct the market survey for identification of health claims of various nutraceuticals products.

6. Preparations of some traditional, fermented, functional and other products.

**References:**

1. Cho S. S. and Dreher, M.L. (2001): Handbook Dietary Fibre, Marcel Dekker Inc., New

York.

2. Yurawecz, M.P., M.M. Mossoba, J.K.G. Kramer, M.W. Pariza and G.J. Nelson eds (1999) Advances in Conjugated Linoleic Acid Research, Vol. 1. AOCS Press,Champaign.

3. Wildman, R.E.C. ed. (2000) Handbook of Nutraceuticals and Functional Foods, CRC

Press, Boca Raton.

4. Fuller, R. ed. (1992) Probiotics the scientific basis, London: Chapman and Hall, New

York.

5. Fuller, R. ed. (1997) Probiotics Applications and Practical Aspects, London: Chapman

and Hall, New York.

6. Salminen, S. A. Von Wright (eds) (1998): Lactic acid bacteria: microbiology and functional aspects, 2nd edition, Marcell Dekker Inc. New York.

7. Goldberg, I. Ed (1994): Functional Foods: Designer Foods, Pharma Foods, Nutraceuticals, Chapman & Hall, New York.

8. Wood, B.J.B. ed. (1992): The lactic acid bacteria in health and disease, Elsevier Applied Science, London.

9. Gibson, G., Williams, C. eds (2000): Functional Foods. Woodhead Publishing Ltd. U.K.

10. Young, J. (1996): Functional Foods: Strategies for successful product development. FT

Management Report Pearson Professional Publishers, London.

11. Frei, B. (1994): Natural antioxidants in human health and disease. Academic Press, San Diego.

12. Tannock, G.W. (1999): Probiotics: A critical review, Horizon Scientist Press, UK

 **SEMESTER-IV**

**PAPER III- NUTRITION IN EMERGENCIES Credit-4**

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| **S.No.** | **TOPICS TO BE COVERED** | **DOMAIN** | **TEACHING HOURS** |
| Module 1. | **Natural/Manmade disasters**Natural/Manmade 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).  | **Must Know**Natural/Manmade disasters resulting in emergency situations-Famine, drought, flood,earthquake, cyclone, war,civil and political emergencies**Nice to Know**Factors contributing to the rise and development of emergency situations (Use illustrations from Indian case studies). | 10 |
| Module 2. | **Nutritional problems and communicable diseases** Causes, major deficiencies and communicable diseases: PEM and other specific deficienciesCholera,Typhoid,Measles, TB Plague.Control and prevention, role of immunization and sanitation. | **Must Know**Causes, major deficiencies and communicable diseases: **Nice to Know**Control and prevention, role of immunization and sanitation.  | 12 |
| Module 3. | **Assessment and surveillance of nutritional status** In emergency affected populationsScope for malnutrition assessmentIndicators and simple screening methods. Organization for nutritional surveillance.  | **Must Know**Scope for malnutrition assessment**Desirable to Know**Indicators and simple screening methods.  | 8 |
|  Module.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.  | **Must Know**Assessment of food needs, food distribution strategy, targeting food aid, mass and supplementary feeding, special foods/ rations for nutritional relief, **Nice to Know**Sanitation and hygiene and public nutrition approach to tackle nutritional and health problems in emergencies, ethical considerations. | 10 |

**References:**

1. World Disasters Report – Focus on Public Health, International Federation of Red Cross and Red Crescent Societies.
2. Disasters – International Public Nutrition and Emergencies: The Potential for improving practice. Special Issue – Vol.23/4, Dec. 1999.
3. Guidelines and Research publications of OXFAM, WFP, Rome. 1999.
4. Nutrient Requirements and Recommended Dietary Allowance for Indians A Report of  the Expert Group of ICMR. 2010.
5. Dr.M Swami Nathan. (2010). Food and Nutrition Volume-2 Second Edition the Bangalore Printing and Publishing Co Ltd Bangalore 560018.
6. 6. Shubhangini A.Joshi. (2010). Nutrition and Dietetics Third Edition Tata Mecgraw Hill Education Private Limited New Delhi.

**SEMESTER-IV**

**PAPER IV- Sports Nutrition Credit-4**

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| **S. No.** | **TOPICS TO BE COVERED** | **DOMAIN** | **TEACHING HOURS** |
| Module 1. | **Approaches to the management of fitness and health:** Nutrition, exercise, physical fitness and health- their inter relationship. Significance of physical fitness and nutrition in prevention and management of weight control regimes. Nutrition guidelines for maintenance of health and fitness.  | **Must Know**Nutrition, exercise, physical fitness and health- their inter relationship.Nutrition guidelines for maintenance of health and fitness.**Desirable to Know**Significance of physical fitness and nutrition in prevention and management of weight control regimes. | 8 |
| Module 2. | **Nutritional requirements of exercise:** Effect of specific nutrients on work performance and physical fitness. Nutrients that support physical activity, Mobilization of fuel stores during exercise. Fluid requirements. | **Must Know**Effect of specific nutrients on work performance and physical fitness. Nutrients that support physical activity**Desirable to Know**Mobilization of fuel stores during exercise. | 7 |
| Module 3. | **Nutrition in sports:** Sports specific requirements- Importance of carbohydrate loading, pre game and post game meals, Diets for persons with high energy requirements, stress, fracture and injury.  | **Must Know**Importance of carbohydrate loading, pre game and post game meals**Desirable to Know**Diets for persons with high-energy requirements, stress, fracture and injury. | 10 |
| Module**.**4. | **Dietary supplements and Ergogenic aids:** Definitions, Use of different nutragenic / ergogenic aids and commercial supplements, Sports drinks, sports bars etc.  | **Must Know**Use of different nutragenic / ergogenic aids and commercial supplements,**Nice to Know**Formulation of Sports drinks & Sports bars etc. | 6 |
| Module **5** | **Challenges in Sports Nutrition:** Nutritional care for children and adolescent athletes Athletes with special needs- Paralympics & special Olympics, vegetarian athletes, Athletes with eating disorder, athletes with diabetes and other medical conditions. | **Must Know**Nutritional guidelines for children and adolescent athletes Athletes with special need | 10 |

**References:**

1. Shils, M.E., Olson, J.A., Shike, N. and Ross, A.C.(Ed)(1999). Modern Nutrition in Health and Disease, 9th Edition, Williams and Wilkins.
2. Whitney, E.N. and Rolfes, S.R.(1999). Understanding Nutrition, 8th Edition, West/Wadsworth, An International Thomson Publishing Co.
3. McArdle, W.Katch, F. and Katch, V. (1996). Exercise Physiology, Energy, Nutrition and Human Performance, 4th edition, Williams and Wilkins, Philadelphia.
4. Ira Wolinsky(ed) (1998). Nutrition in Exercise and Sports, 3rd Edition, CRC Press.
5. Sizer, F. andWhitney, E. (2000). Nutrition – Concepts and Controversies”, 8th Edition,  Wadsworth Thomson Learning.
6. Mahan, l.K. and Ecott-Stump, S. (2000). Krause’s “Food, Nutrition and Diet Therapy”,  10th Edition, W.B. Saunders Ltd.
7. Mahtabs.Bamji and N.Pralhad Rao. (2004).Text book of Human Nutrition, Second  Edition, Oxford and IBH Publishing co. PVT LTD. New Delhi.
8. Heather Hedrick Fink, Alan E. mike sky. (2012). Practical Applications in Sports  Nutrition, Third Edition, Library of Congress Cataloging in Publication Data. United  States of America.
9. Michelle McGuire, Kathy A Beer Man. (2011). Nutritional sciences From Fundamental to  Food, Second Edition, Wadsworth Cengage Learning, Belmont, USA

**SEMESTER-IV**

 **M.Sc. Dissertation Credit-6**

**Submission of Dissertation**

The research project is to be carried out over a period of approximately 6 months and will be carried out in the lab/ hospitals, subject to approval by all concerned. Students will select research project with their respective supervisors. The projects will be selected such that a student can reasonably be expected to make an original contribution to the chosen area of research within the time period allotted. The purpose of the project is to provide the student with training in academic research and acquisition of practical skills, including the design of a research project, planning of experiments, dealing with practical problems, recording of, presenting and analyzing data.

**Unit I- Thesis Proposal Development** is an independent tutorial conducted by the student’s advisor, and involves a comprehensive literature survey of the chosen research area. Through regular meetings, the student and advisor discuss this literature in detail and the topic for research project will be finalized in the third semester.

**Unit II- Thesis proposal** Each student must submit to the university with the signed approval of the advisor, a thesis proposal defining the thesis project, the methods and design of the experiments needed for completion, the progress to date and plans for completion in the third semester.

**Unit III – Thesis preparation**: This is involving preparation of the thesis. The thesis must include a cover page, abstract, table of contents, introduction of the thesis topic with a comprehensive review of literature, appropriately organized methods, results and discussion section for the experiment performed and final conclusions section summarizing the outcome of the project. The student should submit a draft of the thesis to the advisor by the end of the fourth semester.

**CURRICULUM**

**SEMESTER-I**

**PAPER I-NUTRITIONAL BIOCHEMISTRY**

**Credit-4**

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| **S. No.** | **Contents** | **Learning objectives** | **Teaching Guidelines** | **Methodology** | **Time** |
| 1 | **Membrane structure, composition & Transport across cell membranes**  | Describes Membrane structure, its composition & the process of transport across cell membranes.  | To cover the topic-* Introduction to membrane structures
* Composition of membrane structures
* Transport process across cell membranes
 | SIS) Student’s Interactive Session  |  2 |
| 2 | **Acid base balance and its regulation** |  To introduce students to know Acid, Base and its regulation in human body. | To cover the topic- * Introduction
* Acid, Base & PH
* Acid base regulation in human body
 | SIS) Student’s Interactive Session |  2 |
| 3 | **Carbohydrate Metabolism**   | To manifests students about the various aspect of carbohydrate metabolism, transport of glucose across various cells, its cellular metabolism & regulation of carbohydrate metabolism at substrate, enzyme, hormonal & organ level and disorder associated with it. | To cover the topic- * Introduction
* Intestinal transport of carbohydrates.
* Transport of glucose across various cells.
* Cellular metabolism of carbohydrates.
* Glycogen metabolism
* Regulation of carbohydrate metabolism at substrate level, enzyme level, hormonal level and organ level.
* Disorders of carbohydrate metabolism.
* Definition, classification, structure and properties of glycoprotein & Proteoglycans.
 | SIS) Student’s Interactive Session |  6 |
| 4 | **Metabolism of Lipids**  | To make able the student to demonstrates various aspects of lipid metabolism, its transport, cellular metabolism, regulation at substrate, enzyme, hormonal & organ level and associated disorders. | To cover the topic- Introduction* Intestinal transport of lipids.
* Cellular uptake & metabolism of lipids (beta-oxidation, synthesis and breakdown of unsaturated fatty acids, cholesterol, phospholipids & triacylglycerol)
* Lipoprotein metabolism, VLDL and LDL (‘Forward’ Cholesterol transport) VLDL and LDL (Endogenous TAG transport), HDL (‘Reverse’ Cholesterol transport)
* Regulation of lipid metabolism at substrate level, enzyme level, hormonal level and organ level.
* Disorders of lipid metabolism, Dyslipidemia, Lipid storage diseases.
 | SIS) Student’s Interactive Session& Student Seminars |   6 |
| 5 | **Protein Metabolism**  4-5  | To impart the knowledge of various aspect of protein metabolism and associated disorders. | * Introduction
* Metabolism of amino acids
* Biosynthesis & catabolism glucose and ketone bodies, protein, amino acids, non-protein amino acids (urea cycle, transamination, one-carbon metabolism)
* Creatine and creatinine
* Plasma proteins – Nature, properties and functions.
* Biologically active peptides, polypeptides and transport proteins
* Inborn errors of amino acid metabolism.
 | Student Seminars | 8 |
| 6 | **Intermediary Metabolism**   | At the end of the session student must be able to: Describes various intermediary metabolic cycles. | * Introduction
* Starve-feed cycle.
* Caloric homeostasis & futile cycles.
* Tricarboxylic acid cycle
* Biological Oxidation
* Electron transport chain
* Oxidative phosphorylation.
 |  | 4 |
| 7 | **Biochemical aspects of purine and pyrimidines**  | Illustrates about the biochemical aspects of purine & pyrimidines. | * Metabolism of purines
* Metabolism of pyrimidines
* Role of purine & pyrimidine nucleotides in metabolism
 | SIS) Student’s Interactive Session | 4 |
| 8 | **Biochemistry of Nucleic Acids**   | At the end of the session student must be able to: Describes various aspects of biochemistry of Nucleic acids. | To cover the topic- Biochemistry of DNA* Biochemistry of RNAs
* DNA replication
* Concepts of mutation, repair & recombination
* Disorders of nucleic acid metabolism
 | Student Seminars | 4 |
| 9 | **Enzymes**   | Impart knowledge of enzymes and related metabolic aspects. | To cover the topic- Introduction* Kinetics of mono-substrate and bi-substrate catalyzed reactions (including inhibition)
* Enzyme specificity
* Regulation of enzyme activity
* Enzyme synthesis
* Enzymes in clinical diagnosis
* Enzyme detoxification in the body
* Metabolism of xenobiotics, Free radicals, ROS & oxidative damage
 | (SIS) Student’s Interactive Session | 4 |

**Credit-2**

**Practical** Determination of pH(in acids, alkalis and buffers using pH meter and indicators).

* Colorimeter-calibration graph
* Separation Technique-Chromatography(paper and column),Centrifugation and Electrophoresis
* Estimation of Hb by Cyanmethoemoglobin method or Sahl’s method.
* Estimation of fat (centrifugation or soxhlet method)
* Estimation of proteins(by kjeldahl method)
* Estimation of fibre.
* Estimation of ash
* Estimation of moisture
* Estimation of ascorbic acid(titrimetric/ colorimetric method/)
* Estimation of calcium (titrimetric method/)
* Estimation of iron(wong’s method)
* Lipid profile in given blood sample
* Study the principle and working of Glucometer

**References:**

1. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2000): 25th Ed. Harpers Biochemistry. Macmillan Worth Publishers.
2. Nelson, D.L. and Cox, M.M. (2000): 3rd Ed. Lehninger’s Principles of Biochemistry, Macmillan Worth Publishers.
3. Devlin, T.M. (1997): 4th Ed. Text book of Biochemistry with Clinical Correlations, Wiley Liss Inc
4. Stryer, L. (1998): 4th Ed. Biochemistry, WH Freeman and Co.
5. Conn, E.E., Stumpf, P.K., Bruening, G. and Doi, R.H. (2001): 5th Ed. Outlines of Biochemistry, John Wiley and Sons.
6. Voet, D. Voet, J.G. and Pratt, C.W. (1999). Fundamentals of Biochemistry.
7. Tietz, N.W. (1976) Fundamentals of Clinical Chemistry. WB Saunders Co.
8. King, E.J. and Wootton, I.D.P. (1956). 3rd ed. Micro-Analysis in Medical Biochemistry. J and A Churchill Ltd.
9. Plummer, D.T. (1987). 3rd ed. An Introduction to Practical Biochemistry. McGraw-Hill Book Co.

**SEMESTER-I**

**PAPER II-ADVANCED NUTRITION-I Credit-4**

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| **S.****No.** | **Contents** | **Learning objectives**(At the end of session the student must be able to | **Teaching Guidelines****(To cover)** | **Methodology** | **Time** |
| 1. | **Human Nutritional Requirements** – Development and Recent Concepts.  | Introduces the basis human nutritional requirements and recommendations through the life cycle | * Methods determining human nutrient needs,
* Description of basic terms and concepts in relation to human nutritional requirements, guidelines and recommendation,
* Development of International and National Nutritional Requirements,
* Translation of nutritional requirements into Dietary Guidelines
 | SIS) Student’s Interactive Session | 4 |
| 2 | **Body Composition**  | Demonstrates body composition and related terms | 1. Significance of body composition and changes through the life cycle
2. Methods for assessing body composition (both classical and recent) and their applications.
 | (SIS) Student’s Interactive Session | 3 |
| 3 | **Energy**  |

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| Enumerates the major concepts underlying the energy.  |

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 | * Components of energy requirements: BMR, RMR, thermic effect of feeding, physical activity.
* Factors affecting energy requirements, methods of measuring energy expenditure.
* Estimating energy requirements of individuals and groups.
* Regulation of energy metabolism and body weight: Control of food intake – role of leptin and other hormones.
 | (SIS) Student’s Interactive Session | 5 |
| 4 | **Carbohy-drates**  |  Describes the nutritional significance of carbohydrates and changing trends in dietary intake  | * Dietary fibre Types, sources, role and mechanism of action
* Resistant starch, fructo-oligosaccharides, other oligosaccharides: Chemical composition and physiological, Significance
* Glycemic Index and glycemic load
* Carbohydrates and gene expression
 | (SIS) Student’s Interactive Session | 6 |
| 5 | **Proteins**  |  To manifests nutritional significance of proteins in the body. | * tThe overview of role of muscle, liver and G.I tract in protein metabolism
* Amino acid and peptide transporters
* Therapeutic applications of specific amino acids
* Peptides of physiological significance
* Proteins, amino acids and gene expression
 | (SIS) Student’s Interactive Session | 6 |
| 6 | **Lipids** | Enumerates the common health effects associated with lipids. | * Nutritional significance of fatty acids – SFA,MUFA,PUFA functions and deficiency
* Role of n-3 and n-6 fatty acids
* Prostaglandins
* Trans fatty acids, conjugated linoleic acid, Nutritional Requirements and dietary guidelines (International and National) for visible and invisible fats in diets.
* Lipids and gene expression
 | (SIS) Student’s Interactive Session | 6 |
| 7 | **Macro minerals**: Calcium and Phosphorus | To demonstrates the physiological and metabolic role of macro minerals. | History, structure, sources, absorption, transport, utilization, storage, excretion, functions, bioavailability, requirements and RDA, deficiency, toxicity, assessment of status and alteration in requirements in various clinical and metabolic disorders.  | (SIS) Student’s Interactive Session & Student Seminar | 2 |
| 8 | **Vitamin A, Vitamin E, Vitamin K, Vitamin D**  | Gain in-depth knowledge of the physiological and metabolic role of fat-soluble vitamins and their importance in human nutrition. | History, structure, sources, absorption, transport, utilization, storage, excretion, functions, bioavailability, requirements and RDA, deficiency, toxicity, assessment of status and alteration in requirements in various clinical and metabolic disorders.  | (SIS) Student’s Interactive Session & Student Seminar | 4 |
| 9 | **Nutrition in Special Conditions** | Describes the role of nutrition in special conditions | Space Travel, High Altitudes, Low Temperature and Submarines.  |  | 2 |

 **Practical Credit-2**

1. Calculate Calorific Value of raw & Cooked Preparations of all food groups
2. Methods of estimation of protein quality.
3. Quantitative analysis of macronutrients..
4. Assessment of body composition by using various tools and methods.
5. Methods of calculating energy expenditure for assessing energy requirement.
6. Enlisting high and low glycemic index rich foods.
7. Planning and preparation of nutritional menu for specific conditions like space travel, high altitudes, low temperature and submarines.

**SEMESTER-I**

 **Paper III- NUTRITION MANAGEMENT-I Credit-4**

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| **S.No.** | **Contents** | **Learning objectives**(At the end of session the student must be able to) | **Teaching Guidelines****(To cover)** | **Methodology** | **Time** |
| 1. | **Nutritional (and dietary) care Process** | -Describes the processes involved in nutritional care.-Explains how to evaluate the nutritional status of an individual.-Plan, implement and evaluate nutritional care based on the assessment.  | Health depending on the state of growth & development of the individual - at various activity levels and socioeconomic status-Nutritional screening/ assessment and identification of nutritional problem.-Nutritional Intervention and Diet Modification based on interpretation nutrition Education and Counselling-Nutrition Monitoring and Evaluation | (SIS)Student’s Interactive Session | 3 |
| 2. | **Exchange list as a tool in planning diets** | Explain exchange list and method for planning of nutrition chart | -Recommended dietary allowance (RDA)-Food pyramid -Use of exchange list - Advantages and limitations of exchange list | Case Study | 2 |
| 3. | **Nutrition for weight management** | -Enumerates the guidelines for calculating the Ideal Body Weight(IBW) | -Etiology and disorders of energy Balance -Obesity Components of body weight Adipose tissue structure, regional distribution and storage.  | (SIS)Student’s Interactive Session & Problem based learning | 5 |
| 4. | **Regulation of body weight****1.Obesity****2.Underweight****3.Eating disorders:**-Anorexia Nervosa-Bulimia Nervosa. | -Explain the importance of maintain a desirable weight throughout the life.-Describes the causative factors, prevention and treatment of various conditions related to weight management (such as obesity, underweight).-Define eating disorders and plan for the nutritional management of these disorders. | -Types of obesity Assessment of obesity Health risks, causes of obesity: neural, hormonal, and psychological, Management of obesity- Dietary Modification: past and present approach- Maintenance of Reduced weight,-Underweight/**Excessive Leanness**  -Causes and assessment -Health risks -Dietary Management -Eating disorder not otherwise specified (EDNOS): Anorexia Nervosa and Bulimia Nervosa.* Nutritional management of eating disorders
 | Student Seminar | 7 |
| 4. | **Nutrition in Fever and Infectious** **1.Thyphoid****2.Tuberculosis****3.Malaria** | -Demonstrates the various defence mechanisms in the body.-Explains the relationship between nutrition and infection-Differentiate between acute and chronic infections-Identify the symptoms and their physiological significance.-Describes the dietary management of acute and chronic infections | -Defence mechanism in the body-Nutrition and infection-Metabolic changes during infection-Classification and etiology of fever/infection -Acute and chronic fever nutritional management: * typhoid,
* tuberculosis and
* malaria.
 | (SIS)Student’s Interactive Session | 3 |
| 5. | **Nutrition therapy for Upper Gastrointestinal tract Diseases/****Disorders** | **-**Enumerates the principles of nutritional management in different disorders and diseases of the gastrointestinal tract.-Describes the modification of the regular or normal diet to suit these disease conditions. | a) Physiology and Nutritional care and diet therapy in i) Diseases of esophagus; esophagitis, Hiatus hernia  ii) Disorders of stomach: Gastritis, Gastric and duodenal ulcers- Management: associated with H. pylori infection, NSAIDS, Dietary management: traditional approach and liberal Approach | (SIS)Student’s Interactive Session |  2 |
| 6. | **Nutrition therapy for Lower gastrointestinal tract Diseases/****Disorders** a) Common Symptoms of Intestinal dysfunction.b) Diseases of the large intestinec)Malabsorption Syndrome/ Diseases of Small intestined) Intestinal surgery | -Introduces the disease conditions, causes, complications of the disorders of the lower gastrointestinal tract.-Discuss the effect of diseases on normal functioning of the gastrointestinal tract.  | * Flatulence,
* constipation,
* diarrhoea

 * Diverticular disease,
* Irritable bowel syndrome,
* Inflammatory bowel disease
* Celiac (Gluten –induced) sprue,
* tropical sprue,
* intestinal brush border enzyme deficiencies,
* Lactose intolerance,
* protein- losing enteropathy.
* Short bowel syndrome,
* Ileostomy, Colostomy,
* Rectal surgery.
 | (SIS)Student’s Interactive Session& Case study | 5 |
| 7. | **Nutrition therapy for Diseases of the Hepato - Biliary Tract** 1. **Viral hepatitis**
2. **Liver cirrhosis**
3. **Hepatic encephalopathy**
4. **Wilson’s disease**
5. **Billary dyskinesia**
6. **Cholelithiasis**
7. **Cholecystitis and cholecystectomy**
8. **Zollinger- Ellison syndrome**
 | -Describes the numerous functions of the liver, gall bladder and pancreas.- Explain the disease conditions of these organs and how the functioning of these organs are compromised in various disease conditions.-Elaborates on the principles involved in the nutritional and dietary management of these disorders.  | a) Nutritional care in liver disease in context with results of specific function tests liver-Dietary care and management in viral hepatitis (different types), cirrhosis of liver, hepatic encephalopathy, Wilson’s disease. b) Dietary care and management in diseases of the gall bladder and pancreas i.e. billary dyskinesia, cholelithiasis, cholecystitis, cholecystectomy, pancreatitis, Zollinger- Ellison syndrome | (SIS)Student’s Interactive Session | 5 |
| 8. | **Delivery of Nutritional Support** | -Emphasizes on the different modes of feeding. | Meeting nutritional needs a) Enteral tube Feeding b) Parenteral Nutrition | (SIS)Student’s Interactive Session | 2 |

**SEMESTER-I**

**Paper IV- NUTRITION MANAGEMENT-I PRACTICAL Credit-2**

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| **S.No.** | **Contents** | **Practical** |
| **1.** | **Market survey of commercial nutritional supplements** and nutritional support substrates | 2 |
| **2.** | **Nutritional (and dietary) care Process** A) in health depending on the state of growth & development of the individual at various activity levels and socioeconomic status. | 2 |
| **3.** | **Exchange list as a tool in planning diets**  -Interpretation of patient data and diagnostic tests and drawing up of patient diet prescription, using a case study approach. - Follow up – acceptability of diet prescription, compliance, discharge diet plan for each of the diseases listed below. | 2 |
| **4** | **Nutrition for weight management**: Disorders of energy balance A. Obesity, Assessment of obesity, Management of obesity  B. Underweight– Assessment, - Dietary Management  | 3 |
| **5.** | **Nutrition in Fever and Infectious Diseases**  Nutritional management: typhoid, tuberculosis | 3 |
| **6.** | **Nutrition therapy for Upper Gastrointestinal tract Diseases /Disorders** a) Physiology and Nutritional care and diet therapy b) Disorders of stomach: Gastric and duodenal ulcers  | 2 |
| **7.** | **Nutrition therapy for Lower gastrointestinal** tract Diseases/Disorders a) Intestinal dysfunction - Constipation b) Diseases of large intestine: Irritable bowel syndrome | 2 |
| **8.** | **NT for Diseases of the Hepato - Biliary Tract**  - Dietary care and management in viral hepatitis (different types) , cirrhosis of liver, -Dietary care and management in diseases of the gall bladder and pancreas i.e. cholelithiasis, pancreatitis,  | 4 |

**Reference Books:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. | TB | Pre-School Children: Development, Care and Education | Chowdhury, Adarajita | 2002 |
| 2. | TB | *Dietetics* | Srilakshmi, B. | 2014 |
| 3. | TB | Nutrition Science | Srilakshmi, B. | 2012 |
| 4.. | TB | Principles of Nutritional Assessment | Rosalind S. Gibson | 2005 |

**Journals and Other Reference Series**

1. Nutrition Update Series

2. World Review of Nutrition and Dietetics

3. Journal of the American Dietetic Association

4. American Journal of Clinical Nutrition

5. European Journal of Clinical Nutrition

6. Nutrition Reviews

**SEMESTER-I**

**PAPER IV- PHYSIOLOGY Credit-4**

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| **S.No.** | **Contents** | **Learning objectives**  | **Teaching Guidelines** | **Methodology** | **Time** |
|  | **Basic concepts of Physiology**  | Demonstrates the body systems.-Explains the structure of cell,cell cycle and cell division.-Describes the cell functions.-Enumerates the different body fluids essential to maintain body homeostasis.  | * Cell structure and function, fluid and electrolyte
* Brief review of transport across cell membrane
* Genetics, applied genetics
* Musculo skeletal system , disorders of skeletal system
* Immunity Homeostasis
 | Student’s Interactive Sessionwith case study examples | **4** |
|  | **Haematology**  | Explain the composition of blood and its role in our body.-Exhibit about various blood groups and anemia.-Enlist the disorders of coagulation and haemostasis. -To explain and interpret the various diagnostic indicators/parameters. | * Blood, formation , composition
* Erythropoesis
* Haemostasis
* Blood grouping, cross matching , Rh incompatibility
* Anemia’s and clinical manifestations
* Thallesemia and haemoglobinopathies
* Jaundice
 | Student’s Interactive Sessionwith case study examples | **5** |
|  | **Cardiovascular system** | Illustrates the structure of the heart.-Describes the various functions of the heart.-Exhibits the common terminologies of blood pressure and heart attack.-Explain the role of exercise and diet in keeping the heart toned and body fit. | * Structure and function of heart, blood vessels
* Cardiac output
* Blood pressure
* Alteration of cardiovascular functions
* Heart failure , Hypertension
 | Student’s Interactive Session | 5 |
|  | **Respiratory system** | * Explain the functions of the respiratory system
* Explain the difference between internal respiration and external respiration.
* List and explain various respiratory volumes and tell how they are used to diagnose respiratory problems.
* Describe the causes, signs and symptoms, and treatments of various diseases and disorders of the respiratory system.
 | Transport of gases * Mechanics of respiration
* Cardio respiratory response to exercise and effects of training.

Alteration of pulmonary function –signs and symptoms of pulmonary diseases, asthma, ILD  | Student’s Interactive Session | 4 |
|  | **Description of gastrointestinal tract.** | Illustrates the structure and describe the functions of different parts of the digestive systems.Illustrates the structure and describe the functions of different parts of the digestive systems.-Discuss the secretary and digestive functions of salivary glands, stomach, pancreas,liver and intestines. | GIT* Secretory , digestive & absorptive functions
* GI hormones
* Role of liver, pancreas & gall bladder
* Manifestations of GI dysfunction
* Malabsorption syndrome
* Inflammatory bowel diseases
 | Student’s Interactive Session & Student seminar | 5 |
|  | **Excretory system**  | Illustrates the structure and describe the functions of the various organs of the urinary system.-Demonstrate the mechanism of urine formation.-Explains the non-excretory functions of the kidneys.-Describes the medical aspects related to the abnormal or non-functioning of the kidney, such as dialysis and renal transplant. |  Urine formation Role of kidney in maintaining acid base balance | Student’s Interactive Session with case study examples | 3 |
| 7  | **Endocrine system**  | -Illustrates the gross structure of endocrine glands.-Describe the role of various endocrine glands in the regulation of body functions.-Exhibit the effects of over secretion and under secretion of hormones. -Comprehend the implications of functional interrelationships n a diseased body. | Endocrine system * Mechanisms of hormone regulation
* Endocrine glands and their disorders

Emphasis on physiology of diabetes and stress hormones | Student’s Interactive Session & Problem based learning | 5 |
| 8 | **Nervous system**  | * Divisions of the nervous system and their characteristics.
* Identify the structures/functions of a typical neuron.
* Describe the location and function of neuroglia.
* Explain how resting potential is created and maintained.
* List the major types of neurotransmitters and neuromodulators.
* Explain the processing of information in neural tissue.
* Discuss the roles of gray matter and white matter in the spinal cord.
* Name the major regions of the brain, and describe the locations and functions of each.
 | * Conduction of nerve impulse synapse
* Organization of CNS & PNS
* Hypothalamus and its role in body functions- obesity, sleep, memory
* Evoked potentials
* Disorders CNS
* Cerebellum & basal ganglia
 | Student’s Interactive Session & Case Study | 9 |

**SEMESTER-I**

 **Paper V- Human Value &Professional Ethics Credit-4**

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| **S.No.** | **Content** | **Learning objectives**(At the end of session the student must be able to) | **Teaching Guidelines****(To cover)** | **Methodology** | **Time** |
| **1.** | Definition and Nature of Ethics- Professional Ethics - Goals - Ethical Values in various Professions.  | Elaborates and Define nature of Ethics | Nature of Ethics- Its relation to Religion, Politics, Business, Legal, Medical and Environment. Need and Importance of Professional Ethics.Goals - Ethical Values in various Professions. | Student interactive session  | 6 |
| **2.** | Value Education-  | Definition relevance to present day - Concept of Human Values -  | Describe the human value and its components self introspection – Self-esteem - Family values-Components, structure and responsibilities of family- Neutralization of anger - Adjustability - Threats of family life - Status of women in family and society - Caring for needy and elderly - Time allotment for sharing ideas and concern. | Teachers seminar | 8 |
| **3.** | Meaning and definition of clinical nutritionists and dietetic practices. Registered dieticians- rights and duties of medical professionals and dieticians. Role of Indian dietetic Association (IDA) and its power and functions- registration as registered dietician. | Definition of clinical nutritionists and dietetic practices. | Enumerates Role of Indian dietetic Association (IDA) and its power and functions- registration as registered dietician.. | Student seminar | 10 |
| **4.** | Medical profession and consumer protection | Explain the medical profession and consumer protection- medical negligence, standards of proof, individual and joint liability. | Consumer protection- medical negligence, standards of proof, individual and joint liability. | Student interactive session | 5 |
| **5** | Nutritional and medical ethics-.  | Describe Nutritional and medical ethics- autonomy of the patients | Autonomy of the patients, medical confidentiality of medical records, patients and physician / dietician interaction and decision making- judicial trends | Student interactive session | 8 |
| **6.** | Ethical issues in human and animal research. | Understand the Ethical issues in human and animal research | Human and animal research guidelines: aligning ethical constructs with new scientific developments. | Student interactive session &Case study | 8 |

**References:**

* John S Mackenjie: A manual of ethics.
* The Ethics of Management" by Larue Tone Hosmer. Richard D. Irwin Inc.
* "Management Ethics' integrity at work' by Joseph A. Petrick and John F. Quinn. Response Books: New Delhi.
* "Ethics in Management" by S.A. Sherlekar, Himalaya Publishing House.
* Harold H. Titus: Ethics for Today .
* Maitra, S.K: Hindu Ethics.
* William Lilly: Introduction to Ethics .
* Sinha: A Manual of Ethics.
* Text Book for Intermediate First Year Ethics and Human Values. Board of Intermediate Education- Telugu ~ Akademi, Hyderabad.

**SEMESTER-II**

**PAPER I-ADVANCED NUTRITION-II Credit-4**

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| **S. No.** | **Contents** | **Learning objectives**(At the end of session the student must be able to | **Teaching Guidelines****(To cover)** | **Methodology** | **Time** |
| 1 | **Water Soluble Vitamins** 1. Ascorbic acid 2. Thiamin3. Riboflavin4. Niacin5. Pyridoxine6. Folic acid7. Vitamin B12 8. Biotin | Enumerates the physiological and pharmacological actions of water-soluble vitamins   and their importance in human nutrition.  | History, structure, sources, absorption, transport, utilization, storage, excretion, functions, bioavailability, requirements and RDA, deficiency, toxicity, assessment of status and alteration in requirements in various clinical and metabolic disorders. | SIS and Problem based learning | 10 |
| 2 | **Quasi Vitamins (in brief)** 1.Choline/ Betaine2.Myo Inositol3.Carnitine 4.Bioflavinoids  | Identifies the sources of nutrients and explain the functions of each nutrient. | History, structure, metabolism bioavailability, requirements and RDA, deficiency, toxicity, assessment of status and alteration in requirements in various clinical and metabolic disorders. |  SIS and Project based learning | 5 |
| 3 | **Macro minerals Calcium**  Magnesium Sodium, .Potassium .Chloride .Sulfur | Explain the effects on health of deficiency and excess of each nutrient. | History, structure, sources, absorption, transport, utilization, storage, excretion, functions, bioavailability, requirements and RDA, assessment of status and alteration in requirements in various clinical and metabolic disorders. | SIS | 5 |
| 4 | **Micro minerals**  1. Iron2. Copper3. Manganese4. Iodine5. Fluoride6: Zinc7. Selenium 8. Cobalt 9. Chromium  | Enlists the importance and role micro mineral in the body. | History, structure, sources, metabolism, functions, bioavailability, requirements and RDA, deficiency, toxicity, assessment of status and alteration in requirements in various clinical and metabolic disorders. | Student seminar | 10 |
| 5 | **Ultra Trace Elements**  1. Arsenic 2.Vanadium3. Silicon4. Boron5.Nickel6.Lithium, Lead, Cadmium,  | Explains the causes and consequences of excessive intake and deficiency of ultra trace elements. | History, structure, sources, metabolism, functions, bioavailability, requirements and RDA, assessment of status and alteration in requirements in various clinical and metabolic disorders. |  Group Discussion | 10 |

**Practical**

 **Credit-2**

* Critical review of dietary allowances of micronutrients for all age groups
* Critically evaluate national and international dietary guidelines
* Critical evaluation of toxicity and deficiency of micronutrients
* Quantitative analysis of micronutrients
* Critical study of methods for estimating requirements for micronutrients
* Study of nutrient interaction

**References:**

1. Annual Reviews of Nutrition. Annual Review Inc, California, USA.

2. Shils, M.E.; Olson, J.; Shike, M. and Roos, C. (1998): Modern Nutrition in Health and

Disease. 9th edition. Williams and Williams. A Beverly Co. London.

3. Bodwell, C.E. and Erdman, J.W. (1988) Nutrient Interactions. Marcel Dekker Inc. New

York

4. World Reviews of Nutrition and Dietetics.

5. WHO Technical Report Series.

6. Indian Council of Medical Research. Recommended Dietary Intakes for Indians - Latest

Recommendations.

7. Indian Council of Medical Research. Nutritive Value of Indian Foods – Latest Publication.

8. Berdanier, C.D. and Haargrove, J.L. (ed) (1996): Nutrients and Gene Expression:

Clinical Aspects. Boca Raton, FL CRC Press.

9. Baeurle, P.A. (ed) (1994) Inducible Gene Expression. Part I: Environmental Stresses

and Nutrients. Boston: Birkhauser.

10. Chandra, R.K. (ed) (1992): Nutrition and Immunology. ARTS Biomedical. St. John’s

Newfoundland.

**Journals:**

1. Nutrition Reviews

2. Journal of Nutrition

3. American Journal of Clinical Nutrition

4. British Journal of Nutrition

**SEMISTER II**

**PAPER II: APPLIED FOOD SCIENCE AND PRODUCT MODIFICATION Credit-4**

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| **S. No** | **Topic** | **Learning Objectives****(At the end of the session the students must be able to)** | **Teaching guidelines** | **Methodology** | **Time** |
| 1 | **Introduction to sensory analysis and uses of sensory tests**  | Introduce the term sensory evaluation Enumerates the functions, concept, objectives, measurement scales, basic sensory test in detail  | Introduction • History • Definition of sensory evaluation •terms related to sensory evaluation • objectives of sensory evaluation • human senses:- sight, smell, taste:- sweet, salty, sour, bitter, umami , sound, touch • Requirement of sensory analysisVariables controlled during sensory evaluationPanel management Environmental controlScales used in measurement:- category scale, line scale, magnitude estimation scaleRecognition tests for 4 basic tastes, odour and aroma Tests with other senses Threshold tests for basic tastes | SIS & Tutorials  | 5Hrs |
| 2 | **Sensory Evaluation Tests** | Perform and apply the different types of sensory evaluation used by food experts and their importance with application  | Introduction • types * **Analytical Difference test:-**

 Difference test Overall difference test:-  triangle test, duo-trio test* **Attribute difference test:-**

 Paired comparison test Ranking test Rating test* **Analytical descriptive test:-**

 Flavor Profile analysis Quantitative Descriptive analysis Texture Profile analysis* **Affective test**

 Acceptance test Preference test  | SIS & Demonstration  | 5 hrs |
| 3 | **Conducting the Test**:  | Describes effective skills to understand and explain the methods of packing radiation stabilized food  | Introduction • stepwise process of conducting sensory evaluation test * Preparing samples
* Presenting samples
* Using reference samples,
* Reducing panel response error
* Consumer oriented tests,
* Product oriented tests
* Shelf life studies,
* Product matching
* Product mapping,
* Taint Investigation and prevention
* Reducing viscosity and bulk in foods
 |  Role Play and project based learning | 10 hrs |
| 4 | **Increasing energy density**  | Enumerates the ways of increasing energy density of food | Introduction • advantages • methods of increasing energy density | SIS | 2hrs |
| 5 | **Applications of fermentation, germination, malting**   | Demonstrates effective skills to understand and use methods of fermentation, germination, malting in product development  | Introduction **Applications of fermentation**definition of fermentation • advantages of fermentation • application of fermentation in food product development**Applications of germination**definition of germination • advantages of germination • application of germination in food product development**Applications of malting**definition of malting • advantages of malting • application of malting in food product development | Group discussion | 4hrs |
| 6 | **Use of Different Food Ingredients for Development of Health Foods**  | Enumerates the uses and benefits of different food ingredients that can be used in the development of health foods | Introduction • definition of health foods • categories • advantages of health food • **Different Food Ingredients for Development of Health Foods** * Artificial sweeteners
* Modified starches
* Fat replacers
* Increasing fibre content
* Functional ingredients
* Low sodium food adjuncts
* Protein concentrates
* Whey
 | Student Interaction session  | 10 hrs |
| 7 | **New Food Products**  | The students will illustrates different types of packaging material used by food industry and their importance with the purpose, precautions | Introduction • definition • characterizing new product• customer and consumers • ClassificationFactors shaping new product development-* Social concerns
* health concerns
* impact of technology
* market place influence

Designing new product :– introduction •new product development team • types • drawing forces •organizing for product development • phases of new product developmentNeed for product developmentStages of product development * Planning
* standardizing
* testing the product
* nutritional content

Success in product development  | SIS & Project based learning | 12 hrs |
| 8 | **Tapping traditional foods and unconventional sources of foods**.  | At the end of the unit students will perform methods of fermentation, germination, malting in product development  | Introduction • definition of traditional foods • unconventional sources of foods•Modifying traditional foods planning •standardizing • testing the product • nutritional content of modified food | Student seminar | 12 hrs |

**Credit-2**

**Practical Work** Sensory analysis: Different types of sensory tests for basic taste and sensory attributes of products.

* Project on different sensory techniques and responses utilizing prepared products analysis and presentation of sensory data.
* Stepwise development of a new food product, standardization, acceptability studies and submission of project report.
* Survey on types of conveniences foods/consumer behaviour/analysis of food labelling.

**REFERENCE BOOKS:**

* Sensory Evaluation of Food by [Hildegarde Heymann](http://www.amazon.in/s/ref%3Ddp_byline_sr_book_1?ie=UTF8&field-author=Hildegarde+Heymann&search-alias=stripbooks) , [Harry T. Lawless](http://www.amazon.in/s/ref%3Ddp_byline_sr_book_2?ie=UTF8&field-author=Harry+T.+Lawless&search-alias=stripbooks)
* Sensory Evaluation Techniques by [Gail Vance Civille](http://www.amazon.in/s/ref%3Ddp_byline_sr_book_1?ie=UTF8&field-author=Gail+Vance+Civille&search-alias=stripbooks) , [B. Thomas Carr](http://www.amazon.in/s/ref%3Ddp_byline_sr_book_2?ie=UTF8&field-author=B.+Thomas+Carr&search-alias=stripbooks)
* Food Science by B. Srilakshmi
* Objective Methods in Food Quality Assessment by J.G. Kapsalis
* Guidelines for Sensory Analysis in Food Product Development and Quality Control by D.H .Lyon, M.A .Francombe; T.A .Hasdell; K. Lawson.

**SEMESTER-II**

**PAPER III-NUTRITION MANAGEMENT-II Credit-4**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S.No.** | **Contents** | **Learning objectives**(At the end of session the student must be able to) | **Teaching Guidelines****(To cover)** | **Methodology** | **Time** |
| 1. | **Long term complication** | Illustrates different long term complications related patients. | - pathophysiology, diagnosis, types, and treatmenti). Macrovascular 2ii). Microvascular | SIS | 4 |
| 2. | **Nutrition in Diseases of other Endocrine organs** **1.Adrenal gland****2.Thyroid****2.Parathyroid**   | Enumerates the effect of the various endocrine organs related diseases on nutritional status and nutritional and dietary requirements.  | - Functions of the adrenal cortex, thyroid and parathyroid gland, their insufficiencies, clinical symptoms and metabolic implications.- Dietary treatment as supportive to other form of therapy- Hyper and Hyperthyroidism (goiter)- Hypocalcaemia | SIS & Case study | 5 |
| 3. | **Nutrition in Cardiovascular Diseases and Hypertension**-Blood pressure-Hypertension  | -Describes the various forms of coronary heart diseases.-Enumerate the risk factors in causation of CHD. | i) Regulation, Short-term (sympathetic nervous system) and long-term (kidneys)ii) Hypertension – classification (secondary and essential)iii) Risk Factors for hypertensioniv) Dietary management-DASH approach | SIS & Case study |  5 |
| 4. | **Hyperlipidemia and Hyperlipoproteinemia** **-**Atherosclerosis-Coronary Heart Disease-Angina Pectoris and Myocardial Infarction | -Display the etiology, symptoms, as well as, complications of various forms of heart diseases-Explains the treatment management and prevention of disease with emphasis on behaviour modification. | -Classifications and Dietary management-Atherosclerosis - Etiology and understanding the pathogenesis-Coronary Heart Disease **/**Congestive Heart Failure- Angina Pectoris and Myocardial Infarction- Clinical manifestation and importance of cardiac enzymes to aid in the detection of CHD- Dietary management | Student Seminar  | 5 |
| 5. | **Nutrition in Renal Diseases** A.Glomerulo NephritisB. Nephrotic SyndromeC. Uremic Renal FailureD.Acute renal failureE.Chronic Renal FailureF. Types of dialysisG. NephrolithiasesH. Renal TransplantI. Chronic renal disease in Children | -Recapitulate and describe the physiology of kidneys-Discuss the renal function and diagnostic tests-Introduces different renal disorders, their etiology,Clinical and metabolic manifestation.-Rationalize the dietary modifications in renal disorders, especially proteins, minerals and fluids. | - Physiology and function of normal kidney – A brief review- Classification of kidney diseases, Etiology, characteristics Objectives, Principles of dietary treatment and management-History, General importance of protein nutrition in renalfailure and uremia-Causes and Dietary management in Acute Renal Disease-Causes and Dietary management in Chronic Renal Disease-Dietary modification in chronic renal disease with Complications-Sodium and Potassium Exchange list-Types of dialysis and their nutritional care –Haemodialysis, CAPD, Continuous Ambulatory peritoneal dialysis)-Renal Transplant and its nutritional care-Nephrolithiases- etiology, types of stones and nutritionalcare (acid & alkaline ash diet)-Chronic renal disease in Children (in brief) | SIS & Case study | 13 |
| 6. | **NT for Rheumatic disorders (of the musculoskeletal system)**  | -Demonstrates the causes of the disease and symptoms produced.-Elaborate on the principles involved in the nutritional and dietary management of these disorders.-List of foods that can be given and those avoided in these disease conditions. | Physiology of inflammation ini)Rheumatic Diseases ii) Osteoarthritis iii) Rheumatoid Arthritis, iv)GoutPharmacologic therapy and Nutritional Care |  Problem based learning |  8 |

**SEMESTER-II**

 **Paper-IV Nutritional Management II Practical Credit-2**

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Contents** | **Hours** |
| **1.** | **1. Nutrition for Diabetes Mellitus and hypoglycaemia** Management of DM - Nutritional managementi) Diet planning for Type1, Type2ii) For Special conditions -a) Pregnancy b) Elderly c) Physical activitiesAcute complications – Pathophysiology, diagnosis, types, | 5 |
| **2.** |  **Nutrition in Cardiovascular Diseases and Hypertension** i) Dietary management of Hypertension-DASH approachii) Dietary management of Hyperlipidemia and Hyperlipoproteinemiaiii)Congestive Heart Failure,- Nutritional Care | 5 |
| **3.** | **Nutrition Management for Rheumatic disorders (of the musculoskeletal system)** Physiology of inflammation ini)Rheumatic Diseases ii) Osteoarthritis iii) Rheumatoid Arthritis, iv)GoutPharmacologic therapy and Nutritional Care |   5 |
| **4.** | **Nutrition in Renal Diseases** Principles of dietary treatment and ManagementA. GlomeruloNephritisB. Nephrotic SyndromeC. Uremic Renal Failureii) Causes and Dietary management in Acute Renal Diseaseiii) Causes and Dietary management in Chronic Renal DiseaseD) Types of dialysis and their nutritional care –Haemodialysis, CAPD, Continuous Ambulatory peritoneal dialysis)G) Chronic renal disease in Children (in brief) |  5 |

**REFERENCE BOOKS:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. | TB | Advances in Diet Therapy | Vimala, V. | 2009 |
| 17. | TB | Nutrition and Dietetics |  Sharda Gupta, Santosh Jain Passi, Rama Seth, Ranjana Mahna & Seema Puri Kumud Khanna (Author) | 2014 |
| 18. | RB | Krause's Food & the Nutrition Care Process (Krause's Food & Nutrition Therapy),13e |  Mahan | 2011 |

**SEMESTER-II**

**Paper IV-Research Methodology and Biostatistics (Theory) Credit - 4**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S.No.** | **Contents**  | **Learning objectives**(At the end of session the student must be able to) | **Teaching Guidelines****(To cover)**  | **Methodology** | **Time**  |
| **1** | **The Research Process** **Steps in the Research Process**   | Demonstrates scientific approach and know the processes of research. Enumerates the competence for selecting methods and tools appropriate for research topics.  | -The Research Process * Scientific approach to enquiry in comparison to native, common sense approach
* Knowledge, theory and research
* Role, need and scope of research in Nutrition andDietetics
* Introduction to Statistics
* Definition, conceptual understanding of statistical measures, popular concepts and misuse of statistics

- Steps in the Research Process * . Identifying interest areas and prioritizing
* Selection of the topic and considerations in selection
* Review of related literature and research
* Concepts, hypotheses and theories
* Research Design
* Research questions, objectives and assumptions (with examples to be brought by students as exercise)
 | SIS and student seminar | **10** |
| **2** | **Types of Research**  | Demonstrates difference among the different types of research and exercise to be based on actual research papers published in accredited journals. | * Basic and applied research, Qualitative and Quantitative research (brief review of differences)
* Historical research
* Descriptive research methods – survey, case study, correlation study, content analysis, causal-comparative research
* Analytic studies- pre-experimental, experimental research, quasi experimental research
* Qualitative research, ethnography
* Evaluative research- general characteristics, use of qualitative methods in enquiry (Exercise to be based on actual research papers published in accredited journals)
* Results, Discussion, Conclusion, Summary, Abstract, Bibliography and Appendices
 | SIS and student seminar | **5** |
| **3** | **Test of Significance** | Enumerates the competence for selecting methods and tools appropriate for research topics.  |  Test of Significance* Hypothesis- meaning, attributes of a sound hypothesis, Stating the hypothesis and types of hypothesis, Hypothesis testing- null & alternative hypotheses, sampling distribution, standard errors, level of significance, critical regions, Type-I and Type II errors (Hypothesis formations and research questions from Research readings – students identify hypothesis/research questions –Discussion)
* Variables- types of variables including discrete and continuous variable(
* Tools for Data Collection Primary and secondary methods of data collection
* Different types of questionnaires, rating scales, check lists, schedules, attitude scales, inventories, standardized tests, interviews, and observation validity of tools.
 | SIS and student seminar | **7** |
| **4** | **Probability Distributions and its Properties**  | Explain probability Distributions and its uses | - Probability Distributions and its Properties 1* Normal distribution
* Binomial distribution

Probability, use of normal probability tables, area under normal distribution curve | SIS and student seminar | **3** |
| **5** | **Sampling** | Describes the importance of sampling and types with suitable examples | - Sampling 2-3* Concept of population and sample, and utility.
* . Types of sampling methods and generalizability of results
* Probability sampling- simple random sample, systematic random sample, stratified random sampling etc.-random and non-random samples, random numbers and use
* Non-probability sampling-purposive samples, incidental samples, quota samples, snowball samples (Based on Journal contents discuss types of Research with Examples)
* Unit-5.General consideration in determination of sample size
 | SIS and student seminar | **5** |
| **6** | **Data Management and Analysis** | Reproduce the concepts of statistical measures of central tendency, dispersion, variability and probability  | Quantitative analysis, descriptive statistics, inferential statistics: Uses and limitations Summation sign and its propertiesMethod of scalingMeasures of central tendency-mean, median, mode arithmetic mean and its uses, mid – range, geometric mean, weighted mean, measures of dispersion /variability- range, variance, standard deviation, standard error, coefficient of variation, Kurtosis, Skewness (practical aspects of grouped data-frequency distribution, histogram, frequency polygons, percentiles . | SIS and student seminar | **5** |
| **7** | **Data Analysis**  | Discriminate between parametric and non-parametric tests | Data Analysis Coding of dataUse of statistical computation toolsPractical approach : Use of statistical programsSpread sheets: MS Excel and R-Spread sheet Introduction to R programming language for statistical analysis and graphics / SPSS |  | **6** |
| **8** | **Large and Small Sample tests and interpretation and practical approach**  | Perform and apply statistical tests for data analysis for both large and small samples | Large and Small Sample tests, its interpretation and practical approach  Z-test for single proportions and difference between proportions  Large sample test for single mean and difference between meanSmall sample tests- One & Two – Sample t-tests, Paired t – test, F – test. |  | **5** |
| **9** | **Chi square test and its interpretation practical approach**  | Enumerates how to interpret the results of chi square test statistical analysis of data | Chi square test and its interpretation practical approach General features of Chi-square tests, goodness of fit Test for Independence of attributes | SIS and Problen based learning | **5** |
| **10** | **Correlation, Regression & its interpretation** | Indicates the results of statistical analysis of data of correlation and regression. | Correlation and Regression, its interpretation and practical approach  Basic concepts Correlation1. Pearson’s correlation
2. Rank Correlation,

 Linear regression 1. Simple and Multiple Linear Regression, and its interpretations.

Calculation of regression coefficint and Prediction | SIS and Problem based learning | **5** |
| **11** | **Analysis of Variance and its interpretation, practical approach**  | Illustrates how to interpret the results of analysis variance. | Analysis of Variance and its interpretation, practical approach One-way analysis of varianceIntroduction Randomized DesignsIntroduction to Factorial design | Problem based learning | **4** |

**References**

1. Bell, J. (1997): Doing Your Research Project: A Guide for First-time Researchers in

Education and Social Science, Viva Books, New Delhi

2. Bell, J. (1997): How to Complete Your Research Project Successfully: A Guide for

First-time Researchers, UBSPD, New Delhi.

3. Bulmer, M.C. (1984): Sociological Research Methods: An Introduction, Macmillan,

Hong Kong.

4. Festinger, L. and Katz, D. (ed.) (1977): Research Methods in the Behavioral Sciencess,

Amerind Publishing, New Delhi.

5. Holloway, I. (1997): Basic Concepts of Qualitiative Research, Blackwell Science, London.

6. Jain, G. (1998): Research Methodology: Methods and Techniques, Mangal

**Statistics**

1. Gupta, S. (2001) “Research Methodology and Statistical Techniques”,Deep and Deep, New Delhi,

2. Hooda, R.P. (2003) “Statistics for Business and Economics”, 3rd ed., Macmillan India

Ltd., Delhi,.

3. Dey, B.R. (2005) “Textbook of Managerial Statistics”, Macmillan India Ltd., Delhi,

4. Fleming, M.C. & Nellis, Joseph G. (1997) “The Essence of Statistics for Business”,

Prentice-Hall of India, New Delhi,

5. Sarma, K.V.S. (2001) “Statistics made Simple: Do it yourself on PC”, Prentice-Hall,

New Delhi.

**SEMESTER-III**

**PAPER-I NUTRITIONAL MANAGEMENT III Credit-4**

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| --- | --- | --- | --- | --- | --- |
| **S.No.** | **Contents** | **Learning objectives**(At the end of session the student must be able to) | **Teaching Guidelines****(To cover)** | **Methodology** | **Time** |
| 1. | **Nutritional Anaemia** **-Erythropoiesis****-Classifications of Anemias**  | Counsels the patients on the basis of deficiencies /anemia. | **-**Erythropoiesis and haemoglobin synthesis, nutrients involved in Erythropoiesis-Classifications of Anemias and Nutritional Carei) Normocytic anemia – aplastic anemiaii) Megaloblastic anemiaiii) Microcytic anemiaiv) Sickle cell anemia and Thalassemiav) Hemolytic anemia | Student’s Interactive Session  | 7 |
| 2. | **Food Allergies**  | -Elaborates and classify adverse food reactions.-Differentiate between food allergies and food intolerance.-Describes the etiology, clinical manifestation, metabolic aberrations and complications, linked with adverse food reactions-Explains the diagnosis of adverse food reactions.-Describes the dietary management of patients with food allergies and food intolerance.  | i) Definition, Symptoms and mechanism of food Allergyii) Diagnosis – Biochemical, immune testing (brief), history and food recordiii) Elimination dietsiv) Food Selectionv) Food allergy in infancy (milk sensitive enteropathy, colic prevention of food allergy) | Student’s Interactive Session  | 7 |
| 3. | **Nutrition in Pulmonary Disease**  | Illustrates the effect of the various pulmonary diseases on nutritional status and nutritional and dietary requirements.  | A. Effects of Malnutrition on Respiration 2-3B. Chronic Obstructive Pulmonary Diseasei). Etiology and Pathogenesisii). Nutritional ManagementC. Respiratory Failurei). Nutritional Care | Problem based learning |   5 |
| 4. | **Nutrition and Cancer**  | Introduces the etiology, physiological and metabolic abnormalities associated with cancer.-Focused on etiological factors associated with causation of cancer.- Describes therapies for different types of cancers along with their dietary management and feeding problems. | i) Carcinogens in foodsii) Chemoprevention of Cancer: nutrient and non-nutrient dietary componentsiii) Etiology and Pathogenesis of carcinogenesisiv) Metabolic and Nutritional Alterations in Malignancyv) Interrelationships of nutritional status and systemic effects of cancervii) Nutritional impacts of cancer therapy,vii) Types of therapyviii) Nutritional support of the Cancer patient |  Student’s Interactive Session & Problem based learning | 5 |
| 5. | **Nutritional Care in Hyper metabolic Conditions**  | -Elaborates the physiological, hormonal and metabolic changes during situations of stress such as burns, sepsis and surgery.-Describes nutritional support required for these stress conditions  | * Burns
* Sepsis
* Surgery
 | Student’s Interactive Session & Case Study | 4 |
| 6. | **Drug- Nutrient Interactions**   | -Highlights nutrient drug interactions.- Describes the effect of nutrients and food on drugs and the effect of drugs on the nutritional status.-Identifies the clinical significance and risk factors associated with nutrient drug interaction.-Enlists handy guidelines for safe and wise use of drugs. | - Effects of diet and nutritional status on drug absorption, disposition metabolism and action- Effects of drugs on food intake, body weight, nutrient requirements and growth.- Drug induced maldigestion and malabsorbption-Effects of drugs on vitamin and mineral status, requirements and activity, demographics, disease state and risk of drug-nutrient and drug- nutritional status interactions. | Student’s Interactive Session  |  10 |

**PAPER I-NUTRITION MANAGEMENT-III Credit-2**

**Topics**

**1. Nutritional Anaemia**

**2. Food Allergy**

**3. Nutrition in Pulmonary Disease**

**4. Nutrition and Cancer**

**5. Nutritional Care in Hyper metabolic Conditions**

**REFERENCE BOOKS:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. | TB | Advances in Diet Therapy | Vimala, V. | 2009 |
| 2. | TB | Nutrition and Dietetics |  Sharda Gupta, Santosh Jain Passi, Rama Seth, Ranjana Mahna & Seema Puri Kumud Khanna (Author) | 2014 |
| 3. | TB | *Dietetics* | Srilakshmi, B. | 2014 |
| 4. | TB | Nutrition Science | Srilakshmi, B. | 2012 |
| 5. | TB | Principles of Nutritional Assessment | Rosalind S. Gibson | 2005 |
| 6. | RB | Krause's Food & the Nutrition Care Process (Krause's Food & Nutrition Therapy),13e |  Mahan | 2011 |

**SEMESTER III**

**PAPER-II: FOOD SERVICE MANAGEMENT**

 **Credit-4**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No** | **Topic** | **Learning objectives****(at the end of the session the students must be able to)** | **Teaching guidelines** | **Methodology** | **Time** |
| 1 | **Food service Institutions**-  | Introduce the term food service industry , objectives, Demonstrates and explain the principles, types of food service institutions  | Introduction • Definition of food service industry • principles of food service industry • objectives • types of food service industry* hospitals
* school meals
* hostels
* industrial canteens
* commercial hotel
* canteens

Institutions catering to different types of handicapped personnel. | Student’s Interactive Session & Student Seminars | 3 hrs |
| 2 | **Theories about approaches to Food Service Management** - | Determines different types of theories & approaches related to food service management  | Introduction • theories of management and approaches * Classical or traditional theory
* Neoclassical approach
* Quantitative approach
* MBO approach
* System approach
* Behavioural and Human relations
* Contingency approach
* JIT approach
* Total quality management approach
* Management science or operation research
 | Teachers Seminar followed discussion and exercise | 3 hrs |
| 3 | **Developing objectives and goals** | -Manifests effective skills to understand and explain the methods of packing radiation stabilized food. | Definition • importance • types of goals • Policies • procedures • rules. | Student’s Interactive Session  | 3hrs |
| 4 | **Principles and procedures of management** | -Enumerates the term management and principles, functions, roles & responsibilities of leader | -Definition of management • organization & interaction at work •principles of management • functions of management •Managerial roles & responsibilities • the manager& leadership quality. | Student’s Interactive Session  | 3hrs |
| 5 | **Tools of management**  | Illustrates and differentiate among different tools of management  | Definition • classification:- tangible tools, intangible tools**Tangible tools**:- Organization chart •types • structure • function • work improvement techniques. | Student Seminar Discussion , short question exercise | 3 hrs |
| 6 | **Personnel management**  | Describes the skill to explain the term personnel management | Definition • scope • concept of personnel management • approaches of personnel management •personnel policies •staff employment • training• placement• promotion • personnel records • workappraisals  | Group Discussion | 5 hrs |
| 7 | **Material management,****Quantity food preparation and service**  | Enumerates principles involved in quantity food purchase, inventory management  | Definition **Principles of quantity food purchase**- selection, -buying and accountingof different foods. -Inventory management- assessing requirements • receiving of stock • release of stocks.- Record maintenance. Factors in menu planning for large groups• systems for maintaining quality in food preparation and service Kitchen control and maintenance of Kitchen records.  | Teachers seminar by PowerPoint presentation, Exercises followed with discussion, long answers | 8hrs |
| 8 | **Financial management**  | Introduces the term financial management  | Definition • scope of financial management • financial accounting • management accounting •Budgeting • costing• cost control • accounting |  Group Discussion | 6hrs |
| 9 | **Hygiene and sanitation in preparation and serving area**  | Elaborates the importance of hygiene and sanitation in preparation and serving area  | Personal hygiene • types • sourcesof contamination • prevention • safety measures Methods of controlling infestation Methods of dish washing. | Student Seminar Tutorials  | 6hrs |

**PRACTICAL SESSION\*** Credit - 2

**\*Report submission (internal valuation)** Standardization of recipes- costing of recipes.

* 1. Cereal and cereal products Vegetables.
	2. Fruits. Meat, chicken and other fleshy foods.
	3. Sugar and jaggery Milk and its products.
	4. Pulses. Nuts and Oil seeds.
1. Survey of hostels and cafeteria to assess various aspects of food service management. Submit a report.

**REFERENCE BOOKS:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. | TB | A First Course in Food Analysis | Sathe, A.Y. | 1999 |
| 2. | TB | *Catering Management :An Integrated Approach* | *Sethi, Mohini* | 2015 |
| 3. | TB | Fasting and Feasting - Then and Now | *Sethi, Mohini* | 2008 |
| 4. | TB | Institutional Food Management | *Sethi, Mohini* | 2004 |

**SEMESTER-III**

**PAPER III- FOOD MICROBIOLOGY & BIOTECHNOLOGY Credit -4**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S.No.** | **Contents** | **Learning objectives**(At the end of session the student must be able to) | **Teaching Guidelines****(To cover)** | **Methodology** | **Time** |
| 1. | **Introduction and scope of food microbiology.****-Growth of microorganisms**  | Introduces the basic concepts of food microbiology and its relevance to everyday life. - Able to perform how intrinsic and extrinsic factors affect the growth and survival of microorganisms in foods | -General characteristics of bacteria, fungi, virus, protozoa, and algae.-Identification of microorganisms-Morphological characteristics important in food bacteriology-Industrial importance.Intrinsic Factors (Substrate Limitations) * nutrient content
* pH and buffering Capacity
* redox potential, Eh
* antimicrobial barriers and
* constituents
* water Activity-

-Extrinsic Factors (Environmental Limitations) * relative Humidity
* temperature

gaseous atmosphere | SIS, student seminar | 3 |
| 2. | **Contamination and spoilage of cereal, pulses and their processed products**  | Illustrates the spoilage. contamination sources, types, effect on the following  | * Asepsis, cereals grains, pulses and meals, flours, bread, cake and bakery products, pasta, macaroni and tapioca.
 | Teachers seminar, SIS | 4 |
| 3. | Contamination and spoilage of vegetables & fruits and their products , eggs and poultry, milk and milk products  | **Explain the spoilage, contamination sources, types, effect on the following.** | * Asepsis, removal of microorganisms, general types of microbial spoilage, spoilage of fruit and vegetable juices, eggs, poultry and milk.
 | SIS, group discussion- focus | 4 |
| 4. | Food borne illness : bacterial and non-bacterial Investigation of food borne disease outbreaks and preventive measures  | **Highlights the effects of food related illnesses and its consequences alng with importance of investigating such illnesses**  | * General principles underlying Food borne illness- focusing on bacterial and non-bacterial illness
* Ways to investigate these illnesses and outbreak prevention.
 | Student seminar and SIS | 6 |
| 5. | Use of Biotechnology for food preservation and processing.  | -**Illustrates beneficial effect of organism.****-Explains the association of microorganisms and food.** | Some applications of microorganisms-**Food products*** Alcoholic drinks
* Dairy products

**Products from microorganisms*** Enzymes
 | SIS and GD  | 3 |
| 6. | Indian fermented foods | **Indian fermented foods – Historical perspective, mechanism of fermentation**,  | – Historical perspective, mechanism of fermentation, effect on nutritional value* fermented products: bread, Beer, Wine, Vinegar and Cheese. Oriental fermented products and fermented vegetables
 | Student seminar and SIS | 8 |
| 7. | **Genetically modified foods** | **Manifest about the role, issues and safety of of GM 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. | Teachers seminar, SIS | 5 |
| 8. | Good manufacturing practices  | **Enlists all the Good manufacturing practices, , Food control agencies Microbiological criteria for foods**  | * Introduction: Overview of
* Good manufacturing practices
* HACCP
* Food control agencies : FDA, USDANMFS
* Understanding concepts of Microbiological criteria for foods
 | SIS and student seminar | 2 |
| 9. | Microorganisms as food  | -**Enumerates use of microbes as food:: SCP and microbial enzymes** | -overview on SCP production, * amylases,
* invertase,
* proteolytic enzymes,
* cellulose,
* lactase
 | SIS, teachers seminar | 5 |

**(Practical)**

1. Study of common equipments in a microbiology lab.
2. Preparation of media and culturing, sub culturing of bacteria.
3. Staining of bacteria: gram-staining and study of colony morphology
4. Isolation of spoilage microbes from bread
5. Study of Shelf life of specific food item- raw, cooked, packaged.
6. Study of food borne bacteria and viruses – morphology and structure (Photographic)
7. Preparation of Dahi/curd using specific starter culture.
8. Microbiological identification of important molds and yeasts.
9. Visit (at least one) to food processing units or any other organization dealing with advanced methods in food microbiology.

**REFERENCE BOOKS:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. | TB | Food Microbiology, 1st Edition, | M. R. Adams | 1995 |
| 2. | TB | Food Microbiology, 5th Edition | Frazier, Westhoff, Vanitha N M | 2014 |
| 3. | RB | Laboratory Methods in Food Microbiology , , 3rd Edition | Harrigan F.W | 2013 |
| 4. | TB | Fundamentals Food Microbiology, 4e  |  Ray | 2011 |

**SEMESTER-III**

 **PAPER IV- MANAGEMENT OF HEALTH AND FITNESS Credit -4**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No.** | **Contents** | **Learning objectives**(At the end of session the student must be able to) | **Teaching Guidelines****(**To cover the topic) | **Methodology** | **Time** |
| 1 | **Introduction to Fitness and Training Benefits of Exercise**  | Demonstrates effective skills to assess nutritionals status of human and describe holistic approach to health management and fitness including diet, aerobic and anaerobic exercises.  | * Introduction to Fitness and Training Benefits of Exercise.
* Components of physical fitness.
* Assessment of nutritional status.
* Holistic approach to management of health and fitness including diet and exercise (Aerobic and anaerobic).
* Alternative systems for Health and fitness.
* Effect of anaerobic exercise on musculoskeletal system, Endurance , strength/ Power, Speed, Coordination, agility, balance etc.
 | Student’s Interactive Session  | 10 |
| 2. | **Cardio--respiratory System**  | Imparts the education on impact of aerobic exercises on health of cardiovascular and respiratory systems. | * Introduction of Cardio--respiratory System.
* Effect of aerobic exercise on heart rate, blood pressure and lung function.
* Assessment of Cardio-respiratory fitness using Maximum aerobic capacity (VO2 max).
* Assessment of coronary risk profile- RISKO factor.
* Recognizing symptoms to stop any exercise, Emergency procedures.
 | Problem based Learning |   8 |
| 3. | **Substrate for exercise.**  | Illustrates the students about different types of fuels utilized by different type of exercises with varied intensity and duration. | * Substrate for exercise.
* Utilization of lipid and carbohydrate in relation to exercise type, intensity and duration.
 | Skill based learning | 2 |
| 4 | **Water and Electrolyte Balance.**  | At the end of the session student should be able to: enlists the importance of water and electrolyte balance in human body. | * Introduction of Water and Electrolyte Balance: Regime of hydration and dehydration.
* Symptoms and effect of dehydration.
* Sports Drink.
 | Problem based Learning | 2 |
| 5 | **Effect of Specific nutrients on Work Performance and** **Physical Fitness and Training.** | Explains the effect of nutrition on work, performance and physical fitness and the pros and cons of commercial nutritional supplements. | * Introduction to Effect of Specific nutrients on Work Performance, Physical Fitness and Training.
* Diets for physical fitness & training.
* Consumption pattern of nutragenic aids and supplements.
* Merits and demerits of nutragenic aids and supplements.
 | Student’s Interactive Session  | 4 |
| 6 | **Exercise prescriptions in Special Conditions.**  | Reproduce skill of the student for prescription of various types of exercises in different disorders conditions at different life stages for fitness. | * Exercise regime for pre and post-natal fitness.
* Obesity and weight control – Prevention of weight cycling.
* Diabetes
* Hypertension and Coronary Heart Disease
* Osteoarthritis and Osteoporosis
* Spondylitis, Back aches.
 | Student seminar | 10 |
| 7 | **Formulating dietary guidelines for fitness, health and disease conditions.**  | At the end of the session student should be able to: Formulate dietary guidelines for fitness and health. | Fitness and healthFormulating dietary guidelines for fitness, health & disease conditions. Management of obesity  Critically analyzing different established weight reduction diet plans.-Management of CVDs. | Student’s Interactive Session  | 4 |

**REFERENCE BOOKS:**

* Health Fitness Management

Authors- William C. Grantham , R.W. Patton , Tracy D. York , Mitchel L. Winick

Publisher- Human Kinetics(1998).

* Nutrition for health, fitness and sport

Authors-Melvin H. Williams, Eric S. Rawson, J. David BranPublisher-Mc Graw Hill (2016).

**SEMESTER-III**

**PAPER- V Food processing & preservation technology credit -4**

|  |  |  |  |  |  |
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| **S.No.** | **Contents**  | **Learning objectives**(At the end of session the student must be able to) | **Teaching Guidelines****(To cover)** | **Methodology** | Time |
| **1** | **Principles of fresh food storage**: | Describe the storage and quality of plant product. | Nature of harvested crop, plant product storage; effect of cold storage and quality – storage of grains. | Student’s Interactive Session  | 5 |
| **2** | **Processing and preservation by heat** | Explain the processing of ready to eat and newer methods of thermal processing. |  Blanching, pasteurization, sterilization and UHT processing, canning, extrusion cooking, dielectric heating, microwave heating, baking, roasting and frying. Retort processing of Ready to eat (RTE) products. Drying – water activity, microbial spoilage due to moisture. Dehydration of fruits, vegetables, milk, animal products Newer methods of thermal processing – batch and continuous | Student’s Interactive Session & Project based learning | 12 **10 hours** |
| **3** | **Processing and preservation by low Temperature** | Describe the food irradiation and its principles. |  Refrigeration, freezing, CA, MA , and dehydro-freezing. Food irradiation, history and mechanism, the electro-magnetic spectrum, forms of radiant energy. Principles of using electromagnetic radiation in food processing, ionizing radiations and non ionizing radiations, advantages and disadvantages. Controlling undesirable changes in food during irradiation. | Student Seminar & project based learning  | 13 |
| **4** | **Processing and preservation by drying, concentration and evaporation** : | Enumerates the various methods of drying and its importance in food products. | Various methods employed in production of dehydrated commercial products, selection of methods based on characteristics of foods to be produced, advantages and disadvantages of different methods, sun-drying, tray or tunnel drying, spray drying, drum drying, freeze drying, fluidized bed drying. Physical and chemical changes during drying control of chemical changes, desirable and undesirable changes. Packaging and storage of dehydrated products. Ultra-filtration, reverse osmosis, Freeze drying and freeze concentration. | Teacher Seminars & Group Discussion  |  10 |
| **5** | **Processing and preservation by non-thermal methods:** | Explain the importance of chemical preservatives and its uses. | High pressure, pulsed electric field, hurdle technology. GRAS and permissible limits for chemical preservatives and legal aspects for gamma irradiation. Use and application of enzymes and microorganism in processing and preservation of foods; food fermentations, pickling smoking etc; Food additives; Definition, types and functions, permissible limits and safety aspects. | Student’s Interactive Session  | 10  |

**Practical Credit - 2**

* Blanching and browning control
* Preparation of fruit preserves (jam, jelly).
* Preparation of vegetable preserves (pickle)
* Preservation by chemicals
* Preservation and bottling of fruits & vegetables
* Sensory analysis of preserved/ processed food
* Dehydrated products – vegetables dices tray drying, of seasonal fruit.
* Tomato processing
* Fruit pulping / juice / beverage preparation
* Preparation and standardization of traditional Indian fermented foods
* Bread making - texture.
* Confectionery
* Visit to food processing and preservation unit.
* Text books and Reference materials

**PAPER VI-FOOD PACKAGING Credit -4**

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| **S. No.** | **Contents** | **Learning objectives**(At the end of the session student must be able to | **Teaching Guidelines** | **Methodology** | **Time** |
| 1 | **Food packaging.**  | Describes food packaging, its role, need, principles of developing safe protective food packaging, various aspects of designing and testing of packaging materials and safety assessment of packaging materials. | * Introduction
* Need of food packaging
* Role of packaging in extending shelf life of foods.
* Designing of package materials.
* Testing of package materials.
* Testing of package performance.
* Principles in the development of safe and protective packing,
* Safety assessment of food packaging materials.
 | Student’s Interactive Session  | 8 |
| 2 | **Food packaging systems, product characteristics and package requirements.**  | To Illustrates the students about food packaging system, its different form and types for different kinds of foods. | * Introduction of food packaging system.
* Different forms of packaging.
* Rigid, semi-rigid, flexible forms of packaging.
* Different packaging system for-
* Dehydrated foods.
* Frozen foods.
* Dairy products.
* Fresh fruits.
* Vegetables.
* Meat.
* Poultry.
* Sea foods.
 | SIS/Student Seminars | 10 |
| 3 | **Types of packaging materials their characteristics and uses.**  | Explains different types of packaging materials uses for packaging different types of foods. | * Introduction of packaging materials.
* Use of paper as a packaging material-

PulpingFibrillationBeating, Types of papers Testing methods* Use of glass as a packaging material-
* Composition
* Properties
* Types
* Methods of bottle making
* Use of metals as a packaging material-

Tinplate containersTinning processComponents of tinplateTin free steel (TFS)Types of cansAluminum containers Lacquers* Use of plastics as a packaging material-

Types of plasticsPlastic filmsLaminated plastic materialsCo-extrusion | Student’s Interactive Session  | **10**     |
| 4 | **A. Package accessories and advances in Packaging technology.** **B. Packaging equipment and machinery**..  | To highlights the students about various latest technologies and advanced equipments used in food packaging.  | * Active packaging,
* Modified atmosphere packaging
* Aseptic packaging
* Packages for microwave ovens
* Biodegradable plastics
* Edible gums
* Coatings
* Vacuum packaging machine
* CA & MA packaging machine
* Gas packaging machine
* Seal and shrink packaging machine
* Form & fill sealing machine
* Aseptic packaging systems
* Retort pouches
* Bottling machines
* Carton making machines
* Package printing machines
 | Student’s Interactive Session & project based learning |  12 |

**Practical**

 **Credit-2**

1.Identification of different types of packaging and packaging materials.

2. Identify the latest trends in packaging consulting the web

 sites and magzines.

3. To study the health claims of packaged food.

4. Identify the packaged food labelling and their advantages.

5 Visit to relevant industries and prepare report.

**References:**

1. Bhatia S.C. Canning and Preservations of Fruits and Vegetables – New Delhi, India
2. Bureau of G and Multon J.K Food Packaging Technology (vol. 1and2) – VCH,  publishers, INC, New York
3. Dalzett J.M. Food Industry and The Environment – Chapmann and Hall, London.
4. Darry, R.andT, Blackle: Principles and Application MAP – Academic and Professions.
5. Hotchikess Food and Packaging Interaction – American Chemical Society.
6. Madhavaiah M and RV Goramma;( 1996). *Food Packaging Materials* , Tata Mcoraw –  Hill publishing company limited,New Delhi.
7. Robertson G.L. Food Packaging – New York, Marcell Dekker, Inc.
8. Sacharow and Grifin, Food Packing – AVI Publications.
9. Sood. S.K. and MridulaSaxena.(2002). *Food Packaging,* NLERT – Booklet – New  Delhi.
10. Stanley and Sacharow Food Packaging.

**SEMESTER-IV**

 **PAPER I-PUBLIC NUTRITION AND HEALTH Credit -4**

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| **S. No.** | **Contents** | **Learning objectives****(Teaching the student must be able to**  | **Teaching Guidelines** | **Methodology** | **Time** |
| 1 | **Concept of public nutrition**  | Introduce the concept of public nutrition and the role of nutritionists in delivering health care services. | To cover the topic-* Introduction to public nutrition & health.
* Relationship between health and nutrition.
* Role of public nutritionists in the health care Delivery.
 | Student’s Interactive Session  | 3 |
| 2 | **Sectors and Public Policies relevant to nutrition and health**  | Describes public policies and sectors relevant to nutrition and health. | To cover the topic-* Sectors and Public Policies relevant to nutrition and health.
 | Student’s Interactive Session  | 2 |
| 3 | **Primary Health Care of the Community**  | To impart the education about health, its determinants, indicators and health care delivery system of the country. | To cover the topic- * National Health Care Delivery System.
* Determinants of Health Status.
* Indicators of Health.
 | Group Disscussion | 5 |
| 4 | **Population Dynamics**  | At the end of the session student should be able to explain the dynamics of population, its transition, structure, consequences of population policy and fertility behaviour on it. | To cover the topic* Demographic transition.
* Demographic processes.
* Demographic cycle & concepts.
* Population structure.
* Fertility behaviour.
* Population policy.
 | Student’s Interactive Session  | 6 |
| 5 | **Food and nutrition Security**  | Enumerate the concept of food and nutrition security at national and global context. | To cover the topic-* Food production, Access, Distribution, Availability, Losses and consumption.
* Food Security
* Socio-cultural aspects of dietary patterns and their implications for Nutrition and Health.
 | Student Seminars | 4 |
| 6 | **Nutritional Status Assessment** | Demonstrates and explain various methodologies and tools used to determine nutritional status at different ages of life, related indicators and determinants.  | To cover the topic-Determinants of nutritional status of individual & populations.-Nutrition and Non-nutritional indicators:* Socio-cultural,
* Biological
* Environmental
* Economic

-Assessment of nutritional status of individuals of different ages- * MUAC,
* Weight for age
* Height for age
* Weight for height
* Ponderal index
* BMI.

-Applications & limitations in different field situations choice of an indicator. | SIS/PBL | 5 |
| 7 | **Major nutritional Problems.** | Elaborates etiology, prevalence, clinical manifestation, preventive and therapeutic measures of major nutritional problems of the country.  | * Major nutritional Problems – etiology, prevalence, clinical manifestations, preventive and therapeutic measures for: Macro and micro nutrient deficiencies.
* Other nutritional problems- etiology, prevalence, clinical manifestations, preventive and therapeutic measures for: lathyrism, dropsy, aflatoxicosis, alcoholism and fluorosis.
* Overweight, obesity and chronic degenerative diseases.
 | Student Seminars | 3 |
| 8 | **National Food ,Nutrition and Health Policies**  |  Illustrates national food, nutrition, health policies and programmes. | To cover the topic-* National Food, Nutrition & Health Policies.
* Plan of action and programmes.
 | Student Seminars | 3 |
| 9 | **Approaches and Strategies for improving nutritional status and health:**  | At the end of the session student should be able to: Describes various types of approaches and strategies for improving nutritional status and health conditions of people of the country with a fuscous on programmatic options and food based interventions.  | To cover the topic-* Programmatic options- their advantages and demerits, Feasibility Political support Available resources (human, financial, infrastructural).
* Health-based interventions Food-based interventions including:
* Fortification and genetic improvement of foods.
* Supplementary feeding.
* Nutrition education for behaviour change.
 | Student’s Interactive Session SIS | 5 |
| 10 | **Health economics & economics of malnutrition**  | To make student able to explain economics of health and malnutrition and its impact on national development. | To cover the topic- * Introduction of Health economics.
* Cost-Benefit, Cost effectiveness, Cost efficiency.
* Economics of malnutrition.
* Impact of Health economics on productivity and national Development.
 | Student Seminars | 2 |

**Practical Credit-2**

1. Study of various public health nutrition problems trend of the Nation and review it critically.
2. Study of various existing programmes of public health nutrition and review it critically.
3. Assessment of nutritional status of a group of students based of anthropometry
4. Study about various clinical sign and symptoms used in nutritional assessment
5. Study of various dietary approaches used in nutritional assessment
6. Study about various software and applications used in nutritional assessment
7. To study existing national food security system and report writing

**References:**

1. Owen, A.Y. and Frankle, R.T. (1986): Nutrition in the Community, The Art of Delivering Services, 2nd Edition Times Mirror/Mosby.

2. Park, K. (2000): Park’s textbook of preventive and social medicine, 18th Edition, M/s.

Banarasidas Bhanot, Jabalpur.

3. SCN News, UN ACC/SCN Subcommittee on Nutrition.

4. State of the World’s Children, UNICEF.

5. Census Reports.

6. Berg, A. (1973): The Nutrition Factor, the Brookings Institution, Washington.

7. Beaton, G.H. and Bengoa, J.M. (Eds) (1996): Nutrition in Preventive Medicine, WHO.

8. Bamji, M.S., Rao, P.N., Reddy, V. (Eds) (1996): Textbook of Human Nutrition, Oxford

and IBH Publishing Co. Pvt. Ltd., New Delhi.

9. Gopalan, C. and Kaur, S. (Eds) (1989): Women and Nutrition in India, Nutrition Foundation of India.

10. Gopalan, C. and Kaur, S. (Eds) (1993): Towards Better Nutrition, Problems and Policies, Nutrition Foundation of India.

**SEMESTER-IV**

 **PAPER II- FUNCTIONAL FOODS AND NUTRACEUTICALS Credit - 4**

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| **S. No.** | **Contents** | **Learning objectives**(At the end of session the student should be able to | **Teaching Guidelines****(To cover)** | **Methodology** | **Time** |
| 1 | **Functional Food and Nutraceuticals** **An Introduction** | Introduces the scientific basis for the development of functional food and nutraceuticals that are of high demand in both the national and international markets in recent years  | * Definition, history, types and classification
* Perceived effect of diet on disease prevention
* Understanding benefits of functional foods and nutraceuticals
 | Student’s Interactive Session  | 4 |
| 2 | **Probiotics**   | Elaborates the importance, health benefits, quality assurance and probiotic in various dairy and nondairy products. | * Taxonomy and important features of probiotic micro- organisms.
* Health effects of probiotics including mechanism of action.
* Probiotics in various foods: fermented milk products, non-milk products etc.
* Quality Assurance of probiotics and safety.
 | Teacher Seminar | 8 |
| 3 | **Prebiotics**  | Illustrates about the prebiotics and be familiar with applications in food industry.  | Definition, chemistry, sources, metabolism and bioavailability, effect of processing, physiological effects, effects on human health and potential applications in risk reduction of diseases, perspective for food applications for the following:* Non-digestible carbohydrates/oligosaccharides:
* Dietary fibre,
* Resistant starch,
* Gums
 | Student’s Interactive Session & project based learning | 8 |
| 4 | **Other Food Components with potential health benefits:**  | Highlights thorough understanding about the health effects  | Definition, chemistry, sources, metabolism and bioavailability, effect of processing, physiological effects, effects on human health and potential applications in risk reduction of diseases, perspective for food applications for the following: Polyphenols: Flavonoids, catechins, isoflavones,tannins, Phytoesterogens, Phytosterols, Glucosinolates, Organo sulphur compounds,Other components – Phytates, Protease | Student Seminar | 15 |
| 5 | **Non- nutrient effect of specific nutrients:**  | Exhibits the role of specific nutrient. | Proteins, Peptides and nucleotides, Conjugated linoleic acid and n-3 fatty acids, Vitamins and Minerals. | Group Discussion | 5 |

**Practical**

 **Credit-2**

1. Identification of various nutraceuticals and functional foods available in the market

2. Preparation and sensory evaluation of probiotic/prebiotic/synbiotic foods

3. Preparation and sensory evaluation of antioxidant&dietary fiber rich foods.

4. Estimation of crude fibre/dietary fibre content in cereals and their products.

5. To conduct the market survey for identification of health claims of various nutraceuticals products.

6. Preparations of some traditional, fermented, functional and other products.

**References:**

1. Cho S. S. and Dreher, M.L. (2001): Handbook Dietary Fibre, Marcel Dekker Inc., New

York.

2. Yurawecz, M.P., M.M. Mossoba, J.K.G. Kramer, M.W. Pariza and G.J. Nelson eds (1999) Advances in Conjugated Linoleic Acid Research, Vol. 1. AOCS Press,Champaign.

3. Wildman, R.E.C. ed. (2000) Handbook of Nutraceuticals and Functional Foods, CRC

Press, Boca Raton.

4. Fuller, R. ed. (1992) Probiotics the scientific basis, London: Chapman and Hall, New

York.

5. Fuller, R. ed. (1997) Probiotics Applications and Practical Aspects, London: Chapman

and Hall, New York.

**PAPER III- NUTRITION IN EMERGENCIES Credit-4**

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| **S.No.** | **Content** | **Learning objectives**(At the end of session the student must be able to) | **Teaching Guidelines****(To cover)** | **Methodology** | **Time**  |
| Module 1. | **Natural/Manmade disasters** | Explain Natural/Manmade disasters resulting in emergency situations- Famine, drought, flood,earthquake, cyclone, war,civil and political emergencies, | Natural/Manmade disasters resulting in emergency situations-Factors contributing to the rise and development of emergency situations (Use illustrations from Indian case studies). | Student Interactive session& Problem based learning | 10 |
| Module 2. | **Nutritional problems and communicable diseases**  | Describe Causes, major deficiencies and communicable diseases: PEM and other specific deficienciesCholera,Typhoid,Measles, TB Plague.Control and prevention, role of immunization and sanitation. | Control and prevention, role of immunization and sanitation. | Student Interactive session | 12 |
| Module 3. | **Assessment and surveillance of nutritional status**   | Explain emergency affected populationsScope for malnutrition assessmentIndicators and simple screening methods. Organization for nutritional surveillance. | Scope for malnutrition assessmentIndicators and simple screening methods.  | Student Interactive session& Case Study | 8 |
|  Module.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, nutritional and health problems in emergencies, ethical considerations.Sanitation and hygiene and public nutrition approach to tackle nutritional and health problems in emergencies, ethical considerations. | Organizations for mass feeding/ food distribution, | Student Seminar | 10 |

**References:**

1. World Disasters Report – Focus on Public Health, International Federation of Red Cross and Red Crescent Societies.
2. Disasters – International Public Nutrition and Emergencies: The Potential for improving practice. Special Issue – Vol.23/4, Dec. 1999.
3. Guidelines and Research publications of OXFAM, WFP, Rome. 1999.
4. Nutrient Requirements and Recommended Dietary Allowance for Indians A Report of  the Expert Group of ICMR. 2010.
5. Dr. M Swami Nathan. (2010). Food and Nutrition Volume-2 Second Edition the Bangalore Printing and Publishing Co Ltd Bangalore 560018.
6. 6. Shubhangini A.Joshi. (2010). Nutrition and Dietetics Third Edition Tata Mecgraw Hill Education Private Limited New Delhi.

**SEMESTER-IV**

**PAPER IV- Sports Nutrition Credit-4**

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| **S. No.** | **Content** | **Learning objectives**(At the end of session the student must be able to) | **Teaching Guidelines****(To cover)** | **Methodology** | **Time**  |
| Module 1. | **Approaches to the management of fitness and health:**  |  Explain nutrition, exercise, physical fitness and health- their inter relationship. | Nutrition, exercise, physical fitness and health- their inter relationship.Nutrition guidelines for maintenance of health and fitness.Significance of physical fitness and nutrition in prevention and management of weight control regimes. | Student Interactive session | 8 |
| Module 2. | **Nutritional requirements of exercise:**  | Describe specific nutrients on work performance and physical fitness. Nutrients that support physical activityMobilization of fuel stores during exercise. | Effect of specific nutrients on work performance and physical fitness. Nutrients that support physical activity, Mobilization of fuel stores during exercise. Fluid requirements. | Project based learning | 7 |
| Module 3. | **Nutrition in sports:**  | Elaborates and Describe Importance of carbohydrate loading, pre game and post game mealswith high-energy  | Sports specific requirements- Importance of carbohydrate loading, pre game and post game meals, Diets for persons with high energy requirements, stress, fracture and injury. | Student Interactive session& Problem based learning | 10 |
| Module**.**4. | **Dietary supplements and Ergogenic aids:**.  | Understand the Uses of different nutragenic / ergogenic aids and commercial supplementsFormulation of Sports drinks & Sports bars etc. | Formulation of Sports drinks & Sports bars etc. | Student Seminar | 6 |
| Module **5** | **Challenges in Sports Nutrition:**  | Explain for children and adolescent athletes Athletes with special needs- Paralympics & special Olympics, vegetarian athletes, Athletes with eating disorder, athletes with diabetes and other medical conditions. | Nutritional guidelines for children and adolescent athletes Athletes with special need | Student Interactive session& Case Study  | 10 |

**References:**

1. Shils, M.E., Olson, J.A., Shike, N. and Ross, A.C.(Ed)(1999). Modern Nutrition in Health and Disease, 9th Edition, Williams and Wilkins.
2. Whitney, E.N. and Rolfes, S.R.(1999). Understanding Nutrition, 8th Edition, West/Wadsworth, An International Thomson Publishing Co.
3. McArdle, W.Katch, F. and Katch, V. (1996). Exercise Physiology, Energy, Nutrition and Human Performance, 4th edition, Williams and Wilkins, Philadelphia.
4. Ira Wolinsky(ed) (1998). Nutrition in Exercise and Sports, 3rd Edition, CRC Press.
5. Sizer, F. andWhitney, E. (2000). Nutrition – Concepts and Controversies”, 8th Edition,  Wadsworth Thomson Learning.
6. Mahan, l.K. and Ecott-Stump, S. (2000). Krause’s “Food, Nutrition and Diet Therapy”,  10th Edition, W.B. Saunders Ltd.

**SEMESTER-IV**

**Credit-6**

**M.Sc. Dissertation**

**Submission of Dissertation**

The research project is to be carried out over a period of approximately 6 months and will be carried out in the lab/ hospitals, subject to approval by all concerned. Students will select research project with their respective supervisors. The projects will be selected such that a student can reasonably be expected to make an original contribution to the chosen area of research within the time period allotted. The purpose of the project is to provide the student with training in academic research and acquisition of practical skills, including the design of a research project, planning of experiments, dealing with practical problems, recording of, presenting and analyzing data.

**Unit I- Thesis Proposal Development** is an independent tutorial conducted by the student’s advisor, and involves a comprehensive literature survey of the chosen research area. Through regular meetings, the student and advisor discuss this literature in detail and the topic for research project will be finalized in the third semester.

**Unit II- Thesis proposal** Each student must submit to the university with the signed approval of the advisor, a thesis proposal defining the thesis project, the methods and design of the experiments needed for completion, the progress to date and plans for completion in the third semester.

**Unit III – Thesis preparation**: This is involving preparation of the thesis. The thesis must include a cover page, abstract, table of contents, introduction of the thesis topic with a comprehensive review of literature, appropriately organized methods, results and discussion section for the experiment performed and final conclusions section summarizing the outcome of the project. The student should submit a draft of the thesis to the advisor by the end of the fourth semester.