**THIRUVALLUVAR UNIVERSITY**

**MASTER OF SCIENCE DEGREE COURSE**

**M.Sc. FOODS AND NUTRITION**

**CBCS Pattern**

**(With effect from 2020-2021)**

**Programme Specific Outcomes**

* + Enable to pursue highereducation and Researchin academic and research institutions.
  + Inculcate comprehensive and analytical skills in food industries and health sectors.
  + Take up professions in community upliftment programmes.
  + Excel in community health nutrition for employment in State and Central Government.
  + Understand the current concept of personalized nutrition with reference to nutrigenetics and nutrigenomics.

**The Course of Study and the Scheme of Examination**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Sl.***  ***No.*** | ***Study Components*** | | ***ins. hrs / week*** | ***Credit*** | ***Title of the Paper*** | ***Maximum Marks*** | | |
| ***Course Title*** | | ***CIA*** | ***Uni. Exam*** | ***Total*** |
| **SEMESTER I** | | | | |  |
|  | Core-Theory | Paper-1 | 6 | 5 | Advanced Physiology | 25 | 75 | 100 |
|  | Core-Theory | Paper-2 | 6 | 5 | Advanced Food Science | 25 | 75 | 100 |
|  | *Core-Theory* | *Paper-3* | *5* | *5* | *Essentials of Macronutrients* | *25* | *75* | *100* |
|  | Core-Practical | Paper-1 | 3 | 0 | Advanced Food Science | 0 | 0 | 0 |
|  | Core-Practical | Paper-2 | 3 | 0 | Essentials of Macronutrients | 0 | 0 | 0 |
| **Internal Elective for same major students (Choose any one)** | | | | | | | | |
|  | **Core Elective** | **Paper-1** | 4 | 3 | **(to choose 1 out of 3)**  A. Health and Fitness  B. Food Hygiene and Sanitation  C. Food Processing | 25 | 75 | 100 |
| **External Elective for other major students (Inter/multi disciplinary papers)** | | | | | | | | |
|  | **Open Elective** | **Paper-1** | 3 | 3 | **(to choose 1 out of 3)**  A. Culinary Skills  B. Basic Food Science  C. Nutraceuticals | 25 | 75 | 100 |
|  |  |  | **30** | **21** |  | **125** | **375** | **500** |
|  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SEMESTER II** | | | | | |  | ***CIA*** | ***Uni. Exam*** | ***Total*** |
|  | Core-Theory | Paper-4 | | 5 | 4 | Essentials of Micronutrients | 25 | 75 | 100 |
|  | Core-Theory | Paper-5 | | 4 | 4 | Nutrition Through Life Cycle | 25 | 75 | 100 |
|  | Core-Theory | Paper-6 | | 4 | 4 | Food Microbiology | 25 | 75 | 100 |
|  | Core-Practical | Paper-1 | | 4 | 4 | Advanced Food Science & Essentials of Macronutrients | 25 | 75 | 100 |
|  | Core-Practical | Paper-2 | | 4 | 4 | Essentials of Micronutrients & Nutrition Through Life Cycle | 25 | 75 | 100 |
| **Internal Elective for same major students (Choose any one)** | | | | | | | | | |
|  | **Core Elective** | **Paper-2** | | 4 | 3 | **(to choose 1 out of 3)**  A. Food Standard and Quality Control  B. Hospital Food Service  C. Textiles and Clothing in Human Care | 25 | 75 | 100 |
| **External Elective for other major students (Inter/multi disciplinary papers)** | | | | | | | | | |
|  | **Open Elective** | **Paper-2** | | 3 | 3 | **(to choose 1 out of 3)**  A. Bakery Science  B. Home Scale Preservation of fruits and Vegetables  C. Lifestyle Practice | 25 | 75 | 100 |
|  | **\*Field Study** |  | | - | 2 |  | 100 | - | 100 |
|  | **Compulsory Paper** | | | 2 | 2 | **Human Rights** | 25 | 75 | 100 |
|  |  |  | | **30** | **30** |  | **300** | **600** | **900** |
|  |  |  | |  |  |  |  |  |  |
| **SEMESTER III** | | | | | |  | ***CIA*** | ***Uni. Exam*** | ***Total*** |
|  | Core-Theory | Paper-7 | | 5 | 4 | Nutritional Biochemistry | 25 | 75 | 100 |
|  | Core-Theory | Paper-8 | | 5 | 3 | Research Methodology and Applied Statistics | 25 | 75 | 100 |
|  | Core-Theory | Paper-9 | | 4 | 3 | Community Nutrition | 25 | 75 | 100 |
|  | Core-Practical | Paper-3 | | 6 | 0 | Nutritional Biochemistry & Community Nutrition (Practicals) | 0 | 0 | 0 |
| **Internal Elective for same major students (Choose any one)** | | | | | | | | | |
|  | **Core Elective** | **Paper-3** | | 5 | 3 | **(to choose 1 out of 3)**  A.Nutrition in  Emergencies  B.Functional Foods and Nutraceuticals  C.Principles of Food Analysis | 25 | 75 | 100 |
| **External Elective for other major students (Inter/multi disciplinary papers)** | | | | | | | | | |
|  | **Open Elective** | **Paper-3** | | 5 | 3 | **(to choose 1 out of 3)**  A. Princi.ples of Nutrition- I  B. Assessment of Nutritional Status  C. Nutrition Education and Counselling | 25 | 75 | 100 |
|  | Viva Voce |  | | **-** | 2 | Internship | 25 | 75 | 100 |
|  | **\*\*** MOOC Courses |  | | **-** | - |  | 0 | 0 | 100 |
|  |  |  | | **30** | **18** |  | **150** | **450** | **700** |
|  |  |  | |  |  |  |  |  |  |
| **SEMESTER IV** | | | | | |  | ***CIA*** | ***Uni. Exam*** | ***Total*** |
|  | Core-Theory | Paper-10 | | 6 | 4 | Diet Therapy | 25 | 75 | 100 |
|  | Core-Practical | Paper-3 | | 0 | 3 | Nutritional Biochemistry & Community Nutrition | 25 | 75 | 100 |
|  | Core-Practical | Paper-4 | 6 | | 3 | Diet Therapy | 25 | 75 | 100 |
|  | Core | Project / Dissertation | | 10 | 5 | Core Project/ Dissertation with  viva voce | 100  (75 Project +25 viva) | | 100 |
| **Internal Elective for same major students (Choose any one)** | | | | | | | | | |
|  | Core Elective | Paper- 4 | | 5 | 3 | **(to choose 1 out of 3)**  A. Food biotechnology  B. Food Safety and Nutrition Security  C. Computer Application in Food Science and Nutrition | 25 | 75 | 100 |
| **External Elective for other major students (Inter/multi disciplinary papers)** | | | | | | | | | |
|  | Open Elective | Paper- 4 | | **3** | 3 | **(to choose 1 out of 3)**  A. Principles of Nutrition- II  B. Nutrition in Special Condition  C. Techniques of Food Evaluation | 25 | 75 | 100 |
|  |  |  | | **30** | **21** |  | **125** | **375** | **600** |
|  |  |  | | **120** | **90** |  |  |  | **2700** |
|  |  |  | |  |  |  |  |  |  |

**THIRUVALLUVAR UNIVERSITY**

**M.Sc. FOODS AND NUTRITION**

**SYLLABUS**

**UNDER CBCS**

**(with effect from 2020-2021)**

**SEMESTER III**

**CORE PAPER - 7**

**NUTRITIONAL BIOCHEMISTRY**

**Course Objectives:**

To enable the students to :

* Understand the involvement of enzymes and co-enzymes involved in Biological Oxidation
* Learn the various metabolic cycles of nutrients
* Analyze the significance of biochemical findings.
* Obtain in depth knowledge in the study of Biochemistry of major nutrients and metabolic pathways.

**UNIT-I : BIOLOGICAL OXIDATION**

Enzymes and co-enzymes involved in oxidation and reduction, respiratory chain, phosphates in biological oxidation and energy capture, components and role of respiratory chain and mechanism of oxidative phosphorylation ,inhibitors, uncouplers and mitochondrial disease.

**UNIT-II : METABOLISM OF CARBOHYDRATE**

Glycolysis, Gluconeogenesis, TCA cycle, HMP shunt, glycogen metabolism, bioenergetics, disorders of carbohydrate metabolism –fructosuria, galactosemia, glycogen storage disease, pentosuria, abnormal level in blood glucose.

**UNIT-III : METABOLISM Of LIPID**

Biosynthesis and oxidation of saturated and unsaturated fatty acids, glycerides, phospholipids and cholesterol, bioenergetics, lipoproteins and their significance, metabolism and disorders of lipoprotein metabolism.

**UNIT-IV : METABOLISM OF PROTEIN AND AMINOACID**

Biosynthesis of protein, general catabolism of aminoacids, glucogenic and ketogenic aminoacids, deamination, transamination, urea cycle, disorders of aminoacid metabolism - phenyl ketonuria, cystinuria, albinism, alkaptonuria, maple syrup disease.

**UNIT-V : METABOLISM OF NUCLEIC ACIDS**

Biosynthesis and degradation of purine and pyrimidine nucleotides, DNA replication and repair, biochemical importance of cyclic AMP. Disorders of purine and pyrimidine metabolism - gout, aciduria, xanthinuria, lesch-nyhann syndrome. Structure and properties of DNA, RNA - mRNA, tRNA, rRNA. Functional tests - Gastric, liver, renal and endocrine.

**REFERENCES:**

1. Deb, A.C. (2012), Fundamentals of Biochemistry, New Central Book Agency (P)Ltd.
2. Nelson, L. and Michael.M.Cox. (2015), Lehninger Principles of Biochemistry, 4th Edition, W.H. Freeman and Company, NewYork.
3. Palmer, T. (1995), Understanding enzymes, 4th Edition, Prentice Halls, Ellis Horwood, London.
4. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2003), Harper’s Illustrated Biochemistry, 26th edition, International Edition.
5. West, E.S., Todd, W.R., Mason, H.Sand and Van Brugge, T.J. (1966), Biochemistry, 4th edition, The Macmillan Company, London.
6. Voet, D., Voet, G.J. and Pralt, W.C. (2002), Fundamentals of Biochemistry, Upgrade edition, John Wiley and Sons, Inc.

**CORE PAPER - 8**

**RESEARCH METHODOLOGY AND APPLIED STATISTICS**

**Course Objectives:**

To enable the students to :

* Understand the fundamental principles and techniques of methodology concerning research.
* To use effective tools and techniques to collect research data, organize them appropriately for facilitating further analysis.
* Learn the applications of statistics in research.
* Apply statistical procedure to analyse numerical data and interpreting data meaningfully.
* Develop skills in Writing a research report and formatting of thesis writing

**UNIT-I**

Meaning of research, Types of research, Objectives of research, Research process.

Collection of Data - Methods of collecting data.

Primary and Secondary data - Sources of Primary and Secondary data, Editing the data and precautions used in the use of data. Different types of research tools for collecting research data, defining and determining a problem.

**UNIT-II**

Sampling Design - Census and sampling survey, Different types of sampling techniques - Probability and non-probability, size of the sample, Merits & Demerits of each sampling method, Sampling errors and methods of Reducing the error.

**UNIT-III**

Classification and Tabulation of Data - Meaning, Objective, Types of Classification, Formation of frequency distribution, Tabulation of data - Schemes general rules, Types of tables and preparation of tabular forms.

Representation of data - Diagrammatic and Graphic significance, Types of diagrams, Types of graphs.

**UNIT-IV**

Measures of central tendency - Mean, Median, Mode, their relative advantages and disadvantages. Measures of dispersion - mean deviation, standard deviation, Quartile deviation, Co-efficient of variation, percentile, Association of attributes, Contingency table, correlation - coefficient of correlation and its interpretation, Rank correlation, Regression equation and predictions.

**UNIT-V**

Probability - Theorems, Simple Problems, Distributions - Binomial Poisson distribution, normal distribution, their properties and simple problems.

Testing of significance - Large and Small sample tests - ‘t’ test, Chi square test, and ‘F’ test - simple problems.

Writing a research report - format of thesis writing with eg.

**Course Outcomes:**

* Gain knowledge to design the tools for collection, identify the samples, interpretation of data with the use of tables and pictorial representations.
* Assess the numerical data for providing statistical evidences to support the research results.
* Enable to become a qualified researcher.

**REFERENCES:**

1. Donald, H.M.C. Burney , Research Methods, fifth edition, Thomson and Wadsworth Publications, 2002.
2. Devadas, R.P ,A Handbook on Methodology of Research, Sri Ramakrishna Vidhyalaya, Coimbatore, 1989.
3. Pillai,R.S.N and Bagavathi,V , Statistics, Chand and company limited, 2001 .
4. Kothari, C.R , Research Methodology, 2002.
5. Ramakrishnan, P , Biostatistics, Saras publication, 2001.
6. Shanthi,P., Sophia and Bharathi , Computer oriented statistical methods/ probability and Statistics, charulatha publications, second edition, 2000.
7. Gupta, S.P, Statistical Methods, Sultana Chand and Sons, 31st revised edition, 2002.

**CORE PAPER - 9**

**COMMUNITY NUTRITION**

**Course Objectives:**

To enable the students to :

* + Learn the national nutritional problems and consequences of nutritional problems
  + Understand the prevalence malnutrition problems in India.
  + Gain knowledge related to national programmes and policies for combating malnutrition.
  + Able to formulate community nutrition education programme modules
  + Study of common nutritional problems prevailing at community

**UNIT-I**

Nutrition and National Development- Definition and brief study of community, family, village and block.

Malnutrition - causes, ecological factors, effects of malnutrition, protein deficiency diseases - PEM, Kwashiorkor - incidence, prevalence, epidemiology. The package programmes of immunization, marasmus, nutrition education, feeding programmes, and measures to overcome malnutrition.

Vitamin deficiency - A, B1, B2, Niacin, C, D, B12, and Folic Acid - prevalence, programmes to combat.

Nutritional Anaemia - Prevalence, programmes to control.

IDD and fluorosis - Prevalence and programmes to control.

**UNIT-II**

Study of common nutritional problems prevailing at community level – Assessment of Nutritional status – Direct methods– anthropometry, laboratory examination (Bio Chemical), clinical examination, Diet Surveys, socio economic diet survey, for common nutrition problems. Indirect methods – Food Balance sheet, Ecological parameters and vital statistics.

**UNIT-III**

National nutritional policy - Aim, objectives, guidelines and thrust areas. PDS - Public distribution system, Agricultural planning - New strategies.

Concepts and definition of food and nutritional security at National household and individual levels.

**UNIT-IV**

Nutrition intervention Programmes - Objectives, operation of feeding national programmes. ICDS, TINP, NNMS, IRDP, DWACRA.

National organizations - ICMR, NIN, NNMB, ICAR, CFTRI, NIPCCD.

International organizations - FAO, WHO, UNICEF, UNESCO, World Bank.

**UNIT-V**

Demographic changes due to malnutrition. IMR, MMR, Mortality, morbidity rate, birth rate, sex ratio, poverty level.

Nutrition education - Merits, planning, evaluation and conduct.

Health care delivery - PHC, School Health services and their role in preventing communicable diseases.

**Course Outcomes:**

1. Gaining knowledge on nutritional programmes and policies for overcoming malnutrition
2. Understanding the national, international and voluntary nutritional organizations to combat malnutrition
3. Able to organize community nutrition education programme to promote the nutritional knowledge of the community
4. Apply intervention programmes to overcome epidemic of communicable diseases.
5. Application of the principles of massive supplementary feeding and food safety for the welfare of the community

**REFERENCES**

1. Swaminathan M (2018), Essentials of Food and Nutrition. An Advanced Textbook Vol.I, The Bangalore Printing and Publishing Co. Ltd, Bangalore
2. Bhatt D.P (2018), Health Education, Khel Sahitya Kendra, New Delhi
3. Bamji M.S, Prahlad Rao N, Reddy V (2014). Textbook of Human Nutrition II Edition, Oxford and PBH Publishing Co. Pvt. Ltd , New Delhi
4. Park A. (2017), Park’s Textbook of Preventive and Social Medicine XIX Edition M/S Banarasidas, Bharat Publishers, 1167, Prem Nagar, Jabalpur, 428 001(India)
5. Gibney MJ, Margetts BM, Kearney JM, Arab L (2004) Public Health Nutrition Blackwell Publishing Co. UK

**Journals:**

1. Reports of the State of World's Children, WHO and UNICEF, Oxford University.
2. Reports of National Family Health Survey, International Institute for Population Science, Mumbai.
3. Indian Journal of Medical Research, ICMR, New Delhi,
4. Indian Journal of Pediatrics, Valley Micro, Missouri, U.P.

**CORE ELECTIVE**

**PAPER - 3**

**(to choose one out of 3)**

1. **NUTRITION IN EMERGENCIES**

**Course Objectives:**

* Gain knowledge in protecting people’s right to nutrition during disaster
* Prepare for emergencies ,to prevent hunger, malnutrition and deficiency disorders
* Create an awareness on nutrition policies and programmes to combat nutritional problems
* Gain knowledge in Control of communicable diseases in emergencies and Role of immunisation and sanitation.
* Understand the Public nutrition approach to tackle nutritional problems in emergencies.

**UNIT-I**

Natural / manmade disasters resulting in emergency situations.

Famine, drought, flood, earthquake, cyclone, war, civil and political emergencies.

Factors giving rise to emergency situation in these disasters.

Illustration using case studies from Indian Subcontinent.

**UNIT-II**

Nutritional problems in emergencies in vulnerable groups.

Causes of malnutrition in emergency situations.

Major deficiency diseases in emergencies.

Protein – energy malnutrition.

Specific deficiencies.

**UNIT-III**

Communicable diseases: Surveillance and treatment.

Control of communicable diseases in emergencies

Role of immunisation and sanitation.

Public nutrition approach to tackle nutritional problems in emergencies.

**UNIT-IV**

Assessment and surveillance of nutritional status in emergency affected populations.

Scope of assessment of malnutrition in emergencies.

Indicators of malnutrition clinical signs for screening acute malnutrition.

Anthropometric assessment of nutritimal status – Indicators and cut – offs indicating seriously abnormal nutrition situation weight – for – height based indicators, MUAC, social indicators.

Organization of nutritional surveillances and individual screening.

**UNIT-V**

Nutrition Relief and Rehabilitation

Assessment of food needs in emergency situations.

Food distribution strategy – identifying and reaching the vulnerable group – Targeting Food Aid.

Mass and supplementary feeding.

Special foods / rations for nutritional relief.

Local production of special foods.

Local food rehabilitation.

Organization of mass feeding / general food distribution

Feeding centers

Transportation and food storage.

Sanitation and hygiene

Evaluation of feeding programmes.

**Course Outcomes:**

* Gaining knowledge on Natural / manmade disasters resulting in emergency situations.
* Understanding the Nutritional problems common amog the vulnerable groups.in emergencies
* Able to assess the nutritional status of the community
* Gain knowledge on Scope of assessment of malnutrition in emergencies.
* Apply intervention programmes to overcome malnutrition in emergencies
* Application of the principles of massive supplementary feeding and food safety for the welfare of the community

**REFERENCES**

1. Shills, M.E., Olson, J.A, Shike, M and Ross, A.C. (2003): Modern Nutrition in Health and Disease, 9th Edition, A.Williams and Willdns.
2. Goyet, fish.. V.; Seaman, J. and Geijer, u-(2008): The Management of Nutritional Emergencies in Large Populations, World Health Organisation, Geneva
3. Mahan, L.K. and Escott-Stump, S. (2000): Krause’s Food Nutrition and Diet-Therapy, 10th Edition, W-13 Saunders Ltd.

**CORE ELECTIVE**

**PAPER - 3**

**B. FUNCTIONAL FOODS AND NUTRACEUTICALS**

**OBJECTIVES**

To enable the students to gain:

* Knowledge on sources of Functional Foods and Nutraceuticals
* Understand the role of functional foods, nutraceuticals and dietary supplements in health and disease
* Learn about role of probiotics in health and disease
* Aware of the National and International regulatory aspects of Functional foods.

**UNIT - I**

**Definition and History**-Functional foods, traditional foods, nutraceuticals - teleologemey, designer foods and pharma foods, history of functional foods, components of functional foods, stages involved in development of functional foods.

**UNIT- II**

**Classification - B**ased on food source, mechanism of action and chemical nature-isoprenoid, phenolic substances, fatty acids and structural lipids, terpenoids – saponins, tocotrienols and simple terpenes, carbohydrates and amino acid based derivatives, isoflavones.

**UNIT- III**

**Functional foods of Microbial origin**- Human gastrointestinal tract and its microbiota, functions, probiotic microflora and functions- Lactobacillus and Bifidobacterium, concept of probiotics and prebiotics with examples, role of probiotics in health and disease, spirulina as bioactive component.

**UNIT – IV**

**Sources and role of *Functional foods and* Nutraceuticals -** Role of functional foods and Nutraceuticals in diseases, concept of dietary supplements, phytochemicals, phytosterols, omega 3 and 6 fatty acids, dietary fiber, role of nutraceuticals in health and disease management – diabetes mellitus, hypertension, CVD, cancer; non essential nutrients as dietary supplements, FOSHU foods.

**UNIT – V**

**Regulatory aspects-** International and national regulatory aspects of functional foods in India, ICMR guidelines for Probiotics, development of biomarkers to indicate the efficacy of functional ingredients, Research frontiers in functional foods.

**Course Outcomes:**

1. Gain knowledge on sources of functional foods and nutraceuticals.
2. Acquire skills to categorize nutraceuticals.
3. Gain awareness on the functional foods and nutraceuticals of microbial origin.
4. Obtain knowledge of functional foods and nutraceuticals in health and diseases.
5. Understand the regulatory aspects of functional foods and nutraceuticals.

**REFERENCES:**

1. Bamji (2013), Textbook of Human Nutrition, 3rd edition, Oxford & IBH Publishing Co Pvt Ltd, New Delhi.
2. Srilakshmi.B (2018), Nutrition Science, 4th edition, New Age InternationlPvt Ltd.
3. Webb G.P (2016), Dietary Supplements and Functional Foods, Blackwell Publishing Ltd, New York.
4. Tamine. A (2015), Probiotic Dairy Products, Blackwell Publishing Ltd, United Kingdom.
5. USFDA regulations on functional foods.

**Journals**

1. Journal of functional foods
2. Journal of free radical research

**CORE ELECTIVE**

**PAPER - 3**

**C. PRINCIPLES OF FOOD ANALYSIS**

**Course Objectives:**

**To enable the students to**

* **Understand the principles underlying various analytical methods.**
* **Describe the criteria to select appropriate food analysis method.**

**UNIT I**

**Introduction to Food Analysis- Trends and demand, consumer and food industry, steps in analysis, Choice and validity of method, criteria for choice of food analysis Methods, role of AOAC International. Sampling and sample preparation. Brief overview of physical, chemical, Instrumental and Gravimetric Methods of analysis.**

**UNIT II**

**Compositional Analysis of foods-Moisture and total solid analysis, ash analysis, Total fiber analysis, Proteinanalysis, Carbohydrate analysis (mono, oligo and polysaccharides, starch and Starch derivatives), Vitamin and mineral analysis**

**UNIT III**

**Chemical properties and characteristics of foods-pH and titrable acidity, Fat characterization – Analysis of fatty acids, oil fat indices.Protein separation, characterization procedures, amino acid composition, Application of enzymes in food analysis, Immunoassays,**

**Spectroscopy – Basic principles of spectroscopy, ultra violet, visible and**

**Fluroscence spectroscopy. Atomic absorption and emission spectroscopy**

**UNIT IV**

**Chromatographic techniques, Principles of chromatography Types of chromatographic techniques – HPLC, Gas chromatography Rheological principles used for food analysis Viscocity of liquids, Solutions and fine suspensions.**

**UNIT V**

**Pigments and colourants- Extraction, isolation, purificationMeasurements of natural pigments and colouranalysis.ThermalAnalysis- Principles and procedures of calorimetry, Differential scanning of calorimeters.**

**REFERENCE**

**1.Nielson S.S. (2006). Food Analysis (3ndEd), Springer Private Limited.**

**2.Wrolstad R.E. et al (2005). Handbook of Food Analytical Chemistry: Water, Protein, Enzymes, Lipids and Carbohydrates. Published by John Wiley and Sons**

**3.Wrolstad R.E. et al (2005). Handbook of Food Analytical Chemistry: Colourants,Flavours, Textural and Bioactive food components. Published by John Wiley and Sons**

**4.Egan H., Kirk R., Sawyer R., (1981). Pearson’s Analysis of Foods. (8th Edition) Longman Group Limited**

**5.Dr. Latimer G. W., Jr.(2012) (19th Ed). Official Methods of Analysis of AOAC International: Volume I and II.**

**Course Outcomes**

**1.Apply knowledgeon nutrients analysis**

**2.Understand thetypes and techniques of chromatography**

**3.Aquire skill to extract food pigments**

**4.Gain knowledge about chmical properties of food**

**OPEN ELECTIVE**

**PAPER - 4**

**(to choose one out of 3)**

1. **PRINCIPLES OF NUTRITION I**

**Course objectives:**

To enable the students to

.Understand the basic concepts of energy

Classification, functions, metabolism and requirement carbohydrates, proteins and fats

Acquire knowledge on role of water

**UNIT I**

Energy: Definition and Components of Total Energy Requirements, Factorsaffecting total energy requirement, Methods of Estimation of energy requirements, Energy Expenditure and Requirement for various age groups.

**UNIT II**

Carbohydrates - Nutritional importance of Carbohydrates ,Digestion and Absorption, Metabolic Utilization. Blood Glucose, Resistant Starch, Fructose. Oligosaccharides (FOS), role of dietary fiber in human nutrition, concept of Glycemic Index, and Glycemic load,

**UNIT III**

Proteins- Nutritional importance of proteins, nutritional classification of proteins, Improvement of Quality of Protein in the Diet, Methods of Estimating protein quality and RDA for Proteins and Amino Acids, Protein Deficiency.

**UNIT IV**

Lipids - Nutritional Importance of Lipids, Digestion, Absorption and Metabolism ,Sources and Requirements, Consequence of High and Low Fat Intake, Effect of excess intake of fats, Role of Essential Fatty Acids.

UNIT V

Water-distribution of water, functions, requirements, sources, water balance, importance of hydration, Assessment of Hydration Status,, Hazards of Hypo and Hyper Hydration with Suitable Examples

**REFERENCE:**

1. Nutrient requirements and Recommended Dietary Allowances for

Indians, ICMR, National Institute of Nutrition, Hyderabad,2016.

2. Dietary guidelines for Indians, ICMR, National Institute of Nutrition, Hyderabad, 2016

3. Swaminathan,M. Advanced Textbook on Food Science and Nutrition, Vol:2,Second edition, Reprinted, Bangalore Printed and publishing Co Inc, Bangalore,2012.

4. Krause, M.V and Hunsher,M.A, Food, Nutrition and Diet Therapy, 11thEdition, W.B.Saunders company, Philadelphia, London,2014.

5. Bamji M.S, Prahlad Rao N, Reddy V, Textbook of Human Nutrition, II

Edition,Oxford and PBH Publishing Co. Pvt. Ltd , NewDelhi,2014

**Course Outcome**:

1.Gain knowledge on Role of Macro and Micro minerals in our body

2.Understand the deficiency symptoms of minerals

3. Knowledge on various trace element

**OPEN ELECTIVE**

**PAPER - 4**

1. **Nutrition Education and Counselling**

**Course objectives**

**1. Gain knowledge on the meaning and methods of nutrition education**

**2. Develop skills in preparation of education materials**

**3. Learn the different methods of promoting nutrition education and awareness in the community**

**UNIT I**

**Nutrition Education and Counselling - Meaning,objectives and methods of Nutrition education,-direct and indirect methods,individual and group contacts,types merits and demerits.Use of folk media in nutrition education,counseling for life style changes and nutrition care and support.**

**UNIT II**

**Nutrition Education for the Community - Importance of Nutrition education to the community and lessons to be taught. Training workers in nutrition education programmes Methods of education when to teach, whom to teach Use of computers to impart nutrition education, Organization of Nutrition education programmes.**

**UNIT III**

**Mass communication in Nutrition Education - Definition,merits and demerits,Types-Print media,Newspapers,magazines,leaflets,pamphlets,radio,television,films ,filmstrips,internet and computers.**

**UNIT IV**

**Audio visual aids in Nutrition Education-Definition, purpose of using AV Aids,Cone of Experience, classification of AV aids advantages and limitations**

**UNIT V**

**Organising Programmes in Nutrition Education-Introduction–selection of theme, planning the programme, developing teaching materials and methods, execution and evaluation of the programme**

**REFERENCE :**

**1. Mahtab, S. Bamji, 2016, Textbook of Human Nutrition, Oxford and IBM Publishing Co. Pvt. Ltd., NewDelhi.**

**2. Park, K. 2015, Parks Textbook of Preventive and Social Medicine, Banarside Bhanot Publishers, Jabalpur.**

**3. Srilakshmi, B. 2016, Nutrition Science, New Age International Pvt. Publishers, New Delhi.**

**4. Willett ,W 2013,Nutritional Epidemiology,3rd Edition, Oxford University Press.**

**5. Rothman KJ(2016), Modern Epidemiology, Little Brown and Co, Bosten.**

**Course Outcome:**

**• Enable competency as nutrition educators and counselors.**

**• Able organizers of nutrition education and intervention programmes.**

**• Conceptualize and develop audiovisual aids for nutrition education**

**OPEN ELECTIVE**

**PAPER - 4**

**C. ASSESSMENT OF NUTRITIONAL STATUS**

**Course objectives:**

Enable the students to

1.. Develop skills in using epidemiologic concepts and methods to examine nutritional aspects of health and disease in population.

2. Understand the definition and uses of epidemiology and appreciate its role in public health.

3.Learn the techniques and tools to assess the nutritional status of a community.

**UNIT I**

Assessment of Nutritional status by Anthropometry- Introduction, Definition of Nutritional Status, Objective and Classification of Methods- Nutritional Anthropometry – Definition, Instruments, Standard of Reference, Age Assessment, Measurement Techniques, Weight, Linear Measurement, Circumferences, Soft Tissue Subcutaneous Fat, Anthropometric indicators.

**UNIT II**

Clinical Examination and Dietary Survey -Clinical Examination – Specific Deficiency, Signs that Need Further Investigation, Need not Related to Nutrition, Grouping of Signs. Different Types of Dietary Survey, General Survey, Special Survey, Comparison with Nutritional Requirement.

**UNIT III**

Biochemical Tests and Biophysical Methods -Definition of Biochemical tests, Collection of Samples . Test for Specific Nutrients – Protein, Vitamin A, D, Ascorbic Acid, Thiamine, Riboflavin, Niacin, Iron, Folic Acid, Vitamin B12.Definition of Biophysical Method – Test for Physical Functions, Radiographic Examination, functional tests, Cytological Tests.

**UNIT IV**

Nutritional Epidemiology in Public Health - Introduction to Nutritional Epidemiology, Nutritional monitoring and surveillance, Community based epidemiological studies. Basic concepts and applications of Epidemiology in public health, Measurement of disease frequency, Person – Time exposure, Measures of Association and Impact of Health and Non Health related outcomes.

Indirect Nutritional Assessment-Vital Statistics, Age Specific Mortality Rate, Morbidity and Cause of Specific Mortality ,Ecological Factors, Methods of Obtaining Information, Background Data. General Survey Data, Special Survey, Conditioning Infection, Nutritionally Relevant infection, food production,food consumption, cultural factors, socio economic profile and medical and educational service.

**UNIT V**

Assessment of Nutritional Status of a Community -Sensitize stakeholders and policy makers towards community upliftment. Planning, sampling, selection of methods, community nutrition assessment tools and scales, executing nutritional assessment and interpretation of data.

**REFERENCE :**

1. Mahtab, S. Bamji, 2016, Textbook of Human Nutrition, Oxford and IBM Publishing Co. Pvt. Ltd., New Delhi.

2. Park, K. 2015, Parks Textbook of Preventive and Social Medicine, BanarsideBhanot Publishers,

Jabalpur.

3. Srilakshmi, B. 2016, Nutrition Science, New Age International Pvt. Publishers, New Delhi.

4. Willett, W 2013,Nutritional Epidemiology,3rd Edition, Oxford University Press.

5. Rothman KJ(2016), Modern Epidemiology, Little Brown and Co, Bosten.

**Course Outcome:**

1. Critically evaluate methodologies for nutritional assessment

2. Describe the current state of epidemiological evidence for relationships of diet to the development of selected diseases

3. Interpret and evaluate epidemiological data in relation to nutrition and health

4. Create a database on nutritional assessment and epidemiology for target groups

**INTERNSHIP**

**Internship:**

A phase of training where in a graduate is expected to undergo training practice in a hospital industry/food industry according to his or her choice for a period of 30 Days so as to acquire job oriented skills

**Assessment:**

Interns shall maintain a record book which shall be verified and certified by the training authority under whom he or she works during his/her internship period.

An objective evaluation of his/her knowledge, skills and attitude during training will be recorded by the center in-charge and monitored by faculty in-charge and marks shall be allotted accordingly.

Hospital authority - 75

Internal Assessment & Viva Voce - 25

**SEMESTER IV**

**CORE PAPER - 10**

**DIET THERAPY**

**Course Objectives** To enable the students to :

* Understand the principles of diet care for the disease conditions.
* Skills for the modifications in nutrients in therapeutic conditions.
* Learn recent concepts in dietary management of different diseases conditions.
* Obtain knowledge of different therapeutic diet and their preparation
* Develop capacity and attitude for taking up the profession as a dietician

**UNIT-I**

Principle of Nutritional care, Modification of normal diet into therapeutic diet, Types of hospital diets.Nutrition Support Techniques, Eneteral feeding - indications, Types - Nasogastric,

Gastrostomy, Jejunostomy and Rectal feeding - requirements and advantages.Parenteral feeding - Nutritional Support, Formula feeds and Complications in TPN.

**UNIT-II**

Diet in Febrile condition Short duration - Typhoid, Influenza, Malaria, Long duration Tuberculosis.Diet in deficiency diseases - PEM, Vitamin A, Anaemia, IDD, Zinc deficiency.

Surgery - Physiological response, Metabolic Consequences, Stage of Convalescence, pre and post operative diets.Burns- Metabolic changes in protein and electrolytes and Nutritional support.Diet in Energy Imbalance - Underweight and obesity, Etiology and dietary management.

Diet in allergy - Common food allergens, test for allergy - Skin test and Elimination diet and Treatment for allergy.

**UNIT-III**

Diseases of cardio vascular system - Risk factors of CVD, Etiology, Symptoms, and dietary management of atherosclerosis, Cerebral Infarction, Myocardial Infarction, prevention through life style modifications.Classification, prevalence, Diet related factors influencing and dietary management of hypertension, dyslipidemia (Genetic Hyperlipidemia).

**UNIT-IV**

Diseases of the Gastro intestinal system- Disorders, Etiology, Symptoms and dietary management of Acute gastritis, Chronic gastritis, Peptic ulcer - duodenal & gastric

Intestinal disease - Flatulence, Diarrhoea and Dysentry, Constipation, Celiac disease, Tropical sprue, Irritable bowel syndrome, diverticular disease, colon cancer, Ulcerative colitis.

Liver disease - Hepatitis, cirrhosis, Jaundice, fatty liver, cholecystitis and cholelithiasis, Hepatic coma.Pancreas - Pancreatitis, Acute and chronic

Diabetes Mellitus - Etiology, Types, Symptoms, Diagnosis, metabolic alterations, complications and dietary management.

**UNIT-V**

Diseases of the Kidney - Etiology, Symptoms and Dietary modification, Nephritis, Nephrosis, Acute and chronic renal failure, Nephrolilthiasis, Transplantation and dialysis, Dietary Modification.Dietary modification and Nutritional Support for cancer, HIV, Alzheimer’s and Parkinson’s Disease.

**Course Outcomes:**

* understand the concept of therapeutic nutrition as nutritional care and support
* learn the formulation of therapeutic diets and feeding techniques
* categorize the diseases, disorders and deficiencies for planning suitable of therapeutic diets
* update knowledge on advanced techniques and concept of diet planning and of therapeutic diet counseling
* Take up as a Dietitian in the hospitals

**REFERENCES**

1. Srilakshmi. B (2012), Dietetics, New Age International Pvt Ltd, New Delhi.
2. Dietary Guidelines of Indians- A Manual, National Institute of Nutrition, Hyderabad, 2006.
3. Robinson C.H. (2007) Normal and Therapeutic nutrition, 12th edition, Mac Millan Publishing Co. Inc, New York.
4. Krause M.V and Mahan L.K (2010) Food, Nutrition and Diet therapy, 9th edition, W.B. Saunder Co, Philadelphia

**Journals:**

1. Clinical Nutrition, Bell and Bain Ltd., Scotland. Food and Nutrition Bulletin, United Nations University Press, Japan
2. The Indian Journal of Nutrition and Dietetics, Sri Avinashilingam Home Science College for Women, Coimbatore.
3. The American Journal of Clinical Nutrition Published by the American society for Clinical Nutrition, Inc., USA.
4. Journal of American Dietetic Association. The American Dietetic Association Mount Arris, Illinois-61054, USA.

**CORE PRACTICAL – III   
NUTRITIONAL BIOCHEMISTRY**

**Course Objectives:**

* To know the analytical procedures in estimation of nutrients of foods blood and serum .
* To acquire skills in the analysis of macro and micronutrient contents of foods blood and serum
* To be enable to demonstrate the analysis of nutritional quality of foods ,blood and serum

1. Determination of Saponification Number.
2. Determination of Acid Number
3. Determination of Reichert Meissl Number
4. Estimation of Creatinine in urine - Jaff’s method.
5. Estimation of Serum cholesterol - Zak’s method.
6. Estimation of Blood glucose - O -Toluedene method.
7. Estimation of Serum proteins by Biuret method.
8. Estimation of Albumin / Globulin ratio by biuret method.

**COMMUNITY NUTRITION**

1. Development of a plan for nutrition education programmes in community.
2. Preparation of communication aids for different groups.
3. Development of low cost recipes for infants, preschoolers, elementary
4. school children, adolescents, pregnant, lactating mothers, adult women and elderly.
5. Planning and preparation of diet/ dishes for PEM, VAD and IDA
6. Field visits to ongoing national nutrition programmes

**Course Outcomes:**

1. Gain knowledge on the analytical techniques in the nutritional estimation of foods.
2. Understanding of the principles and nutritional requirements of foods for various cage groups
3. Acquire analytical skills in the analysis of macro and micronutrient content of foods.
4. Enable to demonstrate the analysis of nutritional quality of foods.

|  |  |
| --- | --- |
|  |  |

**CORE PRACTICAL – IV**

**DIET THERAPY**

**Course Objectives** To enable the students to :

* Understand the principles of diet care for the disease conditions.
* Skills for the modifications in nutrients in therapeutic conditions.
* Learn recent concepts in dietary management of different diseases conditions.
* Obtain knowledge of different therapeutic diet and their preparation
* Develop capacity and attitude for taking up the profession as a dietician

1. Types of diet - Full liquid, clear liquid, soft, light, bland and regular diet.
2. Diet for - obesity, underweight, febrile conditions.
3. Diet in gastro intestinal disorders - peptic ulcer, diarrhoea, constipation.
4. Diet in liver disorders - jaundice, hepatitis, cirrhosis, hepatic coma, fatty liver and gall stones.
5. Diet in kidney disorders - Glomerulo nephritis, nephritic syndrome, renal failure, and urolithiasis.
6. Diet in Diabetes mellitus – Type1, Type2Diabetes mellitus, diabetes with complications.
7. Diet in Cardio vascular disease - Hypertension, atherosclerosis, congestive heart failure.
8. Visit to a hospital to observe - Enteral Feeding and formula diet for tube feeding.
9. Diet in deficiency diseases – IDA, VAD, IDD

**Course Outcomes:**

* understand the concept of therapeutic nutrition as nutritional care and support
* learn the formulation of therapeutic diets and feeding techniques
* categorize the diseases, disorders and deficiencies for planning suitable of therapeutic diets
* update knowledge on advanced techniques and concept of diet planning and of therapeutic diet counseling
* Take up as a Dietitian in the hospitals

**CORE PROJECT/DISSERTATION WITH VIVA VOCE**

**Semester: IV Hours of Instruction:12**

**No of Credits;8**

**Course Objectives**

* An independent research work has to be undertaken by the students.
* The students will be guided and supervised by a member of a Teaching faculty of the concerned department.
* The Research can either be a survey or Laboratory oriented one.
* In which the research culminates should reflect the students own work.
* The Dissertation should be submitted at the end of the Semester.

**ASSESSMENT DISSERTATION: EVALUATION PATTERN**

Internal : 25 marks and External (including Viva Voce) : 75 marks = Total-100

**CORE ELECTIVE**

**PAPER - 4**

**(to choose one out of 3)**

1. **FOOD BIOTECHNOLOGY**

**Course Objectives**

The students are enabled to

* gain knowledge on the techniques and tools of genetic engineering
* understand the DNA biotechnology in food industries.
* gain knowledge on the techniques and tools of genetic engineering
* understand the Classical strain improvement inNatural selections and mutation, recombination
* explore biotechnological techniques in the production of food based products.
* learn the safety of biotechnological implications in foods.

**UNIT I**

Biotechnology – Introduction – biotechnological applications of animals, plants and microbes; concepts of genetic engineering and molecular cloning and their application in food production, transgenic plants, application of genetic engineering in food science and technology. Genomics, proteomics and bio informatics.

**UNIT II**

Classical strain improvement: Natural selections and mutation, recombination. Concepts and tools for recombinant DNA technology; genetically modified foods: concept, types and applications; safety assessment of genetically modified foods: International and National guidelines of regulations and safety, issues related to production, consumption, export / import and labelling of GM foods. Ethical issues concerning GM foods, Testing for GMOs, IPR, GMO Act 2004.

**UNIT III**

Application of biotechnology to food products: Yeast based processes and products – alcoholic beverages, industrial alcohols, bread and related products; Bacteria based processes and products – dairy products, fermented meat and fish products, fermented vegetable products, vinegar and other organic products, bacterial bio mass.

**UNIT IV**

Application of enzymes in food and beverages industries. Enzyme immobilization and its application in food industry: History, carrier materials, enzyme immobilization techniques, use of immobilized enzyme in food industries. Micro organism based products – sweeteners, flavours and amino acids, vitamin pigments, mushrooms, SCP.

**UNIT V**

Application of Nano biotechnology in food industry: Nano biotechnology in food packaging, nano biotechnology for delivery of bioactive and nutraceuticals, nano biosensors – safety and regulatory aspects of Nano biotechnology applications. Micro encapsulation in food biotechnology: concepts, agents and techniques; application of micro encapsulation – probiotics, flavours, lipids, antioxidants, vitamins and enzymes.

**Course Outcomes:**

* Gain knowledge on the techniques and application of genetic engineering in food science and technology
* Understand the applications of enzyme technology in food industries.
* Application of biotechnology to food products especially Yeast based processes and products
* Gain knowledge related to Application of enzymes in food and beverages industries
* Learn about the Application of Nano biotechnology in food industry and also in food packaging,

**REFERENCES:**

Byong H. Lee, fundamentals of food biotechnology, II editions, wiley – Blackwell, 2014.

Ravishankar Rai, V. Advances in food biotechnology, Wiley – Blackwell, 2015.

Bains W. biotechnology from A to Z, Oxford , University Press, 2009.

1. Lopez, G.F.G., Canovas, G.V.B., Food science and Food Biotechnology , CRC Press, 2003.
2. Crueger, W. Crueber A, Biotechnology; A text book of Industrial microbiology, science tech. Madison, USA, 1984.

**CORE ELECTIVE**

**PAPER - 4**

1. **FOOD SAFETY AND NUTRITION SECURITY**

**Course Objectives:**

To enable the students to

Understand the Food Safety Management System in Household, Food Industries and Establishments

Gain knowledge on National and International Food Safety Laws and Regulations

Learn about the Food and Nutrition Security Management Concepts and Practices

**UNIT I**

Introduction to Food Safety - Definition, Food safety issues in India, food hazards (physical, chemical and biological) natural toxins, Need and importance of food safety in household, food industries and establishments; Factors affecting food safety in household, food industries and establishments; Regulatory authorities at local, national and global level for ensuring food safety in food industries and establishments.

**UNIT II**

Food Hygiene and Microbiology -Inspection of premises and Legal provisions, Quality Control and Quality Assurance, Personal Hygiene of Food Handlers, Routes of Contamination, Danger Zone –In food storage, Food Spoilage, Microbes responsible for Food spoilage-Effect on Health, Incubation period, Symptoms and Treatment .Steps to overcome microbial spoilage.

**UNIT III**

Safety Assessment -Food additives, adulterants, pesticide residues, safety aspects of water and beverages, Good Manufacturing Practices (GMP), Good Agricultural Practices (GAP), Good Hygienic Practices and Good Laboratory Practices, Management and disposal food wastes in food industries and establishments.

**UNIT IV**

Food Laws and Regulations -National Food Safety Legislation –International food safety legislation - Codex Alimentarius, APEDA and WTO,ISO 22000 series, Food Safety Act 2006, Food Safety Rules and Regulations 2011, 2016, 2018, FSSAI, Essential Commodities Act, ISI / BIS, AGMARK, HACCP-Principles and Applications.

**UNIT V**

Food and Nutrition Security -Definition, Importance, Hunger and malnutrition.. Factors contributing to food insecurity, Food security model, Food availability, Household and individual food security survey,Public Distribution System, Strategies to combat food and nutrition insecurity, Food Security Bill and Act.

**Course Outcomes:**

1.Describe the food safety issues

2.Apply knowledge on National and International Food Safety Laws and Regulations

3.Understand the personal hygiene

4.Acquire skills on food additives

**REFERENCE:**

1. Frazier.W., Food Microbiology, Mc Graw-Hill Co Ltd, New Delhi.2005

2. Adams M,R and Moss M,O., Food Microbiology, New Age International(P) Ltd., New Delhi,2005.

3. Vijaya Ramesh,Food Microbiology, MJP Publications,2007.

4. David, A.Shapton and Naroh F.Shapton (1991) Principles and Practices for the Safe Processing of Foods

**CORE ELECTIVE**

**PAPER - 4**

1. **COMPUTER APPLICATIONS IN FOOD SCIENCE AND NUTRITION**

**Course Objectives:**

**Enable the students to**

* **Understand the basics of computer and its applications**
* **Gain knowledge to use computers**
* **Develop skills to apply computer based technology in Food science and Nutrition**

**UNIT I**

Introduction to Computers History of Development of Computers, Main Frame, Minis, Micros and Super Computer Systems, Binary numbers, Bits, Bytes, CPU, Input and Output Devices, Main and Auxiliary Stage Devices, Software and Hardware

**UNIT II**

**Operating Systems and MS Office Introduction to Operating Systems, Windows Applications MS Word, MS Excel. MS Access and MS PowerPoint**

**UNIT III**

Computer Networks -LAN, WAN, Intranet, Extranet, Service Providers, Modem, Fibre Optics Basic of HTML, WWW, URL, TCP/IP

**UNIT IV**

Multimedia -Basic Elements, Hardware, Application of Multimedia, Introduction Multimedia, Authorizing Tools

**UNIT V**

Application of Computers in Food Science and Nutrition -Power point presentation, nutrient and diet calculations, nutrition education and counseling, nutrition softwares and websites, e-journals in Food Science and Nutrition, Use of SPSS .

**TEXT BOOKS**

* 1. Balagurusamy. E (2008) Computing Fundamentals and C Programming, Tata

McGraw Hill Education Private Limited, New Delhi.

* 1. Bansal.S.K (2004) Text Book of Information Technology , APH, Publishing

Corporation.

**REFERENCE**

1. Andrew S. Tanenbaum (2009) IV Edition, Computer Networks, Pearson Education

And Dorling Kindersley Publishers, Delhi.

1. James F. Kurose and Keith W Ross (2008) III Edition, Computer Networking. A Top-Down Approach Featuring the Internet, Pearson Education and Dorling Kindersley Publishers, Delhi.
2. Ralf Steinmetz and KlaraNahrstedt (2011) Multimedia- Computing, Communications and Applications, Pearson Education and Dorling Kindersley Publishers, Delhi

**COURSE OUTCOMES**

1. Gain knowledge on computer applications in food and nutrition
2. Understand the computer networking system
3. Apply knowledge on MS office

**OPEN ELECTIVE**

**PAPER - 4**

**A. PRINCIPLES OF NUTRITION II**

**Course objectives:**

**To enable the students to**

**1.Understand the classification of vitamins and its role**

**2.Differentiate Macro and Micro minerals**

**3.Acquire knowledge on trace elements**

**UNIT I**

**Fat soluble vitamins-A,D,E and K-, functions, absorption, transport, utilization, storage, excretion ,RDA, sources and deficiency.**

**UNIT II**

**Water soluble vitamins -Thiamine, riboflavin, niacin, vitamin B12, folic acid, pyridoxine, panthothenic acid, biotin, and ascorbic acid.functions, absorption, transport, requirement, sources and deficiency .Unit III**

**Macro minerals: Calcium, Phosphorus, Magnesium- Distribution, function, absorption, utilization, source,requirement, effect of deficiency and excess.**

**UNIT IV**

**Microminerals:-Iron, Iodine, Fluorine, copper and Zinc-Distribution, absorption, function, utilization, sources, requirement, effect of deficiency and excess.**

**UNIT V**

**Trace elements:-Molybdenum, Manganese, Selenium, Chromium - Function,absorption, utilization, sources,requirement, deficiency and excess.**

**REFERENCE:**

**Nutrient requirements and Recommended Dietary Allowances for Indians, ICMR, National Institute of Nutrition, Hyderabad,2016.**

**Dietary guidelines for Indians, ICMR, National Institute of Nutrition, Hyderabad,2016**

**Swaminathan,M. Advanced Textbook on Food Science and Nutrition, Vol:2,Second edition, Reprinted, Bangalore Printed and publishing Co Inc, Bangalore,2012.**

**Krause,M.V and Hunsher,M.A, Food, Nutrition and Diet Therapy, 11th Edition, W.B.Saunders company, Philadelphia, London,2014.**

**Bamji M.S, Prahlad Rao N, Reddy V ,Textbook of Human Nutrition II Edition, Oxford and PBH Publishing Co. Pvt. LtdNewDelhi,2014**

**Course Outcome:**

**• Describe types of vitamins**

**• Understand the essentials of vitamins**

**• Knowledge on Macro and Micro minerals**

**• Gain knowledge on trace elements and its deficiency diseases**

**OPEN ELECTIVE**

**PAPER - 4**

B.NUTRITION IN SPECIAL CONDITION

Course Objectives

* To learn about the special conditions in which the nutritional status of human beings are

Affected

* To manage good nutritional status during emergencies

**UNIT I**

Sports - Effect of exercise/ games on muscular, cardiovascular and respiratory activities Energy system - aerobic and aneorobic, fuel modulation on exercise

**UNIT II**

Sports nutrition – Preparation for competition – pre games meal, Carbohydrate loading,

Pre exercise hydration, post game meal. Nutrition during exercise/games – fluid and carbohydrate intake, nutritional factors causing fatigue. Fluid replacement, dietary supplements & ergogenic aids in sports

**UNIT III**

High altitude nutrition – a. Acclimatization, hydration, nutritional problems and altitude sickness, dietary management of mountaineers, Space travel and nutrition. Space physiology, space food system, dietary intake for space flight

**UNIT IV**

Sea voyage and Nutrition – Sea sickness. Deep sea diving. Hyperbaric conditions. Effect of high partial pressures of gases in the body. Hyperbaric oxygen therapy, health problems and dietary management

**UNIT V**

Emergency feeding – emergency situations arising from famine, earthquake, flood and Tsunami. Institutional problems in emergencies, Nutritional relief and rehabilitation – Organization involved, Food Distribution Strategies.

**REFERENCE BOOKS:**

1. Bourland, Charles T., (1998) ‘Advances in Food systems for space flight’. Life support and

Biosphere Science 5:71-77

2.Guyton, A.C. and Hall J.E,(2001). Pocket companion to text book of Medical Physiology,

10thedition W.B. Saunders company, Philadelphia

3.Lane, Helen W., and Smith, Scott M., (1998). ‘Nutrition in space’. In modern nutrition in

Health and Disease, 9th edition eds, M.E. Shills, J.H. Olson, M. Shike and AC Ross, Baltimore,

William and Wilkins.

**COURSE OUTCOMES**

1.Understand the sports nutrition

2.Gain knowledge on nutritional needs during emergency

3.Describe space food systems

**OPEN ELECTIVE**

**PAPER - 4**

**C. TECHNIQUES OF FOOD EVALUATION**

**Course Objectives :**

To enable the students to

* Gain knowledge about different techniques for food evaluation
* Methods of evaluating the quality of foods

**UNIT I**

Introduction to Food Evaluation Quality -Definition, Objectives and Need for Evaluation of Food Quality. Factors Affecting the Evaluation of Food Quality – Psychological and Physiological

**UNIT II**

Methods of Evaluation of Food Quality – Sensory Method Sensory Characteristics of Food – Appearance, Color, Flavour, Taste, Texture and Consistency, Conducting Sensory Tests – Training Panel Members, Testing Laboratory –Preparation of Samples, Techniques of Smelling and Tasting, Testing time, Design of Experiment, Reasons for Testing Food Quality.

**UNIT III**

Sensory Tests used for Food Evaluation -Types of Tests, Difference Tests, Rating Tests, Sensitivity Tests, Descriptive Tests, Interpretation of scores.

**UNIT IV**

Methods of Evaluation of Food Quality – Objective Methods, Basic Guidelines, Advantages and Disadvantages, Tests Used, Chemical, Physico-chemical, Microscopic, Physical Method, Instruments used for Texture Evaluation.

**UNIT V**

Evaluation of Microbial Quality of Foods Methods, Assays used to assess the Microbial Loads of different Foods, Permitted Levels of Microbial Load in Different Foods, Microbes Responsible for Food Quality.

**TEXT BOOKS**

1. **Srilakshmi, B. Second Edition, Food Science, New Age International (P) Limited**

**Publishers, New Delhi.**

1. **Harry T. Lawless, Hildegarde, Sensory Evaluation of Food Principles and Practices, Second Edition, Springer Science, 2010.**
2. **Joshi, V.K Sensory Science : Principles and Applications in Food Evaluation,.,**

**2006.**

**REFERENCE**

1. Hutenwigs, B.J. Food Color and Appearance, Published by Blackie Academic and Professional, London, 2000.
2. Howard R. Beckley, Jacquiline, H. Sensory and Consumer Research in Food Product Design and Development, 2006
3. Bi, Jian, Sensory Discrimination Tests and Measurements: Statistical Principles, Procedures and Tables, 2006

**COURSE OUTCOMES**

1. **Describe evaluation of food quality**
2. **Gain knowledge on sensory tests**
3. **Understand the microbial quality of food**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\***