Annexure 4.1

**Avinashilingam Institute for Home Science and Higher Education for Women**
(Deemed to be University, Estd. u/s 3 of UGC Act 1956, under Category A by MHRD)
Re-accredited with $A^{++}$ Grade by NAAC. CGPA 3.65/4, Category by I UGC
Coimbatore – 641 043, Tamil Nadu, India

## Department of Food Science and Nutrition

## M.Sc. Food Science and Nutrition

**Programme Outcomes:**

1. Apply basic knowledge of food science and nutrition for solving related problems(H,3)
2. Inculcate human values and professional ethics towards personal and professional development (H,3)
3. Design innovative food products and processing techniques with health, nutritional and environmental concern (H,3)
4. Assess community nutritional problems and impart nutrition education based on the needs of community (L,1)
5. Apply the principles of nutrition in the planning of diets for normal and therapeutic nutrition. (L,1)
6. Demonstrate professional attitudes, effective communication and behavioural skills that support and enhance individuals and team performance (L,1).
7. Evolve nutritional practices in the preparation and consumption of food at individual, family and community levels (M,2)
8. Analyze the nutritive value and hazardous components towards providing safe foods to consumers (L,1)
9. Exhibit interdisciplinary science and technological approaches for critical appraisal(M,2)
10. Adapt to the upcoming challenges and advancement in the field of Food Science and Nutrition(M,2)
11. Apply the research knowledge and competency for problem solving and innovation(M,2)

## Programme Specific Outcomes:

1. To enable students with nutritional assessment and identification of nutritional problems
2. To develop the innovative food products with quality evaluation
3. To demonstrate meal planning based on normal and therapeutic conditions.

## Scheme of Instruction and Examination
## (For students admitted from 2023-2024 onwards)

| *Part* | *Subject code* | *Name of paper /component* | *Hours of Instruction / week* | | *Scheme of examination* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | **Theory** | **Practical** | **Duration of exam** | **CIA** | **CE** | **Total** | **Credit** |
| | | **First Semester** | | | | | | | |
| I | 23MFNC01 | Nutrition through Life Span | 5 | – | 3 | 40 | 60 | 100 | 4 |
| I | 23MFNC02 | Food Microbiology and Food Safety | 5 | – | 3 | 40 | 60 | 100 | 4 |
| I | 23MFNC03 | Community Nutrition and Public Health | 5 | – | 3 | 40 | 60 | 100 | 4 |
| I | 23MFNC04 | Research Methods and Statistical Applications | 5 | – | 3 | 40 | 60 | 100 | 4 |
| I | 23MFNC05 | Chemistry of Foods – I | 5 | – | 3 | 40 | 60 | 100 | 4 |
| I | 23MFNC06 | Chemistry of Foods – II (Practical) | – | 3 | 3 | 40 | 60 | 100 | 3 |
| II | | CSS /Adult Education / Community Engagement and Social Responsibility | 2 | - | - | - | - | - | |
| | | **Second Semester** | | | | | | | |
| I | 23MFNC07 | Physiological Basis for Nutrition | 5 | – | 3 | 40 | 60 | 100 | 4 |
| I | 23MFNC08 | Food Biotechnology | 4 | - | 3 | 40 | 60 | 100 | 4 |
| I | 23MFNC09 | Post Production Systems | 4 | - | 3 | 100 | - | 100 | 4 |
| I | 23MFNC10 | Analytical Instrumentation for Foods | 4 | – | 3 | 40 | 60 | 100 | 4 |
| I | 23MFNC11 | Techniques for Clinical Nutrition (Practical) | – | 6 | 3 | 40 | 60 | 100 | 4 |
| I | 23MFNC12 | Mini Project | 1 | - | - | 100 | - | 100 | 2 |
| I | | **Interdisciplinary Course** | 4 | - | 3 | 40 | 60 | 100 | 4 |
| II | 23MXCSS1/ 23MXAED1/ 23MXCSR1 | CSS/Adult Education / Community Engagement and Social Responsibility | 2 | - | 3 | - | - | 100 | 2 |
| II | | Professional Certification | - | - | - | - | - | - | 2 |
| | | **Internship during summer vacation (1 month )** | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Third Semester** | | | | | | | | | |
| I | 23MFNC13 | Therapeutic Nutrition | 4 | 2 | 3 | 40 | 60 | 100 | 4 |
| I | 23MFNC14 | Advances in Nutrition – I | 4 | _ | 3 | 40 | 60 | 100 | 5 |
| I | 23MFNC15 | Biomolecules and Intermediary Metabolism | 4 | _ | 3 | 40 | 60 | 100 | 4 |
| I | 23MFNC16 | Food Product Development and Packaging (Open book exam) | 3 | _ | 3 | 100 | - | 100 | 3 |
| I | 23MFNC17 | Techniques for Experimental Nutrition (Practical) | _ | 6 | 3 | 40 | 60 | 100 | 4 |
| I | 23MFNC18 | Functional Foods and Nutraceuticals | 4 | _ | 3 | 40 | 60 | 100 | 4 |
| I | 23MFNC19 | Food Safety and Security (Self Study) | 1 | - | 3 | 40 | 60 | 100 | 4 |
| I | | Multidisciplinary Course | 2 | _ | 3 | 100 | - | 100 | 2 |
| II | 23MFNC20 | Internship | | | | 100 | - | 100 | 2 |
| **Fourth Semester** | | | | | | | | | |
| I | 23MFNC21 | Advances in Nutrition – II | 5 | _ | 3 | 40 | 60 | 100 | 5 |
| I | 23MFNC22 | Research Project | 25 | | | 100 | 100 | 200 | 8 |
| **Total Credits** | | | | | | | | | **98** |

**Other courses to be undertaken by the student:**
**MOOC Course – 2 to 4 Credits**
**Note: Minimum 98+2 to 4 credits to earn the degree**

**Other Courses offered by the Department**
**Interdisciplinary Course** 23MFNI01 **Nutritional Management for Lifestyle Diseases**
**Multidisciplinary Course** 23MFNM01 **Wellness and Fitness**

## Nutrition through Life Span

**Semester I** **Hrs of Instruction /Week: 5**
**23MFNC01** **No. of Credits: 4**

**Course Objectives:**

Enable the students to

1. Familiarize with the different methods of assessing nutritional status
2. Assess the nutritional status of the community using ABCDE methods
3. Gain knowledge about the methods of assessment of nutritional problems and their implications.
4. Understand the role of nutrition in different stages of life cycle.
5. Comprehend the nutritional requirements for special events

**Unit 1: Assessment of Nutritional Status** **10**

Concept and objectives; Methods available to assess the nutritional status; Direct methods – anthropometric measurements, biochemical estimation, clinical examination and diet surveys; Indirect methods- Mortality and Morbidity rates, Vital statistics, Assessment of ecological factors; Techniques of diet and nutritional surveys; Assessing the food and nutritional problems in the community

*Computer assistance for consolidation and documentation of survey data (SS)*

**Unit 2: Maternal and Pediatric Nutrition** **13**

Stages of gestation, weight gain, complications of pregnancy

Physiological adjustments, nutritional problems and dietary management, Importance of nutrition during and prior to pregnancy and dietary allowances. Physiology of lactation, hormonal control and reflex action, efficiency of milk production, problems of breast feeding, nutritional composition of breast milk, galactogogues, dietary modification and allowances. Nutritional status of infants, infant feeding, nutritional needs and allowances, premature infant and their feeding, breast feeding ,formula feeding

*Weaning foods and supplementary foods (SS)*

**Unit 3: Nutrition During Early And Late Childhood And Adolescence** **12**

Growth and development of preschool children- nutrition and cognitive development, prevalence of malnutrition in preschool age, feeding programmes for preschool children, food habits and nutrient intake of preschool children, dietary allowances.

Nutrition in school children – feeding school children and factors to be considered. School lunch programme

*Food habits and nutritional requirements, packed lunch, Dietary allowances (SS)*

Nutrition during adolescence – changes in growth and development, hormonal influences, psychological problems, disordered eating behaviors, nutritional problems, changes needed to prevent malnutrition

**Unit 4: Adult and Geriatric Nutrition** **10**

Nutritional requirement for the adults; Nutrition and work efficiency

Menopausal and post menopausal women – hormonal changes, nutritional requirements; Physiological changes in aging

*Clinical, psycho-social and economical factors affecting eating behaviour, social situation, institutionalization, common health problems (SS)*

Nutritional requirements, modification in diet, feeding old people.

| | | |
|---|---|---|
| **Unit:5** | **Nutritional Requirements For Special Events**<br>Sports nutrition<br>Nutritional requirements and food modification in higher altitudes,<br>*Space travels and sea voyage (SS)* | **10** |
| | **Related Experience**<br>Assessment of nutritional status and nutritional knowledge through anthropometric measurements, vital statistics, mortality and morbidity rate, clinical, biochemical and biophysical assessments, Food and nutrition survey on selected groups<br>Camp for 7 days in a village | **20** |
| | **Total Hours** | **75** |

**References:**

**Books:**


1. Nutrient requirements and Recommended Dietary Allowances for Indians, ICMR, National Institute of Nutrition, Hyderabad, 2010
2. Dietary guidelines for Indians, ICMR, National Institute of Nutrition, Hyderabad, 2010
3. Swaminathan, M. Advanced Textbook on Food Science and Nutrition, Vol:2, Second edition, Reprinted, Bangalore Printed and publishing Co Inc, Bangalore, 2008.
4. Krause, M.V and Hunsher, M.A, Food, Nutrition and Diet Therapy, 11th edition, W.B.Saunders Company, Philadelphia, London, 2004.
5. Bamji M.S, Prahlad Rao N, Reddy V ,Textbook of Human Nutrition II Edition, Oxford and PBH Publishing Co. Pvt. Ltd , New Delhi,2004


**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 Nicro, Missouri, U.P.
5. Indian Journal of Nutrition and Dietetics, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore.
6. Proceedings of the Nutrition Society of India, NSI, Hyderabad.


**Course Outcomes:**

1. Relate foods and nutrients to the biological requirements of humans at different stages of the life cycle
2. Generate resources to communicate nutritional information compiled from recommendations and scientific sources
3. Explain about the nutritional requirements of humans during different stages of the life cycle
4. Relate the nutrition-related concerns specific to each stage of the human life cycle to consequences for health
5. Explain and reflect upon the consequences of physical, biochemical, physiological, social and psychological factors impacting nutritional intake and status during each stage of the human life cycle

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | H | H | M | M | H | L | H | M | M | M | M | H | M | M |
| CO 2 | H | M | H | M | H | L | H | M | M | M | M | H | M | M |
| CO 3 | H | H | H | M | H | L | H | M | M | M | M | H | M | M |
| CO 4 | H | H | M | M | H | L | H | H | M | M | M | H | M | M |
| CO 5 | H | H | H | M | H | L | H | L | M | M | M | H | M | M |

## Food Microbiology and Food Safety

**Semester I** **Hrs of Instruction /Week: 5**
**23MFNC02** **No. of Credits: 4**

**Course Objectives:**

Enable the students to

1. Learn about the structure, growth and multiplication of microorganisms
2. Acquire knowledge and understand the relevance of microbiology and its application in food industry and maintenance of health.
3. Gain knowledge about food additives and contaminants
4. Analyse the food additive and contaminants from the aspects of safety and hygiene.
5. Understand the importance of food safety and quality management in food processing.

**Unit 1: Introduction to Microbiology** **15**

Structure, Growth and Multiplication of micro-organisms

Definition and History: *Microscopy, General Morphology and Types of microorganisms Bacteria, Fungi, Algae, Yeast and Virus –Bacteriophage (SS),* growth curve, batch and continuous culture, factors affecting growth: intrinsic factors, nutrient content, pH, redox potential, antimicrobial barrier and water activity; extrinsic factors: relative humidity, temperature and gaseous atmosphere.

**Unit 2: Microbiology of Foods, Benefits of Microbes** **15**

Contamination, spoilage and *preservation of cereal and cereal products, sugar and sugar products vegetables and fruits, milk and milk products and canned foods, meat and meat products, egg and poultry, fish(SS)* food fermentation-types; fermented food products

**Unit 3: Introduction to Food Safety:** **10**

Food safety in processing, packaging and labeling, food spoilage,factors affecting food safety, food borne hazards of food poisoning and its types and food intoxication and its types microbial origin.

**Unit 4: Food Additives and Contaminants, Hygiene and Sanitation** **10**

Food colors, flavoring agents, preservatives, antioxidants, emulsifiers, stabilizers, antimicrobial substances; natural contaminants, toxins alkaloids, lathyrogens, goitrogens, haemagglutinins, phytates; indirect additives, pesticides, metallic and microbial contaminants and adulterants *Food hygiene and sanitation–personal hygiene (SS)* and pest control in the food industry, industrial hygiene.

**Unit 5** ***Food Laws (SS) and Quality Management, Recent Concerns in Food Safety.*** **10**

International and National food laws, Essential Commodities Act (ECA). ISI, BIS, AGMARK, Food Safety and Standards Bill 2005, Food Safety Act, 2006, Food Safety Rules and Regulations of FSSAI, 2011, FAO,WHO, Codex Alimentarius, WTO, JEFA, APDA, ISO 22000 series, *HACCP- definition, principles, and affiliations (SS)*, consumer education, food safety education and training, food sampling and analysis of food

**Related Practical Experience** **15**

1. Hanging Drop Method – motility of bacteria.
2. Staining of Bacteria – simple staining, gram staining
3. Preparation of media and microbiological analysis of foods
4. Detecting food contaminants in some common foods.
5. Introduction to microbiological kits
6. Methods of detecting food pathogens
7. Destruction of food pathogens
8. CCP – in various foods

**Total Hours** **75**

**References:**


1. Adams M. R and Moss M. O, Food Microbiology, New Age International (P) Ltd., New Delhi, 2005.
2. Vijaya Ramesh, K. Food Microbiology, MJP Publishers, Chennai , 2007.
3. James G.Cappuccino and Natalie Sherman, Microbiology – A Laboratory Manual, Pearson Education Publishers, USA, 2008.
4. Frazier.W, Food Microbiology, Mc,Grawhill co ltd, New Delhi, 2005
5. James M.Jay Modern Food Microbiology, Fourth edition, CBS Publishers and Distributors, New Delhi, 2005.
6. Adam Tamine, Probiotic Dairy products, Blackwell Publishing, USA, 2005.6.
7. Curricula On Food Safety, Directorate of General of health Services, Ministry of health &family Welfare, Govt of India, New Delhi, 2003.
8. David A. Shapton, Naroh F, Shapton ,Principles and practices for the safe processing of foods, Heineman ltd, Oxford,1991


**Course Outcomes**

1. Understand the general morphology of microorganisms and understand the growth inhibiting and promoting factors for microorganisms.
2. Categorize the sources, contamination and type of spoilage in respective food groups and infer suitable presentation techniques.
3. Enumerate food poisoning food borne hazards and food intoxication of microbial origin to ensure food safety.
4. Interpret the different clauses used and applications of safety management in food industry.
5. Define different food laws and regulations for quality management in food industry.

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | H | H | H | L | L | M | L | H | L | M | M | H | M | L |
| CO 2 | H | M | L | M | M | M | L | L | L | M | H | | M | H |
| CO 3 | H | H | L | M | L | M | M | M | M | L | H | M | L | H |
| CO 4 | H | H | M | M | L | L | M | L | M | M | H | H | M | L |
| CO 5 | H | H | H | L | M | M | L | M | M | M | H | H | M | L |

## Community Nutrition and Public Health

**Semester I** **Hrs of Instruction /Week: 5**

**23MFNC03** **No. of Credits: 4**

**Course Objectives:**

Enable the students to

1. To learn nutritional programmes and policies overcoming malnutrition
2. To understand various nutritional organizations combating malnutrition
3. To be able to apply computers in the formulation of community nutrition education programme
4. To apply the principles of supplementary feeding intervention during emergency.

**Unit 1:** **Nutrition and National Development**: **13**

Ecology of Malnutrition, Strategies To Overcome Malnutrition

Relation of nutrition to national development, nutrition and food security; Consequences of malnutrition;

IMR, NMR,MMR and prevalence of common nutritional problems- PEM, Vitamin A Deficiency Diseases, Anaemia, Iodine Deficiency Disorders and Fluorosis

Ecological factors leading to malnutrition; Synergism between malnutrition and infection; Measures to overcome malnutrition

Nutrition Intervention programmes – Nutritious Noon Meal Programme. ICDS, Prophylaxis programme – Vitamin A deficiency, Iron deficiency anaemia, Iodine deficiency (Eat Right India Movement, Anemia Mukt Bharat, Poshan Abiyan, NeTProFaN

National Nutrition policy, *Empowering women towards improving the nutritional status of the family, community and nation at large (SS)*

**Unit 2:** **National, International and Voluntary Organizations to Combat Malnutrition** **10**

*History of malnutrition in India (SS)*

National organization – ICAR, ICMR, CSWB, SSWB, NNMB, NIN, CFTRI, DFRL, NIPCCD and NFI;

International Organizations - WHO, FAO, UNICEF, World Bank, FFHC, WFP; Voluntary organizations – Global Alliance for Improved Nutrition(GAIN) Micronutrient Initiatives, CARE, CRS, AFPRO, IDA; Concepts of Community Health; Health care of the community

**Unit 3:** **Nutrition Education** **10**

*Meaning, nature and importance of Nutrition education to the community and lessons to be taught (SS)*

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 4:** **Epidemiology of Communicable Diseases** **15**

Definition of epidemiology – causes, signs and symptoms, treatment and prevention of communicable diseases, respiratory infections, intestinal infections, Other infections-dengue, filariasis.

Types of immunity- active, passive and herd-group protection

Immunization agents- vaccines, immuno globulins

*Immunization schedules (SS)* – Active- National and WHO Expanded Programme on Immunization- Universal Passive, Combined, Chemoprophylaxis, non-specific measures

**Unit:5** **Environmental Sanitation and Disaster Management**

Pollution, *Biomanure, Vermicomposting (SS)*, Effective Microorganisms Water purification and recycling **12**

Types of disaster – natural and manmade –earthquakes, volcanic eruptions, flash foods, major floods, tsunami and drought, fire accidents, bomb blast.

Disaster management-mitigation strategies-Role of NGO's and GO's and nutritionists, Major nutritional and health considerations in disaster

Emergency feeding, mass and supplementary feeding, management of feeding operations, water and food safety

**Related Experience**

Planning and conducting nutrition education programmes in a selected village for three days **15**

**Total Hours** **75**

**References:**


1. Park A. (2007), Park's Textbook of Preventive and Social Medicine XIX Edition M/S Banarasidas, Bharat Publishers, 1167, Prem Nagar, Jabalpur, 428 001(India)
2. Bamji M.S, PrahladRao N, Reddy V (2004). Textbook of Human Nutrition II Edition, Oxford and PBH Publishing Co. Pvt. Ltd , New Delhi
3. Bhatt D.P (2008), Health Education, KhelSahitya Kendra, New Delhi
4. Gibney MJ, Margetts BM, Kearney JM, Arab L (2004) Public Health Nutrition Blackwell Publishing Co. UK
5. Swaminathan M (2007), Essentials of Food and Nutrition AndAdvanced Textbook Vol. I,The Bangalore Printing and Publishing Co. Ltd, Bangalore.


**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 Nicro, Missouri, U.P.
5. Indian Journal of Nutrition and Dietetics, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore.
6. Proceedings of the Nutrition Society of India, NSI, Hyderabad.


**Course Outcomes:**

1. Create awareness on nutritional programmes and policies and disease management.
2. Evaluate the impact of community nutrition on national development and analyze the effect of nutrition education programs on public Health
3. Apply the principles of supplementary feeding intervention during emergency
4. Understand the role of various nutritional organizations in combating malnutrition
5. Remember the etiology and epidemiology of communicable diseases and importance of immunization

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | H | H | H | L | L | M | L | H | L | M | M | H | M | L |
| CO 2 | H | M | L | M | M | M | L | L | L | M | H | | M | H |
| CO 3 | H | H | L | M | L | M | M | M | M | L | H | M | L | H |
| CO 4 | H | H | M | M | L | L | M | L | M | M | H | H | M | L |
| CO 5 | H | H | H | L | M | M | L | M | M | M | H | H | M | L |

## Research Methods and Statistical Applications

**Semester I** **Hrs of Instruction /Week: 5**

**23MFNC04** **No. of Credits: 4**

**Course Objectives:**

1. Understand the fundamental principles and techniques of methodology concerning research.
2. Use effective tools and techniques to collect research data, organize them appropriately for facilitating further analysis.
3. Enable students conduct research work, formulate synopsis and report writing.
4. Apply statistical procedure to analyse numerical data and the interpreting data meaningfully.
5. Familiarise learners with statistical tools and Statistical Package for interpretation and drawing conclusions.

**Unit 1: Introduction to Research, Types of Research and Research process** **12**

Definition, Objectives, significance and characteristics of research

Types of Research – Descriptive, analytical, applied, fundamental, quantitative, qualitative, conceptual, empirical and current types of research

Hypothesis – Definition, concepts, tests of hypothesis

Basic components of research design

Sampling design- Probability and non- probability sampling methods

**Unit 2: Data and Tools of Data Collection** **11**

Primary and secondary data and data sources – Interview, observation, schedules and questionnaires – Definition, types, requirements, advantages, disadvantages, limitations

Census Vs sample survey

Pre-testing and pilot study, Editing and coding of data

**Unit 3: Organization and Representation of Data, Report writing** **12**

Classification – Definition, objectives, requisites, methods, qualitative, quantitative; frequency distribution – definition, terms; discrete and continuous

Tabulation of data- parts of a table, preparation of blank tables

Diagrammatic – One dimensional diagrams, two dimensional diagrams, pictogram and cartographs

Graphical- Frequency graphs- line, polygon, curve, histogram, cumulative frequency graphs- ogives

*Components or layout of a thesis (SS)*

**Unit 4: Descriptive Measures** **19**

Mean*, median*, mode* and their applications

Measures of dispersion*- standard deviation, coefficient of variation, percentiles and percentile ranks

Correlation coefficient and its interpretation*, Rank correlation*

Regression equations* and predictions. Association of attributes, contingency table

**Unit:5 Probability and Tests of Significance** **11**

Rules of probability and its applications

Normal, binomial – properties, importance in research studies, Wilcoxan Rank Test, Mann Whitnes U test, Kruskal Wallis Test

Large and small sample tests –'t'*, F* and chi square tests* ANOVA* and applications,Multiple paired comparison test – DMRT test, Tukeys test, Duncan'stest

Statistical software – SPSS

**Related Experience** **10**

1. Identifying the research problems under each type
2. Formulation of questionnaires and schedules
3. Consolidating data and forming tables
4. Drawing graphs and diagrams appropriately
5. Working out numerical sums and interpret
6. Numerical applications and drawing inferences, demonstration of SPSS

**Total Hours** **75**

*Inclusive of simple problems

**Text Books:**

1. C.R.Kothari and Gaurav Garg, Research Methodology: Methods and Technique, New Age International Publishers, 2019, 4th Edition
2. S. P. Gupta, Statistical Methods, Sultan Chand & Sons, 2012.

**Reference Books:**

1. Devadas.R.P. A Handbook on methodology of Research, Sri Ramakrishna Vidyalaya, Coimbatore, 2000
2. Gosh.B.N. Scientific Methods and Social Research Sterling Publishers Pvt.Ltd. New Delhi.
3. Kulbir Singh Sidhu, Methodology of Research in Education Sterling Publishers Pvt. Ltd., New Delhi, 2006
4. Srivastava.A:B.L and Sharma. K.K., Elementary Statistics in Psychology and Education, Sterling Publishers Pvt.Ltd.2003
5. G.C.Ramamurthy, Research Methodology, Kindle Edition, Dream tech Press, 2011
6. Ranjit Kumar, Research Methodology, SAGE publications, 2011, 3rd Edition
7. S.C. Gupta and VK Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2014

**Course Outcomes:**

1. Possess the knowledge on the basic concepts related to research methodology and statistics.
2. Develop understanding on the characteristics of research and sampling design along with data collection, presentation and analytical tools using software
3. Acquire the skill in the design of sampling along with selection, collection, analysis and interpretation of data using statistical procedures.
4. Analyse the situation for identification of problems and assess for fitting hypothesis and statistical procedures for related data.
5. Construct the research design with appropriate tools and statistical analysis in solving problems related to food science and nutrition.

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PS O 2 | PS O 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | H | M | M | H | M | L | | | M | M | H | M | | L |
| CO 2 | H | M | L | M | M | L | | | M | M | H | M | | L |
| CO 3 | H | M | L | M | L | M | | | M | L | H | M | | L |
| CO 4 | H | M | M | M | L | L | | | M | M | H | M | | L |
| CO 5 | H | M | H | L | M | M | | | M | M | H | M | | L |

## Chemistry of Foods-I

**Semester I** **Hrs of Instruction /Week: 5**

**23MFNC05** **No. of Credits: 4**

**Course Objectives:**

1. Outline the basic and advanced concepts of food chemistry
2. Provide insight into the chemistry of various food components
3. Understand the major chemical reactions in food preparation
4. Learn the physico chemical properties of food substances
5. Familiarise with non-nutritive components of food

**Unit 1: Physico Chemical Changes in Foods** **15**

Physical properties of water, structure of water and ice, types of water in foods, water activity in foods, water soluble interactions, role of water in food systems, Hydrogen ion concentration (pH), Solubility, Solutions, Crystallization, Gels, Foams, Colloids, Stabilisers and Emulsions, Oxidation – reduction, Denaturation and coagulation of proteins, *Osmosis, Enzyme action (SS)*

**Unit 2: Chemistry of Starch and Sugars** **15**

Components and characteristics of food starches, non starch polysaccharides, Swelling of starch granules, Gel formation, factors affecting gelatinization, retrogradation, syneresis, effect of sugar, acid, alkali, fat and surface active agents on starch

*Stages of sugar cookery (SS),* Crystal formation, factors affecting crystal formation, types of candies, Action of Acid, Alkali and Enzymes, Non enzymatic browning

**Unit 3: Chemistry of Proteins and Enzymes** **15**

Physicochemical properties of amino acids, *structure and functional properties of protein (SS)*. Gluten formation, effect of soaking, fermentation and germination, Action of Heat, Acid and Alkali on vegetable and animal proteins – egg, milk, meat and fish

Enzymes in foods – Nature of enzymes, stability and action, proteolytic enzymes, oxidases, lipases, enzymes decomposing carbohydrates and applications. Enzymes in food fermentations. Immobilized enzymes.

**Unit 4: Chemistry of Lipids** **15**

Physicochemical properties of Fats and Oils, Rancidity, hydrogenation, winterization, decomposition of triglycerides, Shortening power of Fats

*Role of lipids in flavour enhancement(SS)*, Changes in Fats and Oils during heating and storage, Factors affecting fat absorption of foods

**Unit:5 Chemistry of Non-nutritive components in foods** **15**

Pectins, phenolic components, vegetable gums, volatile compounds, water and fat soluble pigments, Action of heat, acid and alkali on vegetable pigments, enzymatic browning reactions in fruits and vegetables, preventive measures.

*Active principles of spices and condiments(SS)*

Food additives- Definition, types of food additives, role in food processing

**Total Hours** **75**

**References:**


1. Paul, P.C., and Palmer, H. H., (2000) Food Theory and Applications. John Wiley and Sons, Newyork, Revised Edition.
2. Belitz, H.D and Grosh. W, (2005). Food Chemistry. Springer – Verlag.
3. Fennema O.R (1996). Food Chemistry, Fourth Edition, Marcel Deckker,.
4. Meyer, L.H. (1987). Food Chemistry. CBS publishers and Distributors, New Delhi.
5. Manay, S N. and Shadaksharaswamy (2017) Foods: Facts and Principles, Third Revised Edition, New Age International (P) Publishers, New Delhi.
6. Potter, N.N. and Hotchkiss, J.H. (2006), Food Sciences, Fifth edition, CBS Publishers and Distributors, New Delhi.


**Journals**

1. Journal of Food Science.
2. Advances in Food Research.
3. Journal of Food Science and Technology.
4. Journal of Agricultural and Food Chemistry.

**Course Outcomes:**

1. Relate and analyse the composition and chemical groups on food molecules and their role in reaction mechanisms in foods.
2. Acquire knowledge on the physico chemical changes with regard to carbohydrates, lipids, proteins and water
3. Assess implications for food formulations to achieve food quality, palatability, cost and health
4. Analyse and interpret the role of food chemistry in food preparations
5. Analyse the components of foods in relation to processing and preservation

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | H | L | L | L | H | M | M | H | M | L | M | L | M | M |
| CO 2 | H | L | M | M | H | L | M | M | M | L | M | L | L | M |
| CO 3 | H | M | H | M | H | H | H | H | M | L | L | M | M | M |
| CO 4 | H | M | M | L | H | L | M | M | L | L | L | L | H | H |
| CO 5 | H | L | M | L | H | M | H | H | H | L | L | L | L | L |

## Chemistry of Foods- II (Practical)

**Semester I** **Hrs of Instruction /Week: 3**

**23MFNC06** **No. of Credits: 3**

**Course Objectives:**

1. Associate the theoretical concepts to the physico chemical changes in foods
2. Explore the structural changes in foods
3. Provide insight into the effect of various factors involved in food preparation
4. Determine the changes in foods during preparation
5. Prepare recipes based on the physico chemical changes in foods

| | | |
|---|---|---|
| **Unit 1:** | Gelatinization of various starches, microscopic examination of starches Stages of sugar cookery, preparation of Fondant, Fudge, Caramel, Pulled toffees and brittles and microscopic examination for crystallization of sugars,<br>Determination of gluten content in doughs from different flours | **9** |
| **Unit 2:** | Smoking temperature of fats and oils.<br>Factors affecting fat absorption in shallow and deep fried foods | **6** |
| **Unit 3:** | Effect of soaking time, types of water, cooking, acid, alkali and germination on pulses. Fermentation of batter in terms of volume and pH<br>Preparation of cottage cheese, Setting of curd | **9** |
| **Unit 4:** | Changes in cooking of meat, factors affecting the tenderness of meat<br>Effect of cooking time on egg protein, coagulation of egg, preparation of mayonnaise | **6** |
| **Unit:5** | Effect of acid, alkali and heat on vegetable pigments<br>Determination of the strength of pectin in different fruits and vegetable extracts.<br>Preparation of fruit jelly and tomato soup | **6** |
| | Mini project on the application of the concepts of food chemistry in food preparation | **9** |
| | **Total Hours** | **45** |

**References:**


1. Paul, P.C., and Palmer, H. H., (2000) Food Theory and Applications. John Wiley and Sons, Newyork, Revised Edition.
2. Fennema O.R. (1996) Food Chemistry, Fourth Edition, Marcel Deckker.
3. Chandrasekhar U (2002), Food Science and Applications in Indian Cookery, Phoenix Publishing House Pvt Ltd, New Delhi.
4. Manay, S N. and Shadaksharaswamy (2017) Foods: Facts and Principles, Third Revised Edition, New Age International (P) Publishers, New Delhi


**Course Outcomes:**

1. Identify the physico chemical changes in foods and apply the knowledge acquired in food preparation
2. Evaluate the effect of chemical reactions of foods
3. Interpret the food interactions and outcomes
4. Demonstrate skills in food preparation and develop quality food products
5. Generation of novel ideas through small research projects

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PS O 2 | PS O 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | H | H | H | L | M | M | M | M | L | L | M | M | H | H |
| CO 2 | H | M | H | M | H | H | H | M | L | L | M | M | H | H |
| CO 3 | H | H | H | H | H | M | M | H | M | L | L | M | H | H |
| CO 4 | H | M | H | M | H | M | H | H | M | M | L | L | H | H |
| CO 5 | H | H | H | L | H | H | H | H | H | M | H | H | H | H |

## Physiological Basis for Nutrition

**Semester II** **Hrs of Instruction /Week: 5**

**23MFNC07** **No. of Credits: 4**

**Course Objectives:**

To enable the students to

1. Understand the significance of blood and immunity
2. Gain knowledge on body fluids and circulatory system
3. Comprehend the organization and structural plan of the digestive system
4. Gain insight into renal and respiratory physiology
5. Understand the structure and functions of endocrine and nervous system

**Unit 1:** **Blood and Immunology** **15**

*Blood composition (SS)* and functions, plasma proteins- origin and its functions, blood volume haemostasis, *blood coagulation(SS)*

Development of red blood cells and anaemia, white blood cells, platelets, blood groups and blood transfusion.

Definition and types of immunity, lymphocytes in immunity, antigens, development of cellular immunity, development of humoral immunity, immune deficiency diseases and auto immune disease

**Unit 2:** **Body Fluids and Circulatory System** **15**

Compartment of body fluids, composition of body fluids, significance of body fluids, methods of measuring body fluids, lymphatic system and lymph. *Introduction to cardiovascular system(SS)*, origin and spread of cardiac impulse, *cardiac cycle(SS)* heart sounds, electro cardiogram, *heart rate(SS)* blood pressure-regulation of blood pressure and factors influencing blood pressure, hypertension, effect of exercise on cardio vascular system.

**Unit 3:** **Digestive System** **15**

Organization and structural plan of gastrointestinal system, *Functions of the stomach, liver and intestine(SS)*, mechanism of secretion of saliva, gastric juice, bile, pancreatic juice and intestinal juice, movements of gastrointestinal tract, Hormones in the gastrointestinal tract, gastric function tests and liver function tests

**Unit 4:** **Respiratory Physiology and Renal Physiology** **15**

*Physiological anatomy of respiratory tract (SS),* mechanics of respiration, transport of respiratory gases in blood, exchange of respiratory gases pulmonary volumes, regulation of respiration, effect of exercise on respiration, high altitude and acclimatization. Structure of kidney and nephron, urine formation, micturition, renal function test, acid base balance by kidney, dialysis, renal disorders.

**Unit:5** **Endocrine and Nervous System** **12**

Structure and functions of pituitary glands, thyroid glands, endocrinal functions of pancreas, adrenal cortex and medulla, *disorders of endocrine glands (SS),* Introduction to nervous system, neuron, receptors, synapse, neurotransmitters, reflex activity, general anatomy of nervous system, functions of the different parts

**Related Experience**

Determination of bleeding time, Determination of coagulation time, Estimation of haemoglobin, RBC count, **3**

Recording of blood pressure and heart rate at rest and in exercise

**Total Hours** **75**

**References:**


1. Guyton, A.C and Hall, J.B (1996): Text Book of Medical Physiology, 5th Edition, W.B. Saunders Company, Prism Books Private Limited, Bangalore.
2. Chatterjee C.C (1998) Human Physiology, Volume I and II, Medical allied agency, 82/1 Mahatma Gandhi Road, Calcutta.
3. Subramanian and Mathavan Kutty S.M (2001): Text Book of Physiology, Chand and Company, NewDelhi.
4. Sembulingam, K and Prema Sembulingam (2000): Essential of Medical Physiology, 2nd Edition, Jay pee Brothers Medical Publishers (P) Limited, New Delhi.
5. Chaudhuri, K (1997) Concise Medical Physiology, 2nd Edition, New Central Book Agency (P) Limited, Calcutta-9.
6. Vidya Ratan (1993), Hand Book of Human Physiology, 7th Edition, Jay pee Brothers Medical Publishers (P) Limited, New Delhi.7 and 8 in the syllabus
7. Sembulingam and Prema Sembulingam, (2010) 8th Edition, Essential of Medical Physiology, Jay peeBrothers Medical Publishers (P) Limited


**Course Outcomes:**

1. Gain knowledge on the composition of fluids and system of organs in human body.
2. Comprehend the mechanism behind the functions of fluids and system of organs in human body
3. Enumerate the factors associated with normal functions of body fluids and organs
4. Explore the pathological symptoms associated with the physiological dysfunctions.
5. Acquire the skill in basic physiological tests related to the health of human body.

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | L | M | | L | L | M | | | H | L | L | M | | M |
| CO 2 | L | M | | L | L | M | | | H | L | L | M | | H |
| CO 3 | M | L | | L | L | M | | | H | | M | M | | L |
| CO 4 | M | L | | H | M | M | | | H | | L | M | | M |
| CO 5 | M | L | | H | L | M | | | H | M | L | M | | M |

## Food Biotechnology

**Semester II**
**23MFNC08**

**Hrs of Instruction /Week: 4**
**No. of Credits: 4**

**Course Objectives:** Enable the students to

1. To gain knowledge on the techniques and tools of genetic engineering
2. To understand fermentation and enzymatic technology in food industries
3. To explore biotechnological techniques in the production of food based products.
4. To learn the safety of biotechnological implications in foods.
5. To imbibe skills on biotechnological approaches in the production of food additives.

**Unit 1: Introduction and Genetic Engineering** **10**

*Definition, scope and importance of biotechnology (SS)* Tools of genetic engineering: Enzymes-exonuclease, endonuclease, restriction endonuclease, ligase, reverse transcriptase and alkaline phosphatase. Commonly used cloning vectors-plasmids, bacteriophage, cosmids, phasmids: Genetic Engineering and Gene cloning – definition, basic steps and applications

**Unit 2: Microbial Growth and Fermentation Systems** **10**

*Microbial cell growth, microbial metabolism, regulation of metabolism and product secretion (SS).* Fermentation systems – batch, fed batch and continuous process; general structure of fermenter, factors influencing fermentation, Bioreactors – definition and types, Downstream processing – steps involved, biosensors and biochips – definition and applications.

Enzyme Technology – soluble enzymes, immobilized enzymes – methods of immobilization, general pathway for synthesis of enzymes, Synthesis and applications of enzymes in food industries - amylases, invertase, glucoseisomerases.

**Unit 3: Tissue Culture and Single Cell Protein (SCP)** **10**

Plant tissue culture – basic requirements,techniques and applications, Technique of gene transfer into plants- transgenic plants - flavrsavr tomato, golden rice, Btbrinjal, GM mustard, safety aspects of transgenic crops; animal tissue culture - basic requirements and techniques, Applications in food industry.

*Microbial biomass and Single cell protein- definition, importance and applications, synthesis of single cell protein (SS)* spirulina, mushroom culture and yeast biomass production. Single cell cultures for production of food flavours and colours.

**Unit 4: Role of Biotechnology in Food Industries** **10**

a) Food additives, synthesis of acidulants – citric acid, gluconic acid, lactic acid, itaconic acid; sweeteners – glucose syrup and High Fructose Corn Syrup (HFCS): thickeners and gelling agents - xanthan gums.

b)Vitamins and amino acids – vitamin A, ergosterol, riboflavin, vitamin $B_{12}$, fatty acid; amino acids – lysine, methionine, glutamate.

*c) Food fermentations – alcoholic beverages, cheese making, fermented soya based foods, meat fermentation, vinegar (SS)*

**Unit:5 Xenobiotics, Nanotechnology, Nutrigenomics and Regulatory Aspects of Biotechnological Methods** **10**

Definition, components, metabolism of xenobiotics- Phase I and Phase II reactions, Bio- dynamics of xenobiotics, Nanotechnology and Nutrigenomics.: Definition, Concepts and applications; *Impact of biotechnology on the nutritional quality of foods (SS),* Safety aspects of foods produced by biotechnology and genetic engineering

**Related Experience** **10**

Visit to biotechnology/genomics lab
Visit to plant tissue culture laboratory
Visit to animal tissue culture laboratory

**Total Hours** **60**

**References:**

**Books:**


1. V.K.Joshi and Ashok Pandey (2009) Biotechnology: Food Fermentation- Microbiology, Biochemistry and Technology, volume –I. Asia Tech Publishers, New Delhi.
2. V.K.Joshi and Ashok Pandey (2009) Biotechnology: Food Fermentation - Microbiology, Biochemistry and Technology, volume- I . Asia Tech Publishers, New Delhi.
3. Satyanarayana, U, 2008. Biotechnology, Books and Allied (P) Ltd., Kolkata
4. Mansi, EMT, Bryce, CFA, Demain, A.L and Allman, R (2007) Fermentation Microbiology and Biotechnology, Taylor and Francis, New York.
5. Meenakshi Paul (2007) Biotechnology and Food Processing Mechanics, Gene-Tech Publishers
6. JayantoAchrekar , (2007) Fermentation Biotechnology, Dominant Publishers
7. Green P.J 2002, Introduction to Food Biotechnology, CRC Press, U.S.A


**Journals:**


1. Food Technology, Journal of Institute of Food Technology, Illinois, USA
2. Journal of Food Science and Technology by Association of Food Scientists and Technologists, CFTRI India
3. Food Technology, Abstracts, Central Food Technological Research Institute, Mysore.
4. Food Processing, Pitman Publishing Company, New York, USA
5. Journal of Food Science, The Institute of Food Technologists, Illinois, USA.
6. Nutrition and Food Science, Forbes Publications Ltd., Hatree House, Queenway, London.
7. Trends in Biotechnology, USA.
8. R. D. King, Food Biotechnology, Springer, 2011
9. R C Dubey, A Textbook of Biotechnology, Fifth Revised Edition 2014, S Chand Publications
10. Byong H. Lee, Fundamentals of Food Biotechnology, 2nd Edition, 2015, Wiley-Blackwell
11. Joshi VK, Food Biotechnology, Principles and Practices, 2013, I K International Publishing House Pvt. Limited


**Course Outcomes:**

1. Gain knowledge on the techniques and tools of genetic engineering and food biotechnology
2. Recognize the importance of fermentation, xenobiotics, nanotechnology, nutrigenomics and applications of enzyme technology in food industries
3. Identify key genetically modified foods and animal tissue culture in the production and safety of transgenic plants and animals
4. Explore microbial pathways and appreciate the role of microorganisms in industrial processes
5. Elucidate the nutritional and safety aspects of implications of biotechnology in foods

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | H | H | M | L | L | L | M | L | M | H | H | L | H | L |
| CO 2 | H | M | H | M | M | L | M | H | H | H | H | L | H | M |
| CO 3 | H | H | H | H | L | L | M | M | H | H | H | L | H | H |
| CO 4 | H | M | H | M | M | L | M | H | H | H | H | L | H | H |
| CO 5 | H | H | H | H | L | M | H | H | H | H | H | M | H | M |

## Post Production Systems

**Semester II** **Hrs of Instruction /Week: 4**

**23MFNC09** **No. of Credits: 4**

**Course Objectives:**

Enable the students to

1. Learn about national and international agencies controlling food losses
2. Study about agents causing food losses
3. Understand the importance and methods of post-production techniques for foods
4. Gain knowledge in food processing and food conservation

**Unit 1:** **Introduction To Post Production Technology and Agencies Controlling Food Losses** **12**

Need for post-production technology, important measures adopted by Government to augment food production, *Green, Blue, and white revolution (SS)*

Role of SGC, FCI,CWC,SWC,IGS, Pest Control of India(PCI) in controlling food losses

**Unit 2:** **Agents Causing Food Loss and Control Measures** **12**

Types and reasons for losses of foods, extent and cost of losses; Agents causing losses - insects, rodents, micro-organisms, Birds and other physical agents

*Importance and methods of sanitary handling (SS)*

Physical, chemical, biological measures to control insects, rats, rodents and birds; Fumigants, fumigation, safety measures and integrated pest control

**Unit 3:** **Storage of Grains, Fruits and Vegetables** **12**

Importance and requirements of storage structures, *Study of traditional structures and improvements needed (SS)*, modern storage structures, metal bins, silos, storage godown, cold storage chains in India.

**Unit 4:** **Food Processing I** **10**

Importance of processing- methods of processing cereals (wheat, rice, maize), breakfast cereals; premixes and convenience foods, Processing of pulses; Processing of fruits and vegetables, meat, fish, poultry, egg; Processing of sugars

**Unit:5** **Food Processing II** **10**

Processing of oil seeds – ground nut, coconut, soya, gingelly, sunflower, cotton seed

Processing of milk and milk products; Processing of condiments and spices – cumin, mustard, pepper, turmeric, chilli, ginger, coriander, cinnamon, COve, aniseed and garlic

*Beverages , tea, coffee and cocoa (SS)*

**Related Experience** **4**

Visit to FCI, TNAU, Milk processing unit and cold storage facilities

Visit to sugar manufacturing and oil processing unit

**Total Hours** **60**

**References:**

**Books:**


1. Fellows, P (2000) Food Processing Technology-Principles and Practice 2nd edition, CRC press Wood Lead Publishing Ltd, Cambridge, England,.
2. Srilakshmi, B (2002), Food Science, New Age International (Pvt) Ltd, New Delhi.
3. Sivasankar B (2002) Food Processing and Preservation, Prentice-Hall of India Private Limited, New Delhi,
4. Mehas, K.Y., and Rodgers, S. L (2000) Food Science and You. McMillan McGraw Hill Company.
5. Swaminathan, M (2005) Food Science, Chemistry and Experimental Foods, Bappco Publishers.


**Journals**


1. Journal of Technology, Institute of Food Technology, Illinois, USA
2. Food Technology- Abstracts Central Food Technological Research Institute.
3. Food Processing. Pitman publishing Company, New York, USA
4. Journal of Food Science, the Institute of Food Technologists, Illinois, USA.


**Course Outcomes**

1. Understand the various roles of national and international agencies in preventing and reducing food losses.
2. Acquire knowledge about the agent casing food losses and the measures to control the food losses.
3. Learn the different types of the storage of grains, fruits and vegetables - traditional and modern.
4. Understand the importance of the processing of sugar, cereals, pulse, fruit, vegetables and Meat and meat products.
5. Gain knowledge about the processing of oil seed, condiments and spices.

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | L | M | L | M | L | M | M | L | H | M | M | L | M | M |
| CO 2 | M | M | M | M | H | M | M | M | H | M | M | M | M | M |
| CO 3 | L | M | L | M | M | M | M | M | M | L | M | L | M | M |
| CO 4 | M | M | M | M | M | M | M | H | M | M | M | M | M | M |
| CO 5 | M | M | M | M | M | M | M | H | M | M | M | M | M | M |

## Analytical Instrumentation for Foods

**Semester II** **Hrs of Instruction /Week: 4**
**23MFNC10** **No. of Credits: 4**

**Course Objectives:**

1. Learn advanced instrumentation required in food and biochemical analysis
2. Outline principles of instruments
3. Describe applications of instrumental technique in analysis

**Unit 1: Spectrometric Techniques** **10**

Need for analysis and instrumentation, Selecting an appropriate instrumental technique, criteria for selecting a technique, Limit of Detection (LOD) and Limit Of Quantification( LOQ), *Colorimetry (SS),* Spectrophotometry-definition and derivation of Lambert-Beer's Law, UV-VIS Spectrophotometer, Atomic-Absorption Spectroscopy (AAS),Inductively Coupled Plasma – Optical Emission Spectrophotometry (ICP- OES/MS)

**Unit 2: Chromatographic Techniques** **12**

Basics and Classification of Chromatography- Adsorption, partition, size exclusion, ion-exchange, affinity Gas Chromatography, Liquid Chromatography - Instrumentation, Sampling Techniques and Applications, *Applications of HPLC, Comparison of HPLC and GC (SS)* Thin Layer Chromatography, High Performance Thin Layer Chromatography (HPTLC), Hyphenated Techniques - Gas Chromatography-Mass Spectrometry (GC-MS), Liquid Chromatography-Mass Spectrometry (LC-MS)

**Unit 3: Fluorimetry and Flame Photometry and Electrophoresis** **10**

Theory of fluorescence and instrumentation, Instrumentation in Flame Photometry-oxidant, fuel, filter, detector, amplifier, applications, Principles and procedure of electrophoresis – Paper and Agar Electrophoresis, Moving boundary electrophoresis, PAGE, *Applications in food systems (SS)*

**Unit 4: Radioactivity Measurement and Advanced Microscopic Techniques** **10**

*Radioactive isotopes (SS)* Methods and Types, Radioactive Counters- gas and liquid Scintillation- uses, applications and safety, Food Morphology - Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM)

**Unit:5 Techniques for Analysis of Physical Properties of Foods** **12**

Rheology and Viscosity of foods – Rheometer, Viscometer, Barbender Farinograph, Texture Analyser, Hunter Calorimeter, Refractometer, *practical interpretation of texture profile analysis in food systems (SS),* Nuclear Magnetic Resonance Spectroscopy (NMR), Fourier Transform Infrared Spectroscopy (FTIR), Thermo gravimetric analysis (TGA) and differential scanning calorimetry (DSC) - Principle, Instrumentation and Applications

**Related Experience**

1. Visit to laboratories **6**
2. Demonstration of one chromatographic technique or one electrophoretic technique

**Total Hours** **60**

**Text Books:**

1. Kaur.N(2006.) Instrumental Methods of Chemical Analysis. PragatiPrakashan Educational Publishing. 3rd Edition,
2. Alan H.Gowenlock, Jannet R Mc Murray and Donald M. McLauchlex (2006) Varley's Practical Clinical Biochemistry, sixth edition. CBS Publishers and distributors, New Delhi.

**Reference Books:**

1. Egon Stahl, (2005) Thin Layer Chromotography, A Laboratory Handbook, 2nd edition, Springer International Edition, Heidelberg.
2. Rodney Boyer, (2006) Biochemistry Laboratory- Modern Theory and Techniques; Pearson Education Inc. Publications, USA.
3. Official Methods of Analysis, Association of Official Analytical Chemists (2011) - Officially recognized methods of analysis for many food components. 18th edition .
4. Y. Pomeranz and C.E. Meloan (2002). Food Analysis: Theory and Practice. Springer International Edition, Heidelberg.

**Course Outcomes:**

1. Understand the need for analysis and instrumentation
2. Identify an appropriate technique for analysing specific substances
3. Learn the principles of different instruments used for analysis
4. Have an insight into the advanced techniques in food and nutrient analysis
5. Update knowledge on analytical instruments by visiting laboratories

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | H | M | H | L | L | M | L | L | L | L | M | M | M | L |
| CO 2 | M | H | L | M | M | M | L | L | L | M | H | L | M | H |
| CO 3 | M | H | L | M | L | M | M | M | M | L | H | M | L | H |
| CO 4 | H | M | L | M | L | L | M | L | M | M | H | H | M | L |
| CO 5 | H | M | H | L | M | M | L | M | M | H | H | H | M | L |

## Techniques for Clinical Nutrition (Practical)

**Semester II** **Hrs of Instruction /Week: 6**
**23MFNC11** **No. of Credits: 4**

**Course Objectives:**

1. To learn the normal level of biochemical parameters in blood and urine
2. To know analytical techniques in biochemical assessment in blood and urine
3. To analyze the biochemical parameters with the diagnostic level of nutritional status
4. To understand the clinical significance of biochemical chemical parameters in human health
5. Acquires the skills on exploiting kit methods in the analysis of biochemical parameters.

| | Topic | Hrs |
|---|---|---|
| Determination of Blood for | | |
| **a)** | Glucose | **3** |
| **b)** | Haemoglobin - Cyanmethaemoglobin method | **6** |
| **c)** | Iron and haemoglobin - Wong's method | |
| **d)** | Total Cholesterol | **3** |
| **e)** | Triglycerides | **3** |
| **f)** | High Density Lipoproteins(HDL) | **3** |
| **g)** | Serum Calcium | **6** |
| h) | Serum Total Protein and A/G ratio | **6** |
| **i)** | Serum Phospholipid | **6** |
| **j)** | Serum Creatinine | **3** |
| **k)** | Serum Alkaline Phosphatase | **3** |
| **l)** | Serum Glutamic Oxalate Transaminase | **6** |
| **m)** | Serum Glutamic Pyruvate Transminase | **6** |
| **n)** | Serum Bilirubin | **6** |
| Analysis of Urine for | | |
| **a)** | Creatinine | **3** |
| **b)** | Urea | **6** |
| **c)** | Total nitrogen | **9** |
| **d)** | Calcium | **3** |
| **e)** | Phosphorus | **3** |
| **f)** | Iodine | **3** |
| Estimation of Serum Glycosylated Haemoglobin - Demonstration *Invitro absorption studies for macronutrients and micronutrients (SS)* | | **3** |
| | **Total Hours** | **90** |

**References:**


1. Raghuramulu N. Madhavan Nair K. Kalyana Sundram S (2007) A Manual of Laboratory Techniques Silver Printers, NIN.
2. Charles George Lewis Wolf, (2007) A Laboratory Hand-book of Urine Analysis and Physiological Chemistry, W. B. Saunders & Co., Harvard University,
3. Nancy A. Brunzel (2004) Fundamentals of Urine and Body Fluid Analysis, Saunders; 2nd Edition
4. Varley, H., Gowenlak, A. H and Hell, M. Practical Clinical Biochemistry, William Itinmaon Medical Books, London, 2000.

**Course Outcomes:**

1. Acquire the knowledge on diagnostic levels of biochemical parameters in blood and urine
2. Understand the clinical significance of levels of biochemical parameters in association with nutritional status
3. Learn the analytical techniques in the assessment of biochemical parameters.
4. Acquire the analytical skills for the estimation of biochemical parameters in blood and urine.
5. Acquire the skills on employing the appropriate kit methods for the analysis.

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | H | L | | L | M | M | | | M | M | L | H | | M |
| CO 2 | H | L | | L | H | M | | | M | M | L | H | | M |
| CO 3 | H | M | | L | H | M | | | M | M | L | M | | H |
| CO 4 | M | M | | L | M | M | | | M | M | L | M | | H |
| CO 5 | M | M | | L | M | M | | | M | M | L | M | | M |

## Therapeutic Nutrition

**Semester III** **Hrs of Instruction /Week: 6 (4+2)**
**23MFNC13** **No. of Credits: 4**

**Course Objectives:**

1. Understand the role of nutrition for health and diseases.
2. Obtain knowledge of different therapeutic diet and their preparation
3. Develop capacity and attitude for taking up the profession as a dietician.

**Unit 1: Introduction and concept of therapeutic nutrition** **12**

Growth and scope of dietetics, purpose and principles of therapeutic diets, modification of normal diet, classification of therapeutic diet. Concept of tube feeding (intravenous feeding & total parenteral nutrition)

Pre and post-operative nutrition, enteral and parenteral nutrition- *Enteral formula composition, advantages and disadvantages. Pharmacological use of nutrients, Characteristics and role of dietitians and IDA Nutrition and diet counselling. Allergy- definition, classification, manifestation, common food allergies, tests for allergy and diet modification (SS).*

**Unit 2: Endocrine and genetic disorders** **12**

Diabetes mellitus: etiology, types, clinical and biochemical changes, Clinical signs andsymptoms, complications, diagnosis, mode of treatments.

*Disorders of thyroid and para thyroid glands, tetany, gout and arthritis (SS).*

Obesity- etiology, theories on Obesity, types, nutritional/dietary management, complications.

Under weight- etiology, nutritional/dietary management; Genetic disorders: phenyl ketonuria, galactosemia, fructosuria,Maple syrup urine disease

**Unit 3: Diseases of the gastrointestinal tract and liver** **12**

Diseases of gastrointestinal tract- etiology, type, clinical, signs and symptoms, diagnosis, nutritional/dietary management-peptic ulcer, diarrhoea, dysentery, constipation and *other GIT problems like gastritis, tropical sprue dumping syndrome, lactose intolerance, irritable bowel syndrome, diverticulosis celiac disease (SS).*

Diseases of liver: functions of liver, etiology, physiological and metabolic consequences, clinical signs and symptoms, mode of treatment and nutritional/dietary management of jaundice, hepatitis, Cirrhosis, hepatic coma, hepatic encephalopathy

Diseases of Gall Bladder and pancreas: *cholecystitis, cholelithiasis and pancreatitis.(SS)*

**Unit 4: Diseases of cardiovascular system and renal disease** **12**

*Concepts and terms related to cardiovascular disease (SS).* Risk factors for cardiovascular diseases, dietary management. *Role of fat in the development and prevention of cardiovascular diseases, Functional foods for CVD(SS).* Hypertension, atherosclerosis, Hypercholesterolemia, Hyperlipoprotenemia, causes, consequences, prevention and dietary management. Diseases of renal system: function of kidney, etiology, physiological and metabolic consequences, clinical signs and symptoms and nutritional management for nephritis, nephrosis, nephrosclerosis, renal failure-acute and chronic; *Dialysis: principles and types (SS).Kidney stones and urolithiasis- etiology, types, nutritional/dietary management(SS)*

**Unit:5 Diets in other disease conditions , Fever and Infections** 12

Classification, risk factors, symptoms, general systemic reactions, nutritional problems of cancer therapy, nutritional requirement and dietary management; Functional foods for CVD; Pulmonary diseases- bronco pulmonary disease, asthma, respiratory failure; HIV and AIDS- etiology, signs and symptoms, stages, diagnosis and nutritional/dietary management. *Fevers- causes, types, metabolic changes, fevers of short duration and chronic fever and infections, Typhoid, Tuberculosis, malarial infections Dengue, Swine flu and viral fever (COVID19)(SS)*

**Total Hours** **60**

**Practicals/related experience**

| | |
|---|---|
| Visits to dietary department of hospitals<br>Preparation of Hospital diets using functional foods and presentation of case studies | 6 |
| Preparation of diet for diabetes mellitus | 3 |
| Diet in obesity and under weight | 3 |
| Diet for peptic ulcer, Diarrhoea, constipation | 3 |
| Diet for liver disease- jaundice, cirrhosis | 3 |
| Diet for Cardiovascular disease, atherosclerosis and hypertension | 3 |
| Diet for nephritis, renal failure, acute and chronic | 3 |
| Diet for cancer and HIV patient | 3 |
| Diet for febrile condition- TB, Typhoid, Fever Diet | 3 |
| **Total Hours** | **30** |
| **Total Hours** | **90** |

**References:**


1. Robinson C.H. (2015) Normal and Therapeutic nutrition, 12th edition, Macmillan Publishing Co. Inc, Newyork.
2. Krause M.V and Mahan L.K (2016) Food, Nutrition and Diet therapy, 14th edition, W.B. Saunders Co, Philadelphia
3. Srilakshmi. B (2016), Dietetics, New Age International Pvt Ltd, New Delhi.
4. Dietary Guidelines of Indians- A Manual, National Institute of Nutrition, Hyderabad, 2015.


**Journals:**

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

**Course Outcomes:**

1. Understand the concept of therapeutic diets and diet counselling.
2. Learn the formulation of different modified diets and feeding techniques
3. Categorize the diseases and disorders for planning suitable diets
4. Prepare diets and calculate nutrient composition for dietary intervention

| CO/ PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | M | L | M | H | M | H | H | L | M | M | H | - | H |
| CO2 | M | M | M | M | H | L | M | H | L | M | M | M | M | H |
| CO3 | L | L | M | M | M | M | M | M | M | H | M | M | M | H |
| CO4 | M | M | M | H | H | - | M | H | L | L | H | H | M | H |
| CO5 | | | | | | | | | | | | | | |

## Advances in Nutrition- I

**Semester III** **Hrs of Instruction /Week: 4**

**23MFNC14** **No. of Credits: 5**

**Course Objectives:**

1. Provide an insight into the concepts of Nutrition
2. Explore the metabolism and utilisation of macronutrients
3. Associate bioavailability and nutritional significance of macronutrients
4. Learn the techniques and methods of assessing nutrients
5. Understand the role of body fluids and body composition in nutrition and health

**Unit 1: Energy** **10**

Definition of Energy, Components of energy requirements: BMR, RMR, thermic effect of food, physical activity. Energy Content of Foods, Total Energy Expenditure, Energy balance, Factors affecting energy requirements, methods of measuring energy expenditure, Energy utilization in cells, Energy metabolism during Physical Activity, CED and Obesity *Energy requirements and Recommended Dietary Allowances- ICMR, FAO and WHO (SS)*

**Unit 2: Carbohydrates** **12**

Nutritional Importance of Carbohydrates. Review of Classification, Digestion, Absorption, Utilization and Metabolism of Carbohydrates, Glycemic Index and Glycemic Load

Dietary Fibre – Classification, Sources and its role in Human Nutrition, Interrelationship with proteins and fats.

*Disorders related to carbohydrate metabolism(SS)*

**Unit 3: Proteins** **12**

Historical Review, Functions and Classification, Sources,Digestion, Absorption,Utilization and storage of proteins, Protein Turnover, Amino acids and Peptide transporters. Evaluation of Protein Quality- BV, DC, PER, NPR, NPU, PDCAAS, Supplementary value of proteins related to PEM.Computation of Protein Requirements. *Recommended intakes- ICMR, FAO and WHO. Novel proteins (SS)*

Animal model study on estimation of PER and Nitrogen balance- Practical

**Unit 4: Lipids** **11**

Digestion and absorption of lipids, metabolism and transport of lipids in blood. Lipid transformation in the liver, Lipotropic factors, role of essential fatty acids, deposition of fat in the body, Free radical formation and role of antioxidant enzymes in mammalian cells, Consequences of high and low fat intakes

*Review of Lipid Nutrition - saturated, poly unsaturated, mono unsaturated and transfat, Fat Burners and Replacers(SS)*

**Unit:5 Body fluids and body composition** **10**

Body fluid compartments, Water -*Sources, Distribution, Functions and Requirements(SS)* Regulation and disorders of Water Balance, Importance of Euhydration; Assessment of Hydration Status- Common indices

Body composition- Methods of assessment, relation of body composition to nutritional status

Related Experience **5**

Animal model study on estimation of PER and Nitrogen balance

**Total Hours** **60**

**Text Books :**

1. Recommended dietary allowances, ICMR, National Institute of Nutrition, Hyderabad, 2020.
2. Mahtab S. Bamji, Prahlad Rao.N and Vinodhini Reddy, Textbook of Human Nutrition, Oxford IBH Publishing Co Pvt Ltd, 2004

**Reference Books:**

1. Krause,M.V and Hunsher,M.A, Food, Nutrition and Diet Therapy, 14th edition, W.B.Saunders Company, Philadelphia, 2016.
2. Carolyn D. Berdanier, Lynette A. Berdanier and Janos Zempleni, Advanced Nutrition: Macronutrients, Micronutrients, and Metabolism 1st Edition, 2008, Elsevier Inc, USA, 2008
3. Progress in Molecular Biology and Translational Science, Recent Advances in Nutrigenetics and Nutrigenomics Edited by Claude Bouchard and Joseph. M. Ordovas Academic Press, USA, 2012
4. Sareen, S, James, J , Advanced Nutrition in Human Metabolism, 4th Edition, Thomson Wordsworth Publication, USA, 2005.
5. Michael J. Gibney, Hester V Vorster and Frans J Kok Introduction to Human Nutrition. Blackwell Publishing Oxford, U.K, 2003.

**Course Outcomes:**

1. Comprehend the concepts of Nutrition.
2. Apply the knowledge in professional research on macronutrients
3. Acquire skills to evaluate protein quality
4. Create strategies to improve nutritional significance of macronutrients
5. Develop analytical designs in advanced nutrition research.

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | H | M | H | L | L | H | L | M | L | L | M | M | M | L |
| CO 2 | H | M | L | M | M | M | L | L | L | M | H | H | M | H |
| CO 3 | M | H | L | M | L | M | M | M | M | L | H | M | L | H |
| CO 4 | H | M | M | M | M | L | M | L | M | M | H | M | M | L |
| CO 5 | H | H | L | L | M | M | L | M | M | M | L | H | M | L |

## Biomolecules and Intermediary Metabolism

**Semester III** **Hrs of Instruction /Week: 4**

**23MFNC15** **No. of Credits: 4**

**Course Objectives:**

1. To enable the students to obtain depth in the study of biochemistry of major nutrients
2. To help the students to understand the basic metabolic pathways
3. To gain knowledge about the defects in various metabolic pathway

**Unit 1: Carbohydrates** **12**

Introduction, Classification. Structure and Properties of monosaccharides (hexoses and pentoses). Reactions of monosaccharides – oxidation, reduction and reaction with hydrogen cyanide, hydroxyl amine and phenyl hydrazine.

Oligosaccharides – Sucrose, maltose, lactose, isomaltose, cellobiose.

Homopolysaccharides - Structures of storage polysaccharides (Starch and glycogen)

Heteropolysaccharides – Structures of Hyaluronic acid, Heparin and Chondroitin sulphate.

Metabolism – Glycolysis, TCA cycle, HMP Shunt and energy production in the above pathways.

Oxidative phosporylation and Electron Transport Chain, Uronic acid pathway.

*Glycogenesis and Glycogenolysis. (SS)*

**Unit 2: Lipids** **12**

Classification – Triglycerides (Fats), Phospholipids and other non-phosphorylated lipids – cerebrosides, gangleosides, sulfolipids.

Characterisation of fats. Rancidity of fats. Chemistry of Essential fatty acids. Metabolism – Oxidation of fatty acids, biosynthesis of fatty acids (palmitic acid)

*Biosynthesis of triacyl glycerol, phospholipids. (SS)*

**Unit 3: Aminoacids and Proteins** **12**

Structure and classification of aminoacids. Classification of proteins – denaturation, Metabolism – General breakdown of aminoacids, deamination, transamination, decarboxylation and urea formation.

*Structure of proteins with special reference to insulin, myoglobin andhaemoglobin. (SS)*

**Unit 4: Nucleic acids** **12**

Composition and function.

Structure and properties of DNA and RNA (t-RNA, m-RNA and r-RNA), minor RNA types.

Metabolism – Biosynthesis and breakdown of purine nucleotides. Biosynthesis and breakdown of pyrimidine nucleotides.

*Defects in nucleic acid metabolism(SS)*

**Unit:5 Enzymes** **12**

Classification of enzymes. IUB classification Enzyme kinetics – Michaelis Menten equation.

Factors affecting enzyme activity (pH, temperature, substrate concentration and enzyme concentration).

Enzyme inhibition – Competitive, Non- competitive and Uncompetetive (Kinetics not necessary).

*Clinical significance of enzymes in myocardial infarction and liver disorders(SS)*

**Total Hours** **60**

**References**


1. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2021), Harper's Illustrated Biochemistry, 31st edition, International Edition.
2. Deb, A.C. (2002), Fundamentals of Biochemistry, New Central Book Agency (P) Ltd.
3. Nelson, L. and Michael.M.Cox. (2021), Lehninger Principles of Biochemistry, 8thEdition, W.H. Freeman and Company, NewYork.
4. Palmer, T. (1995), Understanding enzymes, 4th Edition, Prentice Halls, Ellis Horwood, London.
5. Voet, D., Voet, G.J. and Pralt, W.C. (2018), Fundamentals of Biochemistry, fifth edition, John Wiley and Sons, Inc.
6. West, E.S., Todd, W.R., Mason, H.Sand and Van Brugge, T.J. (1966), Biochemistry, 4thedition, The Macmillan Company, London.


**Course Outcomes:**

1. Gain basic knowledge about the classification and various aspects of carbohydrate metabolism
2. Describe the classification and oxidative process of lipid metabolism
3. Recognize the structure and metabolism of proteins and specialized structure of proteins
4. Integrate the biosynthesis and degradative pathways of nucleic acids and their disorders
5. Correlate the classification of enzymes and enzyme kinetics and isoenzymes of clinical importance

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | | | M | | | M | | H | H | H | H | | L | M |
| CO 2 | | | M | | | M | | H | H | H | H | | M | M |
| CO 3 | | | M | | | M | | H | H | H | H | | L | M |
| CO 4 | | | M | | | M | | H | H | H | H | | L | M |
| CO 5 | | | M | | | M | | H | H | H | H | | H | M |

## Food Product Development and Packaging (Open book exam)

**Semester III** **Hrs of Instruction /Week: 3**

**23MFNC16** **No. of Credits: 3**

**Course Objectives:**

1. Gain insight into production and processing of foods
2. Learn about quality management considerations
3. Develop new marketable, nutritionally and economically viable food products
4. Gain knowledge about packaging of foods, packaging materials and systems of labeling, testing and evaluation of packaged foods.
5. Develop entrepreneurship skills for setting up small scale food industries

**Unit 1:** **Production and processing of food** **10**

Criteria for selection of raw materials for food processing. Quality standards for various food groups – cereals and pulses, milk and its products, egg, meat, fish and poultry, fruits and vegetables, fats and oils, sugars and its products, spices and condiments, miscellaneous foods. Production systems used in the manufacture of food - small scale, large scale, manual, automated, computerized

*Quality management considerations to achieve safe foods for public consumption (SS)* - Hazard Analysis and Critical Control Point (HACCP), Food Safety and Standards Authority of India (FSSAI)

**Unit 2:** **Product Development** **10**

Principles and stages involved in product development, Sensory, chemical and microbiological evaluation of processed foods. Convenience Foods, Extruded foods, Health foods Nutritional supplements *RTS, RTE foods (SS)*

*Definition, classification, characterization, factors influencing product development - social and health concerns, generation and screening of ideas for new product development, impact of technology and marketing. (SS)*

**Unit 3:** **Packaging Materials** **10**

*An introduction to packaging materials, Basic Packaging Materials – Paper, Wood, Plastics, Glass, Metal Containers (SS)* Packaging Films – Polyethylene, Cellophane, Aluminium foil, Laminates, New Polymeric Packaging Films, Shrink Film, Cling and Wrap Film, Edible Film. Packaging Methods and Systems-Traditional Food Packaging, Retortable, Lined Cartons, Bag in Box, Aseptic, Modified Atmosphere Packaging, Vacuum, Gas Packaging, Bio Based Packaging, Eco-friendly and Safe Packaging for Exports Ovenable Packages, Transport Packages, Packaging Equipments

**Unit 4:** **Storage, Handling and Distribution of Packages** **8**

Shelf Life Testing of Packaged Foods, Evaluation of Packaged Foods

*Labeling – Definition, Purpose, Types, Materials, Adhesives (SS)*

Food and Nutritional Labeling as per FSSAI specifications

Packaging Laws and Regulations – National and International Specifications

**Unit:5** **Marketing of Food Products** **7**

Product Cost Calculation, Product Specifications, Marketing Strategies, Advertising Methods, *Consumer Behaviour and Food Acceptance (SS)*

**Total hours** **45**

**References:**


1. Food Packaging Technology Handbook, 2019, NIIR Board of Consultants and Engineers, National Institute of Research, New Delhi.
2. Potter, N.M., Food Science, The AVI Publishing Company Inc., West Post, Connecticut, USA
3. Modern Packaging Industries, 2014, NIIR Board of Consultants and Engineers, National Institute of Industrial Research, New Delhi.
4. Fuller, Gordon, W., New Food Product Development, 2nd Edition, CRC Press, Boca Raton, Florida, 2015.
5. Paul Baines, BalChansarkar, Introducing Marketing Research, John Wiley & Sons Ltd., 2012.
6. Sudhir Gupta, Handbook of Packaging Technology, Engineers India Research Institute, New Delhi, 2017.


**Course Outcomes**

1. Know about the production and processing of food.
2. Understand and acquire knowledge on product development.
3. Learn the different types of packaging material.
4. Gain awareness of storage, handling and distribution of packages.
5. Enumerate the marketing of the product.

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | M | | H | | | | M | H | | | | | H | |
| CO 2 | M | | H | | | | M | H | | | | | H | |
| CO 3 | M | | H | | | | M | H | | | | | H | |
| CO 4 | M | | H | | | | M | H | | | | | H | |
| CO 5 | M | | H | | | | M | H | | | | | H | |

## Techniques for Experimental Nutrition (Practical)

**Semester III** **Hrs of Instruction /Week: 6**

**23MFNC17** **No. of Credits: 4**

**Course Objectives:**

1. Know the analytical procedures in estimation of nutrients of foods.
2. Acquire skills in the analysis of macro and micronutrient contents of foods.
3. Demonstrate the analysis of nutritional quality of foods.
4. Get equipped in the use of high end equipments
5. Understand the principles of reaction in the identification of nutritional constituents.

| | Topic | Hrs |
|---|---|---|
| Analysis of Food for | | |
| **a)** | Calories and Carbohydrate- Anthrone method | **6** |
| **b)** | Fibre – Crude and Dietary | **9** |
| **c)** | Moisture | **6** |
| **d)** | Nitrogen by Kjeldahl Method | **6** |
| **e)** | Ash | **3** |
| **f)** | Calcium | **3** |
| **g)** | Phosphorus | **3** |
| h) | Iron | **6** |
| **i)** | Total and β Carotene | **6** |
| **j)** | Vitamin A | **3** |
| **k)** | Thiamine | **3** |
| **l)** | Riboflavin | **3** |
| **m)** | Vitamin C | **3** |
| **n)** | Fat | **6** |
| **o)** | Starch | **3** |
| **p)** | Fats – Saponification Value | **3** |
| **q)** | Iodine Number | **3** |
| **r)** | Acid Number | **3** |
| **s)** | RM Value | **3** |
| **t)** | Sorenson's Formal Titration Method | **3** |
| **u)** | Estimation of Total Antioxidant Activity | **6** |
| | **Total Hours** | **90** |

**Reference Books:**


1. Raghuramulu, N., Madhavan Nair, K., Kalyanasundaram, S. A Manual of Laboratory Techniques. Silver Printers, NIN, 2019.
2. Sadasivam, S and Manickam, A., Biochemical Methods, New Age International Pvt. Ltd., Publishers, New Delhi, Second Edition, 2018.
3. Oser, B. L. Hawk's Physiological Chemistry, XIV Edition, Tata McGraw Hill Publishing Company Ltd, Mumbai, 2001.
4. Varley, H., Gowenlak, A. H and Hell, M. Practical Clinical Biochemistry, William Itinmaon Medical Books, London, 2000.

**Course Outcomes:**

1. Gain knowledge on the analytical techniques in the nutritional estimation of foods.
2. Understanding of the principles in the estimation of nutritional composition of foods.
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.
5. Able to identify and analyse the constituents in foods in a logical sequence of steps analysis.

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | H | | | | | M | | H | M | M | M | H | M | L |
| CO 2 | M | | | | | M | | H | M | M | M | L | M | H |
| CO 3 | M | M | | | H | H | | H | | M | H | M | L | H |
| CO 4 | M | | | | H | H | | H | | L | H | H | M | L |
| CO 5 | L | M | | | | L | | H | L | L | H | H | M | L |

## Functional Foods and Nutraceuticals

**Semester III** **Hrs of Instruction /Week: 4**
**23MFNC18** **No. of Credits: 4**

**Course Objectives:**

1. Learn the development of functional foods along with the types of functional foods
2. Understand the category of nutraceuticals based on sources, mechanism of action and chemical nature
3. Analyse the health benefits of foods of different biotics origin
4. Acquire the skills on identification of foods of bioactive compounds with functional efficiency
5. Aware of the National and International regulatory aspects of Functional foods.

| | | |
|---|---|---|
| **Unit 1:** | **Introduction to Functional Foods and Nutraceuticals**<br>Definition, History, Classification - designer foods and pharma foods, Health effects of functional foods, Stages involved in development of functional foods. | **12** |
| **Unit 2:** | **Categorization of Nutraceuticals**<br>Classification - Based 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. | **12** |
| **Unit 3:** | **Probiotics, Prebiotics and Synbiotics**<br>Probiotics: Concept, Human gastrointestinal tract and its microbiota, Classification of probiotics, role of probiotics in health and diseases<br>Prebiotics: Oligosaccharides, Dietary fiber, Resistant Starch, Gums, Spirulina as bioactive component.<br>Synbiotics: Concept and Synbiotic foods with examples | **12** |
| **Unit 4:** | **Functional nature of Nutraceuticals**<br>Polyphenols : Flavonoids, Catechins, Isoflavones, Tannins: Phytoestrogens, Phytosterols, Glucosinolates, Pigments, Organosulphur compounds, proteins and peptides, Conjugated linoleic acid, Omega 3 Fatty acids, Vitamins and Minerals<br>Bioactive compounds: Saponins, Heamagglutinins, Reservatrol, Kaempferol, Quercetin, Cinnamaldehyde, Lutoline, Capsaicin, Piperine, Gingerol, Eugenol, Rosemarinic acid, Apigenine, Thymoquinone | **12** |
| **Unit:5** | **Regulatory Aspects of Functional Foods and Nutraceutical**<br>Regulatory aspects- International and national regulatory aspects of functional foods in India, ICMR guidelines for Probiotics, Research frontiers in functional foods. Regulatory perspective of FOSHU Foods | **12** |
| | **Total Hours** | **60** |

**Text Books**


1. Gibson, G.R. and Williams, M.C. (2001). Functional Foods Concept to Product, CRC Press.
2. Wildma, R.E. (2016). Handbook of Nutraceuticals and Functional Foods. CRC Press.
3. Yashwant Patak (2010). Handbook of Nutraceuticals Volume I Ingredients, Formulations and Applications, CRC Press.

**Journals**

1. Journal of functional foods
2. Journal of Nutraceuticals

**References**


1. Webb G.P (2016), Dietary Supplements and Functional Foods, Blackwell Publishing Ltd, New York.
2. Tamine. A (2015), Probiotic Dairy Products, Blackwell Publishing Ltd, United Kingdom.
3. USFDA regulations on functional foods
4. FSSAI regulation of India


**Course Outcomes:**

1. Gain knowledge on the development of functional foods with the conceptual difference between functional foods and nutraceuticals.
2. Acquire skills to categorize nutraceuticals.
3. Gain awareness on the functional foods and nutraceuticals of biotics origin.
4. Apply the knowledge of functional nature of nutraceuticals
5. Understand the regulatory aspects of functional foods and nutraceuticals.

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PS O 2 | PS O 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | H | H | H | L | M | | | | M | H | H | | M | M |
| CO 2 | H | M | | | L | M | | | M | M | M | | M | M |
| CO 3 | M | M | L | L | M | L | | | M | M | M | | M | H |
| CO 4 | M | M | L | | L | | | | L | M | M | | M | M |
| CO 5 | M | M | M | | L | | | | | L | M | | M | |

## Food Safety and Security (Self study)

**Semester III** **Hrs of Instruction /Week: 1**
**23MFNC19** **No. of Credits: 4**

**Course Objectives:**

1. Get insight on food safety issues in India
2. Know the National and International Food Safety Laws
3. Understand the Safety Management of future foods, Foods in Household and Food Industries
4. Learn about the Food Security Management Concepts and Practices
5. Study about safety policies on future foods and recent packaging technologies

| | | |
|---|---|---|
| **Unit 1:** | Introduction to food safety and issues in India, food adulteration, food hazards (physical, chemical and biological) natural toxins, Need and importance of food safety in household and food industries; Factors affecting food safety in household and food industries; Regulatory authorities at local, district and national levels ensuring food safety in food industries | **3** |
| **Unit 2:** | National Food legislation - FSSAI, Essential Commodities Act, ISI / BIS, AGMARK, International Organization for food safety - FAO, WHO, Codex Alimentarius, APEDA and WTO | **3** |
| **Unit 3:** | Safety assessment of food additives, adulterants, pesticide residues, safety aspects of water, beverages such as soft drinks, tea, coffee, cocoa and safety evaluation of heat treatments and related processing techniques. Artificial Intelligence and Robotics in food safety<br>Good Manufacturing Practices (GMP), Good Agricultural Practices (GAP) and Good Hygienic Practices, Management of disposal of food wastes. | **3** |
| **Unit 4:** | Food and Nutrition Security: Hunger and malnutrition, Definition and measurement. Factors contributing to food insecurity, Food security model, Food availability. Foreign aid, food aid and development. Global sustainability, environmental impacts of the world food system. National and international intervention. Globalization of the food system | **3** |
| **Unit:5** | Food and agricultural policies including Supply side policies, Infrastructure and production policies, Demand side policies, income support and redistribution, Food assistance programs<br>Policies on future foods and packaging:-Super and Organic foods, In vitro meat, Plant based meat Analogue, Insect based foods; Intelligent or smart packaging, Green packaging, Edible Packaging | **3** |
| | **Total hours** | **15** |

**References**


1. Early, R. (1995). Guide to Quality Management Systems for the Food Industry, Blackie, Academic and Professional, London
2. Gould, W.A. and Gould, R.W. 1988. Total Quality Assurance for the Food Industries, CTI Publications Inc, Baltimore
3. Pomeranz, Y. and Meloan, C.E. 1996. Food Analysis : Theory and Practice, CBS Publishers and Distributor, New Delhi

4. Askar, A. and Treptow, H. 1993. Quality Assurance in Tropical Fruit Processing, Springer – Verlag, Berlin
5. Leathers, H.D. and Fosters, P., The World Food Problem: Tackling the Causes of Under nutrition in the Third World, 3rd Edition. Lynne Rienner Publishers, 2004.
6. Southgate, D., Graha, D.H. and Tweeten, L., The World Food Economy, Blackwell Publishing, 2007.
7. Fogel, R. W. 2004. Health, nutrition, and economic growth. Economic Development & Cultural Change 52(3): 643-658.

**Course Outcomes**

1. Understand the introduction to food safety and issues in India
2. Enumerate on the functions of national and international organizations for food safety
3. Gain knowledge on safety assessment of food additives and supporting laws
4. Acquire insight on food and nutrition security and globalisation of food system
5. Learn about the food and agricultural policies and safety policies on future foods and recent packaging technologies

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | H | M | L | H | | L | M | H | M | H | M | H | M | L |
| CO 2 | M | L | | H | | L | | | | M | L | M | | |
| CO 3 | H | | H | H | | L | L | H | | M | | | M | L |
| CO 4 | H | M | M | H | | | M | M | H | H | M | H | | M |
| CO 5 | M | M | H | H | | L | L | M | H | H | H | L | L | |

## Internship

**Semester III**
**23MFNC20** **No. of Credits: 2**

**Course Objectives:**

1. Provide experiential learning opportunities for developing work ethics and Professional demeanor.
2. Develop learning experience for integrating knowledge, skill and work.
3. Acquire professional identity and competence.

**Course Outcomes**

**CO1:** Gain work experience and skills in food industries and hospitals

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | H | H | H | L | H | M | M | M | H | H | H | L | H | H |

## Advances in Nutrition - II

**Semester IV** **Hrs of Instruction /Week: 5**
**23MFNC21** **No. of Credits: 5**

**Course Objectives:**

1. Gain insight into the physiological and biochemical role of Vitamins, Minerals.
2. Outline the role of ultra trace minerals in nutrition.
3. Understand the interrelationship of micronutrients.
4. Explore the bioavailability and deficiencies of micronutrients
5. Enlighten on the significance of gut microbiome in nutrition and health.

| | | |
|---|---|---|
| **Unit 1:** | **Fat soluble vitamins**<br>Vitamins A,D,E and K- History, structure, nomenclature, chemistry, functions, metabolism, transport, storage, excretion and methods of assay, Bioavailability and factors affecting bioavailability, Interaction with other nutrients. *Human deficiency, Dietary sources, recommended intakes (SS)* Pseudovitamins | **15** |
| **Unit 2:** | **Water soluble vitamins**<br>Thiamine, riboflavin, niacin, vitamin B12, folic acid, pyridoxine, panthothenic acid, biotin, ascorbic acid - History, structure, chemistry, functions, metabolism, , transport, storage, excretion, Bioavailability and factors affecting bioavailability, methods of assay, *dietary sources, recommended intakes, human deficiency, hypervitaminosis, antivitamins (SS)* | **15** |
| **Unit 3:** | **Macro Minerals**<br>Calcium, Phosphorus, Magnesium, Sulphur, Choride, Sodium and Potassium Distribution, functions, absorption and utilization, , deficiency and toxicity, calcium - phosphorus ratio, absorption and utilization, Phosphates in blood, Inter relationship of Ca, P ,Vitamin D and parathyroid hormone, calcium balance, Sodium and potassium balance *Hypocalcaemia and hypercalcaemia, sources, requirement (SS)* | **15** |
| **Unit 4:** | **Micro Minerals**<br>Iron, Zinc, Flouride and Copper - Distribution, functions, absorption, metabolism, transport and utilization, deficiency, assessment of iron status, *sources, requirement, effect of excess iron retention and deficiency (SS)*<br>Interaction with other nutrients<br>Ultratrace Minerals- Iodine, cobalt, copper, molybdenum, manganese, selenium, nickel, chromium, boron, cadmium- Functions, sources and requirements, Pharmacological and therapeutic effects. | **15** |
| **Unit:5** | **Gut microbiome in Nutrition**<br>Gut microbiome- An Introduction, Human microbiota , distribution, composition and functions of the gut microbiota, role of gut microbiota in nutrition, *The Human Microbiome project- implications for human health (SS)*, models to study gut microbiota, future perspectives for gut microbiome research in nutrition. | **15** |
| | **Total Hours** | **75** |

**Text Books :**

1. Recommended dietary allowances, ICMR, National Institute of Nutrition, Hyderabad, 2020
2. Mahtab S. Bamji, Prahlad Rao.N and Vinodhini Reddy, Textbook of Human Nutrition, Oxford IBH Publishing Co Pvt Ltd, 2004

**Reference Books:**

1. Krause,M.V and Hunsher,M.A, Food, Nutrition and Diet Therapy, 14th edition, W.B.Saunders company, Philadelphia, London, 2016.
2. Sareen, S, James, J, Advanced Nutrition in Human Metabolism, 4th Edition, Thomson Wordsworth Publication, USA, 2005.
3. Michael J. Gibney, Hester V Vorster and Frans J Kok, Introduction to Human Nutrition , Blackwell publishing Oxford, U.K. ,2003
4. Edward Ishiguro Natasha Haskey Kristina Campbell , Gut microbiota: Interactive effects on Nutrition and Health, 1st Edition, Academic Press, 2018
5. Dirk Haller , The Gut microbiome in health and disease , 1st Edition, Springer, 2018
6. Ana Maria R. Moise , The Gut microbiome: Exploring the connection between, microbes, diet and health, 1st Edition, Greenwood Press, USA, 2017

**Course Outcomes:**

1. Identify the role of micronutrients in health and disease.
2. Associate the inter relationship between vitamins and minerals
3. Develop intervention strategies to combat micronutrient malnutrition.
4. Exhibit professionalism in micronutrient research
5. Interpret the significance of gut microbiome in human nutrition

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | H | H | H | L | M | M | M | M | L | L | M | M | H | H |
| CO 2 | H | M | H | M | H | H | H | M | L | L | M | M | H | H |
| CO 3 | H | H | H | H | H | M | M | H | M | L | L | M | H | H |
| CO 4 | H | M | H | M | H | M | H | H | M | M | L | L | H | H |
| CO 5 | H | H | H | L | H | H | H | H | H | M | H | H | H | H |

## Research Project

**Semester IV** **Hrs of Instruction /Week: 25**

**23MFNC22** **No. of Credits: 8**

**Course Objectives:**

1. Get deeper insights into current research and work.
2. Draw ancillary knowledge of methods in the major subject / field of study.

**Course Outcomes**

**CO1:** Gain insight on community and experimental nutrition research

| CO / PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | H | H | H | H | M | H | H | H | H | H | H | H | H | H |