ಮಂಗಳೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

MANGALORE UNIVERSITY

(Accredited by NAAC)

ಕ್ರಮಾಂಕ/ No. : MU/ACC/CR 15/2023-24/A2

ಕುಲಸಚಿವರ ಕಛೇರಿ
ಮಂಗಳಗಂಗೋತ್ರಿ – 574 199
Office of the Registrar
Mangalagangothri – 574 199
ದಿನಾಂಕ/Date:06.10.2023

NOTIFICATION

Sub: Revised syllabus of M.Sc. Food Science and Nutrition Programme
Ref: Academic Council approval vide agenda
No.: ಎಸಿಸಿ:ಶೈ.ಸಾ.ಸ.2:29(2023–24) dtd 04.10.2023.

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The Revised syllabus of M.Sc. Food Science and Nutrition Programme which is approved by the Academic Council at its meeting held on 04.10.2023 is hereby notified for implementation with effect from the academic year 2023-24 and onwards.

Copy of the Syllabus shall be downloaded from the University Website (www.mangaloreuniversity.ac.in)

REGISTRAR

To

1. The Registrar (Evaluation), Mangalore University.
2. The Chairman Combined BOS in UG FND and PG Food Science and Nutrition, Dept. of Biosciences, Mangalore University.
3. The Co-ordinator, M.Sc. Food Science and Nutrition Programme, Dept. of Biosciences, Mangalore University.
4. The Superintendent (ACC), O/o the Registrar, Mangalore University.
5. The Asst. Registrar (ACC), O/o the Registrar, Mangalore University.
6. The Director, DUIMS, Mangalore University – with a request to publish in the website.
7. Guard File.

MANGALORE UNIVERSITY
DEPARTMENT OF BIOSCIENCES
Syllabus and Scheme for two-year (Four semesters)
M.Sc. in Food Science and Nutrition
Choice-based Credit System (CBCS)

Preamble:

As per guidelines of the UGC and Higher Education Council, Government of Karnataka, the Board of Studies in Food Science and Nutrition, Mangalore University framed a new syllabus according to the regulations governing the Choice-based Credit System for the two-year (four semesters) M.Sc. Degree Programmes in 2016. The syllabus has been subsequently revised.

The M.Sc. programme in Food Science and Nutrition under CBCS scheme has a total of 92 credits consisting of *Hard core courses* for 54 credits (58%) and *Soft core courses* with choice for 28 credits (30%) and *Open elective courses* with choice for a total of 6 credits.

Program Outcome:

PO 1 Interdisciplinary Program: Food Science and Nutrition is an interdisciplinary programme imparting knowledge of food science and nutrition, dietetics, food microbiology, food biochemistry, food preservation and processing, human physiology, and their role in relation to food and health.

PO 2. In-depth Understanding: It also provides an in-depth understanding of the correlation between food and health, role of food under specific disease conditions and applications of food science in food processing industries.

PO3: Hands-on skills and soft skills training: Students are provided hands-on skill training through laboratory exercises and are enabled to prepare and deliver effective presentations of technical information to food science and nutrition professionals and to the general public.

Program Specific Outcomes:

PSO 1 Apply analytical principles of food and nutrients in diet formulation.
PSO 2 Develop comprehensive and analytical skills to work as trained human resource in food industries and health sectors
PSO 3 Gain insight in public health nutrition for employment food as safety officers, Government sectors like FCI, FSSAI etc.
PSO 4 Apply knowledge in the field of personalized nutrition with reference to nutrigenetics and nutrigenomics
PSO 5 Comprehend methods of assessing human nutritional requirements, nutritional assessment and diet planning.
PSO 6 Understand the applications of nutritional sciences in clinical interventions, communication for health promotion,
PSO 7 Acquire skills to work in R&D units of food processing, food products, nutraceuticals and undertake systematic research in the area of food science and nutrition.
PSO 8 Devise research strategies for empowering and promoting healthy living in the community.
PSO 9 Acquire entrepreneurial skills in the field of food science, processed foods and nutrition.

FIRST SEMESTER

Course Code	Course Title	Teaching Hrs/weeks	Exam Hrs.	Marks		Total	Credits
				IA*	Exam		
HARD CORE COURSES – THEORY							
FNH 401	Food Science	4	3	30	70	**100**	4
FNH 402	Principles of Nutrition	4	3	30	70	**100**	4
FNH 403	Human Physiology	4	3	30	70	**100**	4
SOFT CORE COURSES- THEORY (CHOOSE ANY ONE)							
FNS 404	Nutritional Biochemistry	3	3	30	70	**100**	3
FNS 411	Analytical Techniques in Food Science						
PRACTICALS							
FNP 406	Food Science	4	3	15	35	**50**	2
FNP 407	Principles of Nutrition	4	3	15	35	**50**	2
FNP 408	Human Physiology	4	3	15	35	**50**	2
FNP 409	Nutritional Biochemistry	4	3	15	35	**50**	2
FNP 412	Analytical Techniques in Food Science						
Total						**600**	**23**

SECOND SEMESTER

Course Code	Course Title	Teaching Hrs/weeks	Exam Hrs.	Marks		Total	Credits
				IA*	Exam		
HARD CORE COURSES – THEORY							
FNH 451	Vitamins in Human Nutrition	4	3	30	70	**100**	4
FNH 452	Minerals in Human Nutrition	4	3	30	70	**100**	4
SOFT CORE COURSES - THEORY (CHOOSE ANY TWO)							
FNS 453	Life Span Nutrition	3	3	30	70	**100**	3
FNS 455	Food Packaging	3	3	30	70	**100**	3
FNS 456	Food Safety and Quality Control	3	3	30	70	**100**	3
FNS 465	Food Microbiology	3	3	30	70	**100**	3
PRACTICALS							
FNP 457	Vitamins in Human Nutrition	4	3	15	35	**50**	2
FNP 458	Minerals in Human Nutrition	4	3	15	35	**50**	2
FNP 459	Life Span Nutrition	4	3	15	35	**50**	2
FNP 461	Food Packaging	4	3	15	35	**50**	2
FNP 462	Food Safety and Quality Control	4	3	15	35	**50**	2
FNP 466	Food Microbiology	4	3	15	35	**50**	2
OPEN ELECTIVES (CHOOSE ANY ONE)							
FNE 463	Food Safety	3	3	30	70	**100**	3
FNE 464	Food Preservation						
Total						**700**	**25**

THIRD SEMESTER

Course Code	Course Title	Teaching Hrs/week	Exam Hrs.	Marks		Total	Credits
				IA*	Exam		
HARD CORE COURSES –THEORY							
FNH 501	Clinical Nutrition and Dietetics – I	4	3	30	70	**100**	4
FNH 502	Community Nutrition and Statistics	4	3	30	70	**100**	4
SOFT CORE COURSES - THEORY (CHOOSE ANY TWO)							
FNS 503	Dairy Technology	3	3	30	70	**100**	3
FNS 504	Principles of Food Processing						
FNS 505	Post Harvest Technology	3	3	30	70	**100**	3
FNS 506	Functional Foods						
PRACTICALS							
FNP 507	Clinical Nutrition and Dietetics – I	4	3	15	35	**50**	2
FNP 508	Community Nutrition and Statistics	4	3	15	35	**50**	2
FNP 509	Dairy Technology	4	3	15	35	**50**	2
FNP 510	Principles of Food Processing						
FNP 511	Post Harvest Technology	4	3	15	35	**50**	2
FNP 512	Functional Foods						
OPEN ELECTIVES (CHOOSE ANY ONE)							
FNE 513	Nutrition for Health	3	3	30	70	**100**	3
FNE 514	Diet and Disease						
Total						**700**	**25**

FOURTH SEMESTER

Course Code	Course Title	Teaching Hrs/weeks	Exam Hrs.	Marks		Total	Credits
				IA*	Exam		
HARD CORE COURSES – THEORY							
FNH 551	Clinical Nutrition and Dietetics – II	4	3	30	70	**100**	4
FNH 552	Food Preservation	4	3	30	70	**100**	4
SOFT CORE COURSES - THEORY (CHOOSE ANY ONE)							
FNS 553	Food Fortification	3	3	30	70	**100**	3
FNS 554	Sports Nutrition						
FNS 555	Food Service Management						
PRACTICALS							
FNP 556	Clinical Nutrition and Dietetics – II	4	3	15	35	**50**	2
FNP 557	Food Preservation	4	3	15	35	**50**	2
PROJECT WORK / INTERNSHIP							
FNP 558	Project Work / Internship	-	-	30	70	**100**	**4**
Total						**500**	**19**
Grand Total						**2500**	**92**

IA consists of Seminars, Assignments, Internal Tests, Objective test (MCQs)

	HARD CORE COURSES			SOFT CORECOURSES			OPEN ELECTIVES	PROJECT / INTERNSHIP	TOTAL
	No of Courses	**Credits**	**Total**	**No. of Courses**	**Credits**	**Total**	**Credits**	**Credits**	
I	3Th+3 Pr	4+2	**18**	1Th+1 Pr	3+2	**5**	-	-	**23**
II	2Th+2 Pr	4+2	**12**	2Th+2 Pr	3+2	**10**	3	-	**25**
III	2Th+2 Pr	4+2	**12**	1Th+1 Pr	3+2	**10**	3	-	**25**
IV	2Th+2 Pr	4+2	**12**	1Th	3	**3**		4	**19**
Total			**54=58 %**			**28=30%**	**6**	**4**	**92**

NOTE:

INTERNAL ASSESSMENT: Marks in theory courses shall be awarded on the basis of theory test (70 Marks), Objective test (MCQs) (15 Marks), Seminars and Assignments (15 Marks). The marks obtained shall be reduced to 30. The tests will be conducted as per the university time schedule. Practical Internal Assessment marks shall be based on practical test and records. 30 marks for Practical test and 5 marks for Class record. The marks obtained shall be reduced to 15. 30 marks for Project/Internship work (Report/Dissertation and Presentation/Viva).

THEORY QUESTION PAPER PATTERN: Question Papers in all the four semesters consists of three sections (Model question paper enclosed). Section I: Write short notes on any five of the following (5x3=15 Marks) Section II: Write explanatory notes on any five out of the following: (5x5=25 Marks). Section III: Answer any three of the following out of five (3x10=30 Marks). Questions should be drawn from all the units of the syllabus by giving equal weightage.

PRACTICAL QUESTION PAPER PATTERN: 30 marks for practical examination proper (Major experiment (10 marks), Minor experiments (05+05 marks), Identify and Comment (5x2=10 marks) and Class record (05 marks). The Project work may be conducted either in the department or any other Institution/Industry/Hospital. Project/Internship Report/Dissertation carries 70 marks and evaluated on the basis of Dissertation/Report and Viva voce presentation.

I SEMESTER
HARD CORE COURSES
FOOD SCIENCE

52 Hrs (13× 4 units)

Course Outcome:

At the end of the course the students will acquire the knowledge of -

CO 1. Various nutritional classification of food grouping system
CO 2. Structure of cereal grains, nutritional importance, processing and baking technology.
CO 3. Classification of fruits and vegetables, their nutritional importance, the methods of preservation and effect of cooking on nutritional composition.
CO 4. Concept of milk processing, its composition and to assess the quality parameters of milk.
CO 5. Composition of meat and egg, regulations and processing of meat in slaughtering operations and evaluation of egg quality.

Unit I: Introduction to Food Science: Food Group System (5/11groups and ICMR). Cereals and Pulses: Nutritive value of cereals and pulses. Cereals – structure of a cereal grain (rice and wheat), milling of cereals (rice and wheat), parboiling and nutrient loss during parboiling. Baking technology: bread, biscuits, cookies, leavening agents (different types and methods), Breakfast cereals. Pulses – types and processing of different pulses. Processing of pulses- effects of decortications, soaking, germination and fermentation.

Unit II: Fruits and vegetables: Classification and Nutritive value, Principles of fruits and vegetable preservation (heat, sugar, salt, fermented and dried). Pre-processing of fruits and vegetables (peeling, cutting and blanching). Principles of storage; natural, ventilated, low temperature. Pectin substances, ripening of fruits. Vegetable cookery Preliminary preparation- Washing, Peeling and Blanching, Enzymatic and non-enzymatic browning, its prevention. Pigments: Types of Pigments, Water insoluble pigments, Chlorophyll, Carotenoids. Water soluble pigments, Anthocyanins, Flavonoids.

Unit III: Milk and milk products: Milk composition, factors affecting milk quality, physical and chemical properties of milk. Processing of milk- Filtration, Clarification, separation, centrifugation, pasteurization, fortification, sterilization, homogenization, effect of processing on nutritive value. Quality test for milk-platform test, adulterant test and other quality checks. Fermented and non-fermented milk products.

Unit IV: Meat, fish, poultry and egg: Meat- composition, slaughtering and related practices, ageing, and curing, smoking, tenderizing, colour changes during cooking. Fish - composition, quality factors, preservation, drying, salting, curing, smoking, fermented fish products and canning. Poultry- processing plant operation (slaughtering to packaging), cooking, flavor and colour changes. Eggs - composition, quality factors, pasteurization of eggs, egg substitutes and powdered egg, role of egg in cookery.

REFERENCES

- Fabriani, G and Lintas C. 1988. Durum wheat chemistry and technology. American Association of Cereal Chemistry Inc.
- Winton and Winton 1991. Techniques of food analysis, Allied Scientific Publishers
- Pomeranz Yeshuraj, 1987. Food Analysis; theory and practice,
- Matz A Samuel, 1999 Bakery Technology and Engineering
- Lavie A., 1979. Meat Handbook- AVI Publishing, Westport

PRINCIPLES OF NUTRITION

52Hrs (13× 4 units)

Course Outcome:

At the end of the course, students will gain-

CO 1. Knowledge about the total energy requirements, balance and its concepts depending on the individual specific needs.

CO 2. An understanding of body composition and its changes through life cycle and the techniques of measuring body composition.

CO 3. Knowledge regarding carbohydrate chemistry and its role in energy metabolism.

CO 4. Knowledge of protein, its metabolism and importance in normal physiological function of the body.

CO 5. Basic understanding of requirements, metabolism, functions and deficiencies of lipids.

Unit I: Principles of nutrition –Food as a source of nutrients, Nutritional classification of foods. Basis for computing nutrient requirements, latest concepts in dietary recommendations, RDA- ICMR and WHO: their uses and limitations**.** Body Composition. Changes in body composition through life cycle. Energy Metabolism: -BMR, energy balance, physical activity, energy expenditure calculation of an average man and woman. Importance of water and fibers in human nutrition.

Unit II: Carbohydrates: Classification, functions, digestion and enzymes involved, absorption, assimilation, deficiency, metabolism, requirements and sources. Significance of carbohydrate as energy source; trends in dietary intake of carbohydrate. Glycemic index of foods – scope and significance, glycemic load of foods and its use. Artificial sweeteners.

Unit III: Proteins: Functions, digestion and enzymes involved, absorption, assimilation, Nitrogen balance, amino acid pool, requirements. Protein supplements. Quality of protein analysis, essential amino acids and therapeutic application of amino acid. Protein energy malnutrition – clinical features and biochemical changes.

Unit IV: Lipids: Significance of lipids and fatty acids, functions, deficiency, SFA, PUFA, MUFA, omega 3 fatty acids and omega 6 fatty acids, trans fatty acids, requirements and dietary guidelines, fat metabolism – digestion and enzymes involved, absorption and assimilation.

REFERENCES

- Honyman and Guthri- 2000. An introduction to the chemistry of carbohydrates
- Birch, G.G. et al., 1986. Food science- Pergamon press, New York
- Fennema, O R., 1976 Principles of Food Science (part- I Food Chemistry)- Marcel Dekker, USA,
- Guthrie A.H., 1986. Introductory Nutrition –6thedition, the C.V. Mosby company
- Swaminathan M., 1991. Essentials of food and nutrition - Vol I and II, Ganesh & Co. Madras
- Berg JM, Tymoczko JL and Stryer L., 2002. Biochemistry 5thed.WH Freeman

HUMAN PHYSIOLOGY

52 Hr (13× 4 units)

Course Outcome:

At the end of the course students will be able to-

CO 1. Enhance their knowledge of human physiology.
CO 2. Understand physiological systems such as cardio-vascular, excretory, reproductive and digestive systems.
CO 3. Identify the movement and coordination of human body, structure and physiology of various muscle systems, hormones and its regulatory functions.
CO 4. Understand the interrelationship between various physiological and metabolic processes.

Unit I: Transport and Defence: Blood: composition, plasma, blood cells, hemoglobin, blood clotting process, heartbeat, initiation, contraction and regulation, physiology of circulation. Adipose tissue structure, composition, deposition of triglycerides in adipose tissues, role of brown adipose tissues in thermogenesis. Immunity: immune response, antibody, cell mediated and humoral immunity.

Unit II: Movement and co-ordination: Organization of body, structure of skeletal, cardiac, smooth and physiology of muscle contraction, structure of brain and neurons, physiology of nerve impulse conduction, excitability of membrane, electrical and chemical transmission between cells. Hormones: classification, synthesis, regulatory functions and mechanisms of hormone action.

Unit III: Digestion: Structure of digestive tract, regulators of GI activity, mechanical and chemical aspects of digestion, and transport of major nutrients. Liver- role of liver in processing and distribution of nutrients absorbed from small intestine, inter relationship of major metabolism in liver. Detoxification: Definition. Xenobiotics, enzyme systems involved mechanisms of detoxification. Oxidative stress and anti-oxidants in health, free radicals, role of free radicals and anti-oxidants in health and diseases.

Unit IV: Excretion, detoxification and reproduction: Excretion: Internal structure of kidney and nephron, fluid and electrolyte balance, acid and base balance, physiology of excretion, roles of kidney in body water regulation. Reproductive health and nutritional requirements

REFERENCES

- Chatterjee C C., 1985. Human physiology Vol I &II, Medical Allied agencies
- Mukherjee W F. 2003. Review of medical physiology, Tata McGraw-Hill
- Jain A K. 2017. Text book of Physiology Vol I &II, Avichal Publishing Co., New Delhi
- Guyton A C. Hall, J E. 1996. Textbook of Medical Physiology 9thEd., Prism Books Pvt. Ltd., Bangalore
- Sembulingam, 2009. Text book of medical physiology.

SOFT CORE COURSES
NUTRITIONAL BIOCHEMISTRY

39 hr (13× 3 units)

Course Outcome:

At the end of this course the students will be able to-

CO 1. Describe macronutrients, energy metabolism, its utilization, and the general functions.
CO 2. Understand nucleotides, structure and its properties
CO 3. Identify biological oxidation and electron transport chain taking place in an organism.
CO 4. Describe the classification, nomenclature and other basic concepts of enzymes and hormones.

Unit I: Nutrient metabolism: Carbohydrates - Glycolysis, TCA Cycle, HMP shunt, Energy metabolism, energy production, glucogenesis, gluconeogenesis. Proteins and Amino acids: Synthesis, metabolism, denaturation, transamination, decarboxylation, urea formation, synthesis and break down of hemoglobin. Functions and classification of nucleotides, structure and properties of RNA and DNA. Lipids: Synthesis of saturated and unsaturated fatty acids, cholesterol synthesis and regulation, oxidation of saturated and unsaturated fatty acids, phospholipids and lipoprotein synthesis.

Unit II: Biological oxidation and Electron Transport Chain: Reduction potentials, anatomical site and components of oxidative phosphorylation, enzymes involved, membrane location of electron transport, chemiosmotic theory, inhibitors of respiratory chain

Unit III: Enzymes and Hormones: Enzymes - Classification, nomenclature, general properties- stereo and reaction specificity, kinetics and mechanisms of enzyme action, regulation of enzyme activity. Coenzymes and co factors, their structure and functions. Enzyme inhibition, isoenzymes, immobilized enzymes, estimation of enzyme activity, clinical significance of enzymes and enzyme based assays. Hormones - Classification, regulatory functions and mechanisms of hormone action. Prostaglandin - structure, biosynthesis, metabolism and biological action and their role in pathology.

REFERENCES

- Raghuramulu N., Madhavan Nair K and Kalyansundaram S. 1983.A manual of laboratory techniques edited by NIN-ICMR
- Tietz NW (Ed). 1976. Fundamentals of clinical chemistry, WB Saunders Co.
- Jain J.L. 2016. Fundamentals of biochemistry, S. Chand & Company Ltd, Ram New Delhi
- Delvin T M., 2010. Text book of biochemistry with clinical correlation, Wiley Liss Inc
- Murray R K., Granner, D.K., Mayes, P.A., Rodwell, V.W. 2000. Harper's biochemistry, Macmillan Worth Publishers

ANALYTICAL TECHNIQUES IN FOOD SCIENCE

39 Hr (13× 3 units)

Course outcome:

At the end of this course the students will gain in-depth knowledge of-

CO 1. Various analytical techniques used in food industry.
CO 2. Different techniques used in chromatography to differentiate nutrients and other chemical compounds in foods.
CO 3. Chemical properties and role of enzymes in food industries.
CO 4. Techniques in proximate analysis of foods and feeds including anti-nutritional factors and antibiotics.

Unit I: Techniques – paper, TLC, Gel filtration, ion exchange, affinity, HPLC and GLC. Spectroscopy - UV-visible, fluorescent spectroscopy, CD spectroscopy, NMR. Radiotechniques – nature of radiation sources, radioactive decay, units of radiation, detection and measurements of radioactivity, autoradiography, GM counter, Scintillation counter.

Unit II: Optimisation of PCR reactions and application in food technology, immunological techniques. Extraction, isolation and purification of soluble and membrane bound enzymes. Enzyme. Isolation of enzymes, extraction of soluble and membrane bound enzymes purification of enzyme- criteria for purification.

Unit III: Quantification of organic acids (citric acid). Proximate analysis of foods and feeds (moisture, nitrogen, crude fiber, crude lipids and ash). Mineral analysis of foods and feeds. Vitamin assay (water soluble and fat soluble). Analysis of antinutritional factors (phenolics). Estimation of secondary metabolites (antibiotics).

REFERENCES

- Raghuramulu et al. 1983. A manual of Laboratory Techniques, NIN, ICMR, Hyderabad
- Plummer, D.T. 1971. An introduction to practical Biochemistry, McGraw Hill Pub. Co., New York,
- Khopkar S.N. 1998. Basic Concepts of Analytical Chemistry (2nded), New Age Pub.
- Upadhaya A. 2019. Biophysical Chemistry – Principles and techniques –Himalaya pub.
- King R.D., 1978 Developments in Food Analysis –Applied Science Publishers Ltd., London,
- Joslyn, M.A., 1970. Methods of Food Analysis –Academic Press, New York
- Friedlander G., Kennedy JW, Macias ES., et al. 1981. Nuclear and Radio Chemistry – 3rded. John Wiley and sons
- Hudson et al 1986. Practical Immunology –., Blackwell scientific pub
- Old and Primrose 1994. Principles of Gene Manipulation, Blackwell scientific Pub.,
- Skooge D.A. 1985. Principles of Instrumental Analysis, Holt-Saunders.
- Morris, C.J. and Morris, P. 1976. Separation Methods in Biochemistry, Pitman Publ., London

PRACTICALS

FOOD SCIENCE

Course Outcome:

At the end of this course the students will be skilled in the -

CO 1. Application of cereal and pulse cookery in food science.
CO 2. Detecting chemical reactions in fruits and vegetables and various methods used in preservation
CO 3. Assessing the milk quality using various parameters.
CO 4. Evaluation of eggs and egg cookery.

1. Cereals
Cereal cookery
Methods of cooking fine and coarse cereals
Preparation of selected Indian Cereal recipes
Pulses cookery
Cooking soaked and raw pulses
Effects of adding salt, acid and alkali on cooking
Preparation of baked products using leavening agents (bread, biscuits, cookies)

2. Fruits and Vegetables
Effect of acid and alkali
Browning reaction
Preparation of dishes with fruits and vegetables (different modes of cooking)

3. Milk
Milk adulteration test
Milk platform test, pH, sensory evaluation
Preparation of fermented and non fermented milk products. Analysis of chemical properties of milk
Specific gravity
Total solids
Acidity
Lactose content

4. Egg
Egg quality evaluation
Egg cookery

PRINCIPLES OF NUTRITION

Course outcome:

At the end of this course the students will be thorough with-

CO 1. Laboratory techniques common to basic food chemistry.
CO 2. Analytical techniques used for food products
CO 3. Evaluating chemical properties and estimating carbohydrates and proteins quantitatively and qualitatively.
CO 4. Estimating quantity of lipids in various food samples by using various methods.

1. Determination of energy value of food using Parr oxygen bomb calorimeter
2. Glucose estimation (reducing sugar method or Willstates method)

3. Test for protein (qualitative analysis)
4. Nitrogen analysis by Kjeldhal method
5. Estimation of amino acid by Sorenson's formaldehyde titration method
6. Protein estimation by Lowry's method
7. Crude lipid estimation- groundnut, egg yolk, soya product
8. Estimation of total lipid in egg yolk

HUMAN PHYSIOLOGY

Course outcome:

At the end of this course the students will be able to-

CO 1. Identify different blood grouping,
CO 2. Handel hemocytometer and blood cell counting.
CO 3. Estimate hemoglobin content of blood
CO 4. Identify other different parameters of hematology.

1. Study of hemocytometer
2. Blood groups
3. Estimation of hemoglobin
4. Total WBC count
5. Total RBC count
6. Total platelet count
7. Packed cell volume
8. Blood indices

NUTRITIONAL BIOCHEMISTRY

Course outcome:

At the end of this course the students will be able to-

CO 1. Use techniques and instruments for biochemical analysis of different biological samples.
CO 2. Use colorimetric techniques.
CO 3. Analyze blood parameters.
CO 4. Analyze the urine samples using different qualitative and quantitative methods.

1. Techniques used in biochemical analysis
   - Determination of pH in acids, alkalis and buffers using pH meter and indicators
   - Colorimeters – use of colorimeter in UV and visual range, flame photometer, flourimeter (principle to be explained and demonstrated with one example for each)
   - Separation techniques- chromatography- paper and Column. Centrifugation, electrophoresis and dialysis (one example for each may be demonstrated)
2. Blood analysis- enumeration of RBC & WBC. Blood glucose, serum albumin, globulin, phosphorous, calcium, cholesterol and urea.
3. Urine analysis- quantitative- sugar, albumin and microscopy

ANALYTICAL TECHNIQUES IN FOOD SCIENCE

Course outcome:

At the end of this course the students will be skilled on-

CO 1. Chromatographic and immunological techniques used to identify different compounds.
CO 2. Estimating enzyme activity and various factors affecting it
CO 3. Handling spectrophotometer and its application
CO 4. Estimating and isolating organic acids and nucleic acids respectively.

1. Factors affecting enzyme activity
2. Chromatographic techniques - paper, TLC, Column
3. Estimation of organic acids
4. Verification of Beer Lambert's Law
5. Isolation of DNA /RNA
6. Immunological techniques

II SEMESTER

HARD CORE COURSES
VITAMINS IN HUMAN NUTRITION

52 Hr (13× 4 units)

Course outcome:

At the end of this course the students will be able to-

CO 1. Describe the importance of vitamins in human metabolism
CO 2. Classify the vitamins based on solubility in food and human system.
CO 3. Elucidate the chemical properties of both fat- and water-soluble vitamins.
CO 4. Understand the source, digestion, absorption and functions of both fat- and water-soluble vitamins.
CO 5. Describe the effect of dietary deficiency and complications of each vitamin.
CO 6. Describe how certain vitamins interact with some drugs.

Unit I: Fat soluble vitamins: Chemistry, classifications - A, D, E & K, deficiency, toxicity, physiological action, transport and utilization, storage, dietary sources, losses during preparation and handling, conversion of beta carotene into vitamin A

Unit II: Water soluble vitamins - I: Thiamine, riboflavin, niacin, Folic acid pyridoxine, pantothenic acid, vitamin B12 – chemistry, functions, digestion, absorption, utilization, deficiency and sources.

Unit III: Water soluble vitamins - II: Biotin, ascorbic acid- chemistry, functions, digestion, absorption, utilization, losses in preparation and handling, deficiency. Natural sources of vitamins. Synthetic vitamins and their absorption.

Unit IV: Vitamin like compounds and Pseudo vitamins: Choline, carotene, inositol, taurine, flavanoid, pangamate. Vitamin drug interaction. Drug food interaction.

REFERENCES

- Srilakshmi B. 2006. Nutrition Science, New Age International Publishers.
- Gibney M J, Elia M, Ljungqvist & Dowsett J., 2005. Clinical Nutrition. The nutrition Society Textbook Series, Blackwell publishing Company
- Williams, S R., 2001, Basic Nutrition and Diet Therapy 11thed. Times Mirror Mosby College Publishing
- Mahan, L K., Escott Stump S. 2008. Krause's Food and Nutrition Therapy 12thed., Saunders

MINERALS IN HUMAN NUTRITION

52 Hr (13× 4 units)

Course outcome:

At the end of this course the students will acquire the knowledge of-

CO 1. The importance of minerals in human metabolisms and its contribution.
CO 2. Classification of the minerals depending on its requirement in human body.
CO 3. The chemical properties of major minerals.
CO 4. The source, digestion, absorption and functions of major, minor and trace minerals.
CO 5. Effect of dietary deficiency and its complications of each mineral.
CO 6. Mineral toxicity and their interaction with some drugs.

Unit I: Macro minerals - I: Calcium, phosphorus: Calcium in skeleton and other tissues, bone mass, calcium absorption and utilization, calcium balance, requirement, sources, deficiency and toxicity. Phosphorus: concentration in the body, calcium and phosphorus ratio, absorption and utilization, sources, deficiency and toxicity

Unit II: Macro minerals - II: Sodium, Potassium, Magnesium and Sulphur - Metabolism and electrolyte balance, absorption, utilization, role in human nutrition, sources, deficiency, toxicity.

Unit III: Micro minerals: Iron, iodine, zinc, copper, cobalt; metabolism, role in human nutrition, sources, deficiency, toxicity.

Unit IV: Ultra trace minerals: Cobalt, Nickel, Cadmium. Manganese, Molybdenum, Chlorine, Selenium, Fluorine: Metabolism, role in human nutrition, sources, deficiency and toxicity. Minerals and drug interaction.

REFERENCES

- Srilakshmi B. 2006. Nutrition Science, New Age International Publishers.
- Gibney M J, Elia M, Ljungqvist & Dowsett J., 2005. Clinical Nutrition. The nutrition Society Textbook Series, Blackwell publishing Company
- Williams, S R., 2001, Basic Nutrition and Diet Therapy 11thed. Times Mirror Mosby College Publishing
- Mahan, L K., Escott Stump S. 2008. Krause's Food and Nutrition Therapy 12thed., Saunders Elsevier

SOFT CORE COURSES
LIFE SPAN NUTRITION

39 Hr (13× 3 units)

Course outcome:

At the end of this course the students will be able to-

CO 1. Describe the methods and principles involved in menu planning using food group system and food exchange list.
CO 2. Understand the nutritional requirement and challenges of differ age groups through life cycle.
CO 3. Explain the role played by nutrition during pregnancy and lactation.
CO 4. Describe the physiological changes which take place through lifecycle

Unit I: Principles of meal planning: Balanced diet, Food groups. Food exchange list. Role of hunger and satiety centre. Dietary Assessment – 24 hour recall, food records, dietary history, food frequency questionnaire. Nutrition for adulthood and old age: Nutrient requirements for adult man and woman, nutritional status of Indian adult population – community nutrition. Geriatric nutrition: Physiological changes in elderly, Nutritional requirements, special needs, nutritional problems health concerns in old age and their management, factors contributing to longevity.

Unit II: Nutrition during pregnancy and lactation. Pregnancy: Physiological changes, nutritional requirements, optimal weight gain and its components, effect of malnutrition on outcome of pregnancy, complications of pregnancy. Lactation: Physiology of lactation, factors affecting lactation, nutritional requirements, community nutrition, and fertility.

Unit III: Nutrition during childhood: Infancy: Growth and development, growth reference/ standards, breast feeding, compositional differences between human milk and milk substitute. Weaning practices, weaning and supplementary foods. Nutritional concerns and healthy food choices. Preschool children: Growth and development, nutritional requirements, special care in feeding preschoolers, nutritional problems specific to this age. School age and adolescent children: Growth spurt, nutritional requirements, factors affecting their eating habits, nutritional problems specific to this age.

REFERENCES

- Khanna K, Gupta S, Seth R, Passi SJ, Mahna R, Puri S. 2013.Textbook of Nutrition and Dietetics. Phoenix Publishing House Pvt. Ltd.
- Wardlaw GM, Hampi JS, DiSilvestro RA. 2004. Perspectives in Nutrition, 6th edition. McGraw Hill.
- Dietary Guidelines for Indians, ICMR (2011), NIN, Hyderabad.
- Dietary Allowances for Indians. ICMR (2010), NIN-Hyderabad.
- Chadha R., Mathur P. (eds). 2015. Nutrition: A Lifecycle Approach, Orient, New Delhi.
- Seth V and Singh K., 2006. Diet Planning through the Life Cycle: Part 1 Normal Nutrition, A Practical Manual. Elite Publishing House Pvt. Ltd. New Delhi.
- Gopalan C, Rama Sastri BV, Balasubramanian SC. 1989. Nutritive Value of Indian Foods. National Institute of Nutrition, ICMR, Hyderabad.
- Mann J, Truswell AS, 2002. Essentials of Human Nutrition second edition, Oxford University Press

FOOD MICROBIOLOGY

39 Hr (13× 3 units)

Course Outcome

At the end of this course students will be able to-

CO 1. Identify microorganisms associated with food.
CO 2. Describe different type of microbes present and their beneficial as well as deleterious effect on food.
CO 3. Understand food borne pathogens, food spoilage and toxins produced by them and its health effect.
CO 4. Assess the importance of microbes in food industry for baking, fermentation and various traditional foods.

Unit I: History and scope of food microbiology. Types of micro-organisms associated with food- mold, yeast, and bacteria, Microbial growth pattern, physical and chemical factors influencing destruction of microorganisms. Growth curve, bacterial group based on morphology- gram positive, gram negative, motile, non-motile, sporulating and non sporulating. Microorganisms in natural food products and their control.

Unit II: Food spoilage and food borne diseases: Food spoilage - definition, biochemical changes caused by microorganisms, deterioration and spoilage of various types of food products – Physical, chemical and microbiological spoilages (Enzymatic or fermentative spoilage – rancidity, hydrolytic spoilage, putrefaction, souring, off flavour etc.; Texture deformations – slime, ropiness, curdling, discoloration etc.; Contamination of fruits vegetables, cereals, pulses, oilseeds, milk and meat during handling and processing. Microbial spoilage of foods and food items – milk, cereals, fruits and vegetables, meat, egg, fish, poultry. Toxin production –endotoxins and exotoxins). Food borne diseases and infections, mycotoxins, typhoid, diarrhea, botulism, salmonellosis, staphylococcal intoxication. Food borne pathogens, food poisoning, food infection and intoxication - *E. coli* O157:H7, *Campylobacter jejuni*, *Bacillus cereus*, Shigella sp., Hepatitis A. Assessing the microbiological quality of food – indicator organisms, microbiological standards, principals of GMP and HACCP in food processing.

Unit III: Fermentation: Importance of microorganisms in food industry and food preparations (milk industry, meat, fish, baking). Food fermentation -Traditional fermented foods of India and other Asian countries; Probiotics and prebiotics: effect on gut microflora. Fermented foods based on milk, meat and vegetables; Fermented and alcoholic beverages.

REFERENCES

- Banwart G J., 1987, Basic Food Microbiology, CBS Publishers and Distributors
- Frazier WC, Westoff DC. 1998, Food Microbiology, 4thEdition, Tata Mc Graw Hill Publishing Co. Ltd
- Prescott L M, Harley J P, Klein D A., 2008. Microbiology 6th Ed., WMC Brown Publishers
- Pelczar MJ, Chan ECS, Krieg N. 1993. Microbiology 5th Ed., Tata McGraw Hill Publishing Co. Ltd
- Garbutt John, 1997. Essentials of Food Microbiology, Arnold London
- James M. Jay, 2000. Modern Food Microbiology 6th edition AN ASPEN PUBLICATION® Aspen Publishers, Inc.

FOOD PACKAGING

39 Hr (13× 3 units)

Course outcome:

At the end of this course the students will be able to-

CO 1. Describe the objectives of food packaging and packaging material.
CO 2. Classify the different types of packaging material depending on food type.
CO 3. Write down the different packaging equipment and machinery.
CO 4. Identify the importance of modified atmospheric packaging.

Unit I: Food packaging: Definitions, objectives and functions of packaging and packaging materials. Packaging requirements and selection of packaging materials; Types of packaging materials. Sanitation and hygiene.

Unit II: Food packaging systems: Different forms of packaging such as rigid, semi-rigid, flexible forms and different packaging system for (a) dehydrated foods (b) frozen foods (c) dairy products (d) fresh fruits and vegetables (e) meat, poultry and sea foods.

Unit III: Packaging equipment and machinery: Vacuum, CA and MA packaging machine; gas packaging machine; seal and shrink packaging machine; form and fill sealing machine; aseptic packaging systems; bottling machines: carton making machines. Smart packaging systems for bacterial spoilage, water activity.

REFERENCES

- Robertson, G.L. 2006. Food Packaging: Principles and Practice (2nd Ed.), Taylor &Francis
- Sacharow, S. and Griffin, R.C. 1980. Principles of Foods Packaging (2nd Ed.), Avi, Publication Co. Westport, Connecticut, USA.
- Rooney, M.L. 1995. Active Food Packaging - Blackie Academic & Professional, Glasgow, UK.
- Food Packaging Technology Handbook, 2003. NIIR Board, National Institute of Industrial Research,
- Ahvenainen, R. (Ed.), 2003. Novel Food Packaging Techniques, CRC Press
- Han, J.H. (Ed.) 2005. Innovations in Food Packaging, Elsevier Academic Press

FOOD SAFETY AND QUALITY CONTROL

39 Hr (13× 3 units)

Course outcome:

At the end of this course the students will be able to-

CO 1. Describe the importance of quality control system in food plants.
CO 2. Classify the different types of food labeling and label claims
CO 3. Understand the different food laws including national and international laws.
CO 4. Know the importance of various mandatory and voluntary quality systems in food industry.
CO 5. Know the common testing methodologies for food adulterants and toxicants

Unit I: Quality control and quality assurance: Importance and functions, statistical quality control. TQM, GMP, GLP and HACCP its implementation in various food industries. Concept of Codex Alimentarious, ISO system, Sensory evaluation-introduction, panel screening, Sensory and instrumental analysis in quality control, IPR and Patents.

Unit II: Methods of quality, assessment of food materials: Fruits, vegetables, cereals, dairy products, meat, poultry, egg and processed food products. Sanitation and hygiene, FSSAI. AGMARK (BIS) systems. Differences between mandatory law and optional rules.

Unit III: Food labeling and label claims. Law on label claims and punishments. Food adulteration, Common testing methodologies for food adulterants and toxicants.

REFERENCES

- Early. R. 1995. Guide to Quality Management Systems for the Food Industry, Blackie, Academic and professional, London.
- Gould, W.A and Gould, R.W. 1998.Total Quality Assurance for the Food Industries, CTI Publications Inc. Baltimore.
- Bryan, F.L. 1992. Hazard Analysis Critical Control Point Evaluations - A Guide to Identifying Hazards and Assessing Risks Associated with Food Preparation and Storage - World Health Organization, Geneva.
- Manuals of Food Quality Control: 2 Additives, Contaminants, Techniques. 1980. Food and Agricultural Organization, Rome.
- Singhal, RS., Kulkarni PR., Rege, DV. 1997. Hand Book of Indices of food Quality and Authenticity, wood head Publishing Ltd.

PRACTICALS

VITAMINS IN HUMAN NUTRITION

Course outcome:

At the end of this course the students will acquire the skills of-

CO 1. Various techniques to estimate different vitamins from their natural sources.
CO 2. Methods to study the effect of processing on vitamin losses during processing.
CO 3. Food fortification and its importance.
CO 4. Preparation of vitamin rich foods based on nutritional demand.

1. Estimation of carotene of any 03samples
2. Analysis of food for thiamine and riboflavin (03samples)
3. Estimation of lycopene from food sample.
4. Estimation of vitamin C by EDTA method(03samples)
5. Estimation of vitamin C losses during processing
6. Preparation of vitamin rich foods for fat soluble and water-soluble vitamins
7. Fortification with any 02 vitamin rich foods
8. Survey on fortified food available in market

MINERALS IN HUMAN NUTRITION

Course outcome:

At the end of this course the students will be able to-

CO 1. Describe the various techniques to estimate different minerals from their natural sources.
CO 2. Identify the qualitative changes in analyzing various minerals.
CO 3. Creates awareness about recent in food fortification and its importance.
CO 4. Preparation of mineral rich foods based on nutritional demand.

1. Qualitative analysis of minerals
2. Estimation of iron, phosphorous, calcium using any three foodstuffs
3. Preparation of iron, calcium, phosphorous rich foods
4. Fortification mineral rich foods and testing food samples for fortificants

LIFE SPAN NUTRITION

Course outcome:

At the end of this course the students will be able to-

CO 1. Preparation of meal using food exchange lists.
CO 2. Plan and preparation of weaning food.
CO 3. Creates awareness about low cost nutritional rich food for children.
CO 4. Preparation of balanced diet for different age group individuals.

1. Introduction to meal planning: Use of food exchange list
2. Planning and preparation of weaning foods for Infants
3. Planning and preparation of diets and dishes for two different calories:
   Preschool child; School age child and adolescents, Young adult, Pregnant and lactating woman, Elderly

FOOD MICROBIOLOGY

Course outcome:

At the end of this course the students will be able to-

CO 1. Identify basic microbiological laboratory practice, culturing and handling of microbes.
CO 2. Isolate microorganisms from water and food sources.
CO 3. Identify by various staining techniques.
CO 4. Estimate total count in various food samples.

1. Study of microbiological laboratory instruments.
2. Preparation of media and isolation techniques
3. Preparation of bacterial smears, simple staining, differential staining, spore staining, staining of molds and yeast
4. Study of the microbiological quality of milk by MBR test.
5. Direct microscopic examination of foods.
6. Estimation of total microbial count of yeast and molds from spoiled food samples.
7. Estimation of total microbial bacterial plate count of spoiled food sample
8. Enumeration of Coliforms and indicator organisms (Most Probable Number)
9. Detection of Coliforms using membrane filter techniques.
10. Estimation of total microbial count of (a) milk products (b) fruits and vegetable products (c) meat, fish and poultry products (d) canned foods.

FOOD PACKAGING

Course outcome:

At the end of this course the students will be able to-

CO 1. Understand water vapour transmission rate for different materials.
CO 2. Identify toxins, pesticides and adulteration in food.
CO 3. Handel surface sterilization and its application in food handling
CO 4. Assess food packaging effectiveness using various methods.

1. Assessment of air using Surface Impingement method.
2. Detection of efficacy of surface sterilization using swab and Rinse method.
3. Determination of water vapour transmission rate for different materials.
4. Estimation of toxins and pesticides in food.
5. Detection of adulteration in foods.

FOOD SAFETY AND QUALITY CONTROL

Course outcome:

At the end of this course the students will be able to-

CO 1. Differentiate normal and abnormal biochemical parameters by determination of moisture, ash and acidity of food sample.
CO 2. Determine water vapor transmission rate and air using Surface Impingement for different materials.
CO 3. Detect adulteration in foods.
CO 4. Analyze the safety parameters of food.

1. Determination of moisture in a given food sample
2. Determination of ash in a given food sample.
3. Estimation of acidity of given food sample/beverage
4. Determination of water vapour transmission rate for different materials.
5. Detection of adulteration in foods.
6. Assessment of air using Surface Impingement method.

OPEN ELECTIVES

FOOD SAFETY

39 Hr (13× 3 units)

Course outcome:

At the end of this course the students will gain the knowledge regarding-

CO 1. The importance of quality control system in food plants.
CO 2. Different types of food labeling and label claims
CO 3. Different food laws including national and international laws.
CO 4. Common testing methodologies for food adulterants and toxicants

Unit I: Food Quality: importance and functions of quality control. Methods of quality, assessment of food materials-fruits, vegetables, cereals, dairy products, meat, poultry, egg and processed food products. Food adulteration and food safety. HACCP, Sensory evaluation-introduction, panel screening,

Unit II: Sampling and specification of raw materials and finished products, Concept of Codex Alimentarious/USFDA/ISO 9000 series, rules and regulations for waste disposals. FSSAI and AGMARK

Unit III: Food packaging: Definitions, objectives and functions of packaging and packaging materials. Packaging requirements and selection of packaging materials; Types of packaging materials.

REFERENCES

- Swaminathan MS. 1979. Food Science & Experimental Foods, Ganesh & Co
- Srilakshmi B. 2003. Food Science, New Age International publication
- Frank AP. 1987. Modern Processing, Packaging & Distribution System for Food, AVI Vannonst and Reinhold.co.

FOOD PRESERVATION

39 Hr (13× 3 units)

Course outcome:

At the end of this course the students will be able to-

CO 1. Describe different processing and food preservation techniques based on different food materials

CO 2. Understand the food processing techniques, various methods used to preserve foods and factors influencing the shelf-life of the food products.

CO 3. Know the different packaging techniques used for food packaging.

CO 4. Describe the effects of different processing techniques on palatability and nutritive value of food.

Unit I: Principles of food preservation, methods of food preservation, Asepsis, removal of micro-organisms, maintenance of aseptic condition, classification of food for processing, chemicals in food preservation, food irradiation, concept of hurdle technology, Microwave heating.

Unit II: Preservation of food by high temperature-Pasteurization, sterilization, Canning. Preservation by low temperature-refrigeration, freezing, freeze drying, freezer burn

Unit III: Food dehydration and concentration: methods of drying and concentration, Osmotic dehydration, equipment for drying/dehydration, factors affecting drying process.

REFERENCES

- Desrosier N W & JN Desrosier. 2004. The Technology of Food Preservation, AVI Publication
- Potty VH. & BM J Mulki, 1993. Food Processing, Oxford & IBH Publications
- Swaminathan MS. 1979. Food Science & Experimental Foods, Ganesh & Co
- Srilakshmi B. 2003. Food Science, New Age International publication
- Frank AP, 1987. Modern Processing, Packaging& Distribution System for Food, AVI Van nonst and Reinhold.co.

III SEMESTER
HARD CORE COURSES

CLINICAL NUTRITION AND DIETETICS – I

52 Hr (13× 4 units)

Course outcome:

At the end of this course the students will have a detailed understanding of-

CO 1. Basic concepts and interrelation between food health and nutrition, special therapeutic diets and its significance.
CO 2. Pre- and postoperative diet and team approach in patient care
CO 3. The special feeding methods, role of dietitian in hospital and the objectives of diet therapy.
CO 4. Etiology and pathophysiology of common diseases of digestive and respiratory systems and conditions like obesity and diabetes
CO 5. The concept of principle diet and the dietary management of various diseases.

Unit I: Introduction to clinical nutrition and therapeutic diet - Concept of inter-relationship between foods, health and nutrition. Special diet – mechanical soft diet, clear liquid diet, full liquid diet, pre- and post-operative diet, team approach in patient care, role of dietitian in hospital, functions and classification, objectives of diet therapy. Enteral and parenteral feeding.

Unit II: Dietary management in common disease condition - Diet in fever (acute and chronic) -typhoid, malaria, tuberculosis, injury, burns, arthritis: rheumatoid and osteo-arthritis.

Unit III: Obesity and Underweight- etiological factors, types of obesity, assessment of obesity, theory of obesity – fat cell theory and set point theory, dietary modification, dietary management. Eating disorders: anorexia, bulimia nervosa. Diabetes mellitus - etiology, types, symptoms, diagnosis, treatment, short term and long-term complications, physical activity and diabetes mellitus, glycemic index - factors affecting glycemic index.

Unit IV: Diet in Gastrointestinal disorders – Etiology, dietary modifications, dietary management - Peptic ulcer, diarrhea, steatorrhea, celiac disease, inflammatory bowel syndrome, diverticular disease, lactose intolerance, gout, dumping syndrome, Crohn's disease, constipation.

REFERENCES

- Srilakshmi, B. 2003. Dietetics, New Age International (P) Limited, New Delhi
- Robinson C H. 1990. Normal and Therapeutic nutrition, Oxford & IBH Publishing Co, Calcutta
- Bamji,M., Rao, P.N., Reddy, V. 2002. Text book of Human Nutrition, Oxford & IBH Publishing Co. Pvt. Ltd.
- Gopalan C. & S. Kaur, 2016. Towards Better Nutrition- Problem & Policies, NFI publications
- Swaminathan MS. 1985. Modern Nutrition in Health and Disease, Williams & Wilkins
- Shill ME & Young VR. 1962. Normal and therapeutic nutrition. 17th Ed. Macmillan Publishing Co. Modern Nutrition in Health & Disease 7th Ed.
- Bedi Y. P., 1962.Public Health and Hygiene, Atmaram & sons, Kashmere gate, Delhi.

- Williams SR, RS Worthington, 2000. Introduction to Nutrition throughout the lifecycle
- Garrow, J. S., James, W. P.T and Raiph, A 2000. Human Nutrition and Dietetics, 10th ed., Churchill Livingstone
- Mahan, L. K and Escott Stump. S. 2008. Kraus's Food & Nutrition Therapy 12th Ed. Saunders- Elsevier
- Anderson L., Dibble, Turkki PR, Mitchell HS & Rynbergen HJ. 1982. Nutrition in Health and Disease. Saunders-Elsevier
- Khader V, Sumathi A & Manorama R. 1998. Clinical Nutrition. Hober Medical Division.
- JB Lippincott, Bamji, M. S., P. N Rao & Reddy, 1999 Textbook of Human Nutrition, Oxford & IBH, FAO/WHO/UNU1985.
- Shills ME, Olson JA, Shike M & Ross AC. 1999. Normal and therapeutic nutrition, Macmillan.
- Robinson, Lawler, Chenoweth & Garwick, 1987. Normal and therapeutic nutrition, Pearson.
- Stanfield PS, Lea & Febiger, Hui YH. 1993. American Dietetics Association

COMMUNITY NUTRITION AND STATISTICS

52 Hr (13× 4 units)

Course outcome:

At the end of this course the students will be able to-

CO 1. Describe the public health aspects of malnutrition.
CO 2. Identify the cause of malnutrition and its preventive measures.
CO 3. Know the health care services by Government, health programs in India
CO 4. Understand the role of international and national organizations in public health various disease.
CO 5. Apply the various statistical methods and interpretation of the results.

Unit I: Public health aspects of malnutrition - Public health nutrition: Principles and concepts in public health nutrition. Types and magnitude of public health problems in India. Community and health Management: Health concept - definition, positive health, health situation in India. Health indices: fertility indicator, vital statistics, mortality and morbidity, human development index. Protein energy malnutrition: etiology, types, prevalence, metabolic and physiological changes and prevention. Malnutrition prevention programmes: causes, types, control programme in India. Health care: Principles of health care, Health care services by Government, health programs in India, nutrient deficiency prophylaxis programmes in India (Vitamin A, Iodine, Iron). Assessment of nutritional status; anthropometric, clinical, biochemical, dietary, vital health status. Basic principles of low-cost menu planning. Nutrition care process. Corporate Social Responsibility (CSR)

Unit II: Role of international and national organizations in public health: FAO, WHO, UNICEF, CARE, NIN, NNMB, ICAR, ICMR, CFTRI, PHC, ESI. Contribution of Melinda and Bill Gates foundation Nutrition education- importance, objectives, methods of nutrition education, nutrition education programme. Mid-day meal programme.

Unit III: Nutrition and health of women: Women and health system, women's welfare programme, national nutrition programmes for women, empowerment and role of education for women, national and voluntary agencies in improving women's situation in India

Unit IV: Application of Statistics: Analysis of data- measures of central tendencies (mean, median and mode), measure of dispersion (range, mean deviation and standard deviation). Testing of hypothesis. t-test, chi-square test for comparing variance. Analysis of variances, Co-variances and multivariate techniques- concept of ANOVA, one-way and two-way ANOVA, analysis of Co-variance. Correlation analysis, regression analysis, simple linear regress and multiple linear regression. Interpretation: meaning of interpretation, techniques of interpretation, precaution in interpretation- interpretation of tables and figures.

REFERENCES

- Bamji,M., Rao, P.N., Reddy, V. 2002. Text book of Human Nutrition, Oxford & IBH Publishing Co. Pvt.Ltd.
- Dutt P. R., 1993. Primary Health Care Vol I-III, Gandigram Institute of Rural Health & Family Welfare Trust, Ambathurai
- Manelkar R. K., 1991. A Textbook of Community Health For Nurses, Vora Medical Publications, Mumbai
- Shefler WC., 1969. Statistics for Biological Sciences, Addison Wesley, California,

- Zar, J. H., 1974. Biostatistical analysis, Prentice Hall, New Jersey
- Lewis, A.E., 1971. Biostatistics-, Affiliated East West, New Delhi
- Jelliffee BD., 1966. The assessment of the Nutritional Status of the Community, WHO
- Jolliffee O., 1962. Clinical Nutrition. Hoeber Medical Division, Mclaren DS.1983
- Park JE & Park K., 2000. Nutrition in the Community. John Wiley &Sons
- Shukla PK., 1982. Text Book of preventive and social medicine. Barnasidas Bhanot Publ. SCN News, United Nations. System Forum on Nutrition. WHO.

SOFT CORE COURSES

DAIRY TECHNOLOGY

Course Outcome: **39 hr (13× 3 units)**

At the end of this course the students will be able to-

CO 1. Acquire the basic knowledge of developments in dairy industries.
CO 2. Comprehend the recent advances in processing of dairy products.
CO 3. Acquire the knowledge in manufacturing of different dairy products.
CO 4. Understand about types of dairy plants and working principles of dairy instruments.
CO 5. Gain knowledge regarding hygiene and sanitation practices in the milk and milk products industry.

Unit I:

Dairy industry: Review of dairy development in India. Dairy industry in India and abroad. Co-operative dairying, Market survey; milk production & consumption pattern, national and global markets. Clean milk production & hygienic handling of raw milk. Milk collection/procurement and pricing. Recent developments in dairy sector: Dehydration, UHT processing, types of UHT plants, aseptic fillers, heat stability and deposit formation aspects, retort processing, use of bio-protective factors for preservation of raw milk and their effects on physicochemical, microbial and nutritional properties of milk and milk products. Packaging of dairy products.

Unit II:

Dairy products: Fluid milk: Full cream, standardized, toned & double toned milk, reconstituted, rehydrated and recombined milk, flavored milk. Traditional dairy products, Fat-rich dairy products, Heat and acid coagulated milk products, Cheese (types and manufacture process), value added dairy products, ice-cream and frozen desserts, imitation dairy products, By-products Technology (Processing and utilization of whey, ghee residue, casein – classification and applications).

Unit III:

Dairy Plant Management: Principles of dairy plant design, classification of dairy plants, Instrumentation and process control, microbial quality and safety in dairy industry, HACCP, GMP/GHP practices in dairy processing. Waste Disposal and Pollution Abatement, Current trends in cleaning and sanitization of dairy equipment.

REFERENCES

- Aneja R. P., Mathur, BN, Chandan RC, Banerjee AK. 2002. Technology of Indian Dairy Products. Dairy India Year book Publications, New Delhi.
- Gupta P. R., 1997. Dairy India, 5th Ed., New Delhi.
- Robinson R. K., 1994. Modern dairy Technology, 2nd Ed., Chapman and Hall, New York.
- Subbulaksmi G and Shobha A. Udipi, 2008. Food processing and preservation, New age international.
- D.B. Puranik, 2014. Dairy plant management, New India Publishing Agency.
- De Sukumar, 2001. Outlines of dairy: Technology, 1st edition, Oxford.

PRINCIPLES OF FOOD PROCESSING

39 Hrs (13× 3 units)

Course outcome:

At the end of this course the students will gain knowledge about the-

CO 1. Basic operation in food processing.
CO 2. Principles of cold processing of foods and irradiation
CO 3. Basic principles of thermal processing.
CO 4. Concept of controlled atmosphere packaging
CO 5. Interaction between packaging material and food

Unit I: Basic operation in food processing: Mixing, stirring, cooling, separation, evaporation, forming/moulding, processing of extruded products, rendering, refining, tempering, thawing, canning. Basic principles of cold processing of foods and irradiation: Refrigeration, freezing of foods, initial freezing point, freezing curve, changes during the freezing, rate of freezing, damage from intermittent thawing, factors affecting the freezing rate, freezer burn. Irradiation of foods – methods, safety aspects, regulations, food selection.

Unit II: Basic principles of thermal processing: Thermal food processing, canning, steps and process, heat penetration into cans**,** cold point in food mass, determination of process time, thermal death time determination, TDT curve. Heating food in containers, hydrostatic cooker or cooler, hot pack and hot fill, inoculated pack studies.

Unit III: Basic principles of post food processing operation: Controlled atmosphere, MAP (Modified atmospheric packaging), coating and enrobing, packaging materials specially designed for processed foods, advantages and disadvantages. Interaction between packaging material and food, aseptic processing and aseptic packaging.

REFERENCES

- Fabriani, G and Lintas C. 1988. Durum Wheat Chemistry and Technology, American Association of Cereals Chemistry Inc.
- Kent N L. 1993. Technology of Cereals., 4thed, Pergamon Press
- Olson, V M Shemwell G A and Pasch S. 1988. Egg and Poultry, Meat Processing
- Fellows P J. 2002. Food Processing Technology- Principles and Practices, 2nded. Woodhead Publishing Ltd.
- Potter N and Hotchkiss JH, 1998. Food Science, 5th Edi. AVI Book
- Manay NS &Shadaksharaswamy 1997. Food facts and principles: New Age Publ.
- Potty VH & Mulky MJ. 1993. Food processing, Oxford &IBH.
- Srilakshmi B. 2002. Nutrition Science, New Age Publ.
- Swaminathan MS. 1993. Food Science, New Age International

POST HARVEST TECHNOLOGY

39 Hr (13× 3units)

Course outcome:

At the end of this course the students will be able to-

CO 1. Describe post harvesting technology and the methods of harvesting
CO 2. Know about the post harvest handling and also various kinds of packaging.
CO 3. Identify the storage of food products and its challenges.
CO 4. Understand the control of wastage due to bad storage.
CO 5. Describe the types of food storage.

Unit I: Introduction to Post harvest technology: Definition, importance and scope of post harvest technology. Types of maturity of crop produces: Physiological maturity, horticultural maturity, harvest maturity, commercial maturity. Maturity indices and methods of determining maturity.

Unit II: Methods of harvesting and post harvest handling: Methods of harvesting. Good agricultural practices (GAP). Methods of post harvest handling: pre-cooling, washing, cleaning and trimming, sorting, grading and sizing, disinfection, post harvest treatment, curing, waxing, packaging and storage. Packaging materials.

Unit III: Storage of food products, challenges during storage and their control: Types of food storage, cold storage, controlled atmospheric storage. Storage pests: insect pests, spoilage microbes and other pests.

REFERENCES

- Frank A.P. 1987. The Technology of Food Preservation, AVI Publ.
- Frazier WC. 1988. Modern processing, packaging and distribution system for foods, AVI Van nonstand Reinhold Co.
- McWilliams M. 1993. Food Microbiology. Tata McGraw Hill
- Potty VH &Mulky MJ. 1993. Foods - Experimental perspectives, Macmillan
- Srilakshmi B. 2001. Food processing, Oxford &IBH
- Swaminathan MS. 1993. Food Science, New Age International.

FUNCTIONAL FOODS

39 Hr (13× 3 units)

Course outcome:

At the end of this course the students will understand-

CO 1. Nutraceutical composition
CO 2. Regulatory issues related to nutraceuticals
CO 3. Role of functional foods and its impact on health.
CO 4. The benefits and role played by nutraceuticals in treating various diseases.

Unit I: Introduction to nutraceuticals: Definitions, synonymous terms, basis of claims for a compound as a nutraceutical, regulatory issues for nutraceuticals including FSSAI, CODEX/USFDA, labelling issues. Use of nutraceuticals in traditional health sciences. Role in preventing/controlling diseases.

Unit II: Functional foods: Definition, functional components, types of functional foods, development of functional foods, prebiotics and probiotics – usefulness of probiotics and prebiotics in gastrointestinal health and other benefits. Synbiotics, bioactive peptides and polyphenols.

Unit III: Role of nutraceuticals/functional foods: Benefits of specific nutraceuticals in cardiovascular diseases, cancer, diabetes, cholesterol management, obesity, immune enhancement, age-related macular degeneration, endurance performance, peri-menopausal syndrome – compounds and their mechanisms of action, contra-indications.

REFERENCES

- Brigelius-Flohé, J & Joos HG. 2006. Nutritional Genomics: Impact on Health and Disease. Wiley VCH.
- Cupp J & Tracy TS. 2003. Dietary Supplements: Toxicology and Clinical Pharmacology. Humana Press.
- Gibson GR & William CM. 2000. Functional Foods – Concept to Products.
- Goldberg I. 1994. Functional Foods: Designer Foods, Pharma Foods.
- Losso JN. 2007. Anti-angiogenic functional and medicinal Foods. CRC Press
- Neeser JR & German BJ. 2004. Bioprocesses and Biotechnology for Nutraceuticals. Chapman &Hall.
- Robert EC. 2006. Hand book of Nutraceuticals and Functional Foods. 2nd Ed.Wildman.
- Shi J. 2006. Functional Food Ingredients and Nutraceuticals: Processing Technologies. CRC Press.
- Webb GP. 2006. Dietary Supplements and Functional Foods. Blackwell Pub.

PRACTICALS

CLINICAL NUTRITION AND DIETETICS – I

Course outcome:

At the end of this course students will acquire the skills on-

CO 1. Estimation of the constituents of urine by quantitative and qualitative analysis
CO 2. Calculating the nutritional requirements of various diseases and abnormality.
CO 3. Planning and preparing various therapeutic diets

- Quantitative test – Urine analysis – Creatinine, Urea, Sugar
- Dietary management for the following conditions: Fever; Diarrhoea; Underweight; Obesity; Peptic ulcer, Constipation, Diabetes mellitus, Burns
- Maintaining a ready reckoner of samples prepared in the lab

COMMUNITY NUTRITION AND STATISTICS

Course outcome:

At the end of this course students will be able to-

CO 1. Write down the different methods of nutritional status assessment.
CO 2. Plan and conduct diet survey in a community
CO 3. organize nutrition education programs in the community
CO 4. Plan and prepare low cost menu for the community.
CO 5. Apply statistical methods and interpret results.

1. Assessment of nutritional status in the community
2. Planning and conducting diet survey in a community (different age groups and socioeconomic status)
3. Planning and organizing nutrition education programs in the community
4. low cost menu planning
5. Processing of data – data entry using statistical package and formulation of tables
6. Application of statistical methods- frequency distribution table, mean, SD, t-test and chi-square
7. Interpretation of results and preparation of reports using different graphical and tabular presentation

DAIRY TECHNOLOGY

Course outcome:

At the end of this course students will acquire skills in-

CO 1. Perform the basic milk platform tests and quality tests.
CO 2. Determine the chemical constituents of the milk.
CO 3. Prepare and analyze the quality of various dairy products.
CO 4. Utilize the dairy by-products in development of new food products
CO 5. Understand the working process of dairy industries.

1. Rapid tests for evaluation of milk quality- Clot on boiling test, alcohol test, alizarin alcohol test, phosphatase, acidity, turbidity
2. Chemical analysis of milk and determination of its components like fat, SNF, protein and TSS.
3. Preparation and quality evaluation of milk products: Heat desiccated/ Heat - acid coagulated milk products, cultured milk products, Fat rich products, Puddings/desserts.
4. By product utilization experiments (Whey and ghee residue)
5. Visit to dairy plant.

PRINCIPLES OF FOOD PROCESSING

Course outcome:

At the end of this course students will be skilled in-

CO 1. Several techniques in food processing and physical, chemical and nutritional changes during freezing.

CO 2. Know about processes such as freezing and thawing and also the changes occurring in these processes.

CO 3. Comprehend effects of physical and chemical changes during processing and also the nutritional loss occurred.

CO 4. Identify the loss during processing and also the techniques to minimize the loss

1. Determination of physical and chemical changes during freezing
2. Nutritional changes of food during food processing
3. Determination of changes occurring at the time of thawing
4. Estimation of freezing point of different solids/ liquid and semi solid foods
5. Physical changes during the evaporation and drying

POST HARVEST TECHNOLOGY

Course outcome:

At the end of this course students will be able to-

CO 1. Describe the grading and post harvest processing of seasonal fruits and vegetables.

CO 2. Write about storage pests and methods to overcome the wastage.

CO 3. Identify the importance of different packaging materials.

CO 4. List out different types of microorganisms responsible for food spoilage and steps to overcome it.

1. Grading of seasonal fruits and vegetables
2. Post harvest processing of fruit/vegetable
3. Study on storage pests/spoilage of selected food sample
4. Study on Total Soluble Solids of different fruits
5. Study of different post harvest spoilage microbes of fruits and vegetables
6. Waxing of fruits
7. Study of different packaging materials

FNP 512 FUNCTIONAL FOODS

Course outcome:

At the end of this course students will be able to-

CO 1. Describe functional food and its role in treating diseases.

CO 2. Estimate the secondary metabolites produced by the plant sources using laboratory techniques.

CO 3. Identify the process of development of probiotic and prebiotic food product.

CO 4. List out the naturally occurring phytochemicals and also their quantification in food.

1. Anti-oxidant content in kokum and different tea infusions
2. Estimation of polyphenols in kokum and different tea infusions
3. Development of a probiotic yoghurt
4. Development of a prebiotic food product
5. Survey of intake of functional foods by patients suffering from non-communicable disorders

OPEN ELECTIVES

NUTRITION FOR HEALTH

39 Hr (13× 3 units)

Course outcome:

At the end of this course students will be able to-

CO 1. Describe the importance of macro and micro nutrients its importance in human body
CO 2. Understand the nutritional requirement and challenges of differ age groups through life cycle.
CO 3. Write down the role nutrition played during pregnancy and lactation.
CO 4. Describe the physiological changes which take place through lifecycle

Unit I: Functions, requirements, sources and deficiency of macro- and micro-nutrients

Unit II: Nutrition during early years: Physical growth and maturation. Monitoring of growth chart. Pediatric formula preparation. Nutrition and dietary guidelines during Infancy, Pre-school and School-going children. Childhood Obesity and eating disorders.

Unit III: Dietary guidelines and nutrition in adolescence. Women and nutrition: nutrition during pregnancy and lactation. Nutritional needs of the elderly. Nutrition for athletes.

REFERENCES

- Ashworth A., et.al. 2008. Growth monitoring and promotion: review of impact. Maternal and child nutrition 4, pp. 86-117
- World Health Organization Growth Standards: British Columbia Training Manual: June 2011
- Growth monitoring and promotion: intervention or platform for action: UNICEF: 35th SCN Session WG Breastfeeding and Complementary Feeding: http://www.unsystem.org/SCN/Publications/AnnualMeeting/SCN/35/wgbfcf/Nune%20MANGASARYAN.pdf
- Rolfes Sharon D., Linda K. Debruyne and EN Whitney. 1997. Life Span Nutrition:
- Rolfes S.R. et.al., 2009. Understanding Normal and Clinical Nutrition, Thomson Wadsworth
- Mahan L. Kathleen &Slyvia Escott-Stump, 1996. Krause's Food & Nutrition Therapy
- Wardlaw Gordon M. 1995. Perspectives in Nutrition

DIET AND DISEASE

39 hrs (13 x 3 units)

Course outcome:

At the end of this course students will acquire knowledge about-

CO 1. Basic concepts and dietary approaches in obesity.
CO 2. Dietary management in diabetes and hypertension.
CO 3. Identifying the risk complications in gastro intestinal health
CO 4. Etiology and pathophysiology of kidney and liver diseases
CO 5. The main causes of cancer and its dietary management

Unit I: Obesity- classification, causative factors (behavioral risk factors), overview of approaches to treatments and interventions. Diabetes- Etiology, symptoms, classification, early diagnosis, Short term and long term complications and management. Cardiovascular disease - etiology, incidence, symptoms, risk factors, congestive heart failure and Dietary management. Hypertension- types, symptoms and role of minerals in the diet

Unit II: Gastrointestinal diseases/disorders – Gastritis, Peptic ulcer and duodenal ulcers. Diagnostic, diarrhoea, constipation, diverticular disease and Irritable Bowel Disorder. Diseases of Liver, Gall bladder & Pancreas - Hepatitis, (A, B, and C), Cirrhosis, effect of alcohol on liver, Gall stones, pancreatitis-Causes, symptoms and dietary management.

Unit III: Renal disease - Nephrotic syndrome, Acute and Chronic renal failure principles of dietary management. Dialysis- types. Cancer – Types and dietary management

REFERENCES

- Rolfes and Whiney. 2009. Understanding normal and clinical nutrition
- Katz, David L., Friedman, Rachel S.C., 2014. Nutrition in clinical practice: A comprehensive, evidence-based manual for the practitioner, 2nd Edition.
- Width M, Reinhard T, 2008. Clinical Dietitian's Essential Pocket Guide, The Essential Pocket Guide, 1st Edition
- Robinson and Lawler, 1990. Normal and therapeutic nutrition, Pearson
- Srilakshmi, B. 2003. Dietetics. New Age International Publisher

IV SEMESTER
HARD CORE COURSES
CLINICAL NUTRITION AND DIETETICS – II

52Hr (13× 4 units)

Course outcome:

At the end of this course students will be acquiring knowledge about-

CO 1. Basic concepts and interrelation between food and liver health.
CO 2. Various types of renal diseases and its dietary treatments.
CO 3. Process of dialysis and its role in renal disease.
CO 4. Etiology and pathophysiology of Cardiovascular diseases.
CO 5. The concept of dietary management in cancer and inborn errors of metabolism.

Unit I: Liver disorders - Functions of liver, agents for liver damage, fatty liver, effect of alcohol on liver, hepatitis, cirrhosis, hepatic encephalopathy, hepatic coma – Etiology, dietary modifications and MNT. Pancreas disorders: pancreatitis (acute and chronic) – Etiology, symptoms, dietary modifications and MNT. Gall bladder disorders: Cholelithiasis, cholecystitis - – Etiology, symptoms, dietary modifications and MNT.

Unit II: Renal disorders - Functions of kidney, glomerulonephritis, nephritic syndrome, acute and chronic renal failure, dialysis, urolithiasis, uremia, urinary tract infections - – Etiology, symptoms, dietary modifications and MNT.

Unit III: Cardiovascular disorders - Clinical effects and risk factors, role of fat in the development of atherosclerosis, Etiology, symptoms, nutritional management for myocardial infarction, congestive heart failure, hyperlipoproteinemia, hypercholesterolemia, hypertension: types, symptoms and role of minerals in diet. DASH diet.

Unit IV: Cancer and other disorders - Risk factors and symptoms, nutritional problem of cancer therapy, dietary management and nutritional requirement, role of food in etiology and prevention of cancer, eating problems in cancer and nutritional therapy, MNT. Physiological changes and dietary management of AIDS. Inborn errors of metabolism: causes, consequences and dietary management of phenyl ketonuria, fructosemia, galactosemia, maple syrup urine disease.

REFERENCES

- Robinson C. H., 1990. Normal and Therapeutic nutrition, Oxford & IBH Publishing Co. Calcutta.
- Bedi Y. P., 1962. Public Health and Hygiene, Atmaram& sons, Kashmere gate, Delhi.
- Bamji, M. S., P. N Rao & Reddy, 2002. Textbook of Human Nutrition, Oxford & IBH Publ. Co.
- Williams SR, Worthington, RS. 1988. Worthington, Introduction to Nutrition throughout the lifecycle
- Gopalan C., 1987. Combating under Nutrition – Basic issues & Practical Approaches, NFI Publications.
- Garrow, J. S., James, W. P.T and Raiph, A. 2000. Human Nutrition and Dietetics, 10thed., Churchill Livingstone
- Mahan, L. K and Escott Stump. S. 2008. Kraus's Food &Nutrition Therapy 12thEd. Saunders- Elsevier
- Anderson L., Dibble, Turkki PR, Mitchell HS & Rynbergen HJ. 1982. Nutrition in Health and Disease. Saunders-Elsevier

- Khader V, Sumathi A & Manorama R. 1998. Clinical Nutrition. Hober Medical Division.
- JB Lippincott, Bamji, M. S., P. N Rao & Reddy, 1999 Textbook of Human Nutrition, Oxford & IBH, FAO/WHO/UNU1985.
- Swaminathan MS. 1985. Modern Nutrition in Health and Disease, Williams &Wilkins
- Shills ME, Olson JA, Shike M & Ross AC. 1999. Normal and therapeutic nutrition. Macmillan.
- Shill ME & Young VR. 1962. Normal and therapeutic nutrition. 17thEd. Macmillan Publishing Co. Modern Nutrition in Health & Disease 7thEd.
- Stanfield PS, Lea & Febiger, Hui YH 1993. American Dietetics Association

FOOD PRESERVATION

52 Hr (13×4 units)

Course outcome:

At the end of this course students will be able to-

CO 1. Describe different processing and food preservation techniques based on different food materials like low temperature processing, high temperature processing, irradiation, preservation by chemicals and high concentration.

CO 2. List different food processing techniques, various methods used to preserve foods and factors influencing the shelf-life of the food products.

CO 3. Know the different packaging techniques used for food packaging and also effects of different processing techniques on palatability and nutritive value of food.

CO 4. Understand the basic principles of different preservation methods.

CO 5. List down the chemicals used in food preservation and its limitations.

Unit I: Low temperature processing and storage - Chilling, cryogenic chilling, chill storage, freezing, cryogenic freezing, frozen food storage, freeze drying, changes in food during freezing, various types of freezers (tunnel types, fluidized bed, airblast etc.)

Unit II: High temperature processing - Drying , dehydration, solar drying, mechanical driers, heat processing using hot oil (frying, shallow frying, deep fat frying), heat sterilization, pasteurization and its types and advantages, heat processing using hot air, baking, effect of heat on foods (texture, flavor, aroma, colour and nutritive value).

Unit III: Irradiation - Irradiation of foods, types and sources of irradiation, effects or impacts of radiation on foods constituents, hurdle technology, irradiation of packaging material, methods of application of irradiation on foods, dosimetry, health consequence of irradiated food.

Unit IV: Preservation by chemicals and high concentration - Types and mode of action of organic and inorganic preservatives, antibiotics, antioxidants, anti-browning, cleaning, sanitizing and fungicidal agents. Sugar concentrates- general principles and methods of preparation of jam, jellies and marmalade, crystallized and glazed fruits, preserves, squashes and syrups. Theory of gel formation. Salt concentrates- general principle, role of ingredients, preparation of sauerkraut, dill and common Indian pickles.

REFERENCES

- Fenema 1975. Principles of Food preservation Vol I and II,
- Desrosier N W & JN Desrosier, 1977. The Technology of Food Preservation, AVI Publication
- Potty VH. & B M J Mulki 1993. Food Processing, Oxford & IBH Publications
- Swaminathan MS 1979. Food Science & Experimental Foods, Ganesh &Co
- Srilakshmi B, 2003. Food Science, New Age International publication
- Frank AP. 1987. Modern Processing, Packaging & Distribution System for Food, AVI Vannonst and Reinhold.co.

SOFT CORE COURSES
FOOD FORTIFICATION

39 Hr (13× 3 units)

Course outcome:

At the end of this course students will be able to-

CO 1. Describe the basic principles of food fortifications and its needs.
CO 2. List the characteristics of fortificants and fortification methods.
CO 3. Describe design of fortification and about different fortification methods.
CO 4. Know the effect of cooking on fortified foods

Unit I: Food fortification – Needs, objectives, principles and rationale, selection and basis of fortificants. Types of fortification. Health benefits of fortification, Selection of nutrients for fortification, Levels to be added, Characteristics of fortificants and method of fortification. Technology of fortifying cereal products: Fortification methods. Fortification premixes, Design and composition of premixes and quality control. Fortification of bread, pasta, noodles, biscuits, and breakfast cereals.

Unit II: Micronutrient fortification of snack products, merits and demerits of fortification, choice of products and selection of micronutrients, Setting level of fortification, Safety limits, Technological and cost limits, Challenges in fortifying snack products, Nutrient interaction and bioavailability.

Unit III: Other special fortified products - salt, sugars, milk and oils: Salt: Technology of fortifying salt with iron and iodine, Iodine stability and quality of double fortified salt, Safety issues, Levels to be added. Sugars: Fortification with iron and vitamin A, Premix formulation, Fortification level, Packaging. Milk: Fortification with vitamin A, technology and levels. Oils: Fortification with vitamin A, Rationale of vitamin A fortification, Stability of vitamin A in oil during storage and cooking, Effects of frying on Vitamin A content, Efficacy and safety of vitamin A added to oil, Technology of fortifying, Packaging.

REFERENCES

- Lindsay Allen, Bruno de Benoist, Omar Dary and Richard Hurrell (Eds.) 2006. Guidelines on food fortification with micronutrients: World Health Organization and Food and Agriculture Organization of the United Nations
- Stakeholder consultation on Regulation for staple food Fortification: 15 April 2011: National Institute of Nutrition and Indian Council of Medical Research, Hyderabad, working paper
- www.who.int/nutrition/.../guide_food_fortification_mirconutrients.pdf
- PATH: Ultra Rice technology. http://www.path.org/projects/ultra_rice.phd [Accessed February 25,2011]
- www.a2zproject.org/node/10
- www.fortaf.org

SPORTS NUTRITION

39 Hr (13× 3 units)

Course outcome:

At the end of this course students will be able to-

CO 1. Describe nutrition, exercise, physical fitness and their interrelationship.
CO 2. List the importance of nutrition and diet in different sports.
CO 3. Describe importance of different macro- and micro- nutrients in pre- and post-exercise.
CO 4. Explain the nutrition requirements of exercise, ideal body composition for different sports and events, nutrition in sports and also about dietary supplements and ergogenic aids.

Unit I: Approaches to the management of fitness and health: Nutrition, exercise, physical fitness and health- their inter relationship. Significance of physical fitness and nutrition in prevention and management of weight control regimes. Ideal body composition for different sports and events. Nutritional guidelines for maintenance of health and fitness.

Unit II: Nutritional requirements of exercise: Effect of specific nutrients on work performance and physical fitness. Nutrients that support physical activity, Mobilization of fuel stores during exercise. Fluid, carbohydrate and electrolyte requirements and balance. Nutrition in sports: Sports specific requirements- Importance of carbohydrate loading, pre game and post game meals, Diets for persons with high energy requirements, stress fracture and injury.

Unit III: Dietary supplements and Ergogenic aids: Definitions, Use of different nutragenic / ergogenic aids and commercial supplements, Sports drinks, sports bars etc. Guidelines for selection of ergogenic aids. Ill effects of soft and energy drinks, processed foods, energy food and drinks, alcohol and its abuse, drugs and rehabilitation techniques and its nutrition requirements.

REFERENCES

- Falkner F & Tanner JM. 1978 Human Growth - Principles and Prenatal Growth. vol. I. Bailliere Tindall.
- Falkner F & Tanner JM. 1980 Nutrition - An Integrated Approach. John Wiley & Sons. Passmore R & Eastwood MA. 1986. Human Growth Methodology. Ecological, Genetic, and Nutritional Effects on Growth. Vol. III. Plenum Press
- Pike RL & Brown ML. 1988. Human Nutrition and Dietetics. ELBS Churchill Livingstone.

FOOD SERVICE MANAGEMENT

Course Outcome: **39hr (13× 3 units)**

At the end of this course students will be able to-

CO 1. To create an awareness on the organizational aspect and functioning of different types of food service institutions.
CO 2. To develop managerial skills among the students.
CO 3. To understand the space allocation and arrangement of food service units.

Unit I:

History and Development of food service establishment. Factors affecting development, recent trends, Types of food service establishment.

Approaches to management: - Theories of management, principles and aspects of management and management tools. Entrepreneurship and Food service Management Conceptual perspective of entrepreneurship, creativity and innovation, Business requirements for food products, Entrepreneurship development and training.

Unit II:

Personnel Management: - Staff planning and Management, Employment process, staff recruitment and selection, placement and training, employee laws, trade unions and negotiations, leadership, formal relationships and duties, work design, work measurement in food service operations.

Food Management: - Menu – Planning, purchase and storage, Quality food production, planning and control, kitchen production, records and control, delivery and service styles, types of food service systems.

Unit III:

Kitchen layout and equipment: - Steps in planning and layouts. Determining equipment selection and placement, maintenance of equipment.

Sanitation and safety: - Plant sanitation and safety, considerations necessary for an efficient cleaning programme, Post cleaning care and cleaning premises and surroundings. The 3 E's of safety, standards, Policies and schedules, Microbiology and food safety, food borne illness, Modes of Disease transmission, Food spoilage, importance of pest control, Hygienic food handling.

REFERENCES

- Sethi. M. 2004. Institutional food management. New Age International Publishers, New Delhi.
- Bali P. S. 2021. Food production operations, 3rd Ed., OUP, India
- Sethi, M. and Malhan, S. 1993. Catering management an integrated approach, 2nd Ed., New Age, International Publishers, New Delhi.
- Andrews S., 2017. Food and Beverage Management. McGraw Hill Education, New York.
- Payne-Palacio J & Theis M. 2019. Food service management: Principles and practices, 13th Ed., Pearson Education.

PRACTICALS

CLINICAL NUTRITION AND DIETETICS II

Course outcome:

At the end of this course students will acquire the skills to-

CO 1. Explain dietary management for different chronic disorders based on biochemical parameters and activity like mild, moderate and sedentary.
CO 2. Plan diet for various diseases by considering the biochemical parameters.
CO 3. Prepare planned diet and sensory evaluating it.
CO 4. Counsel the patients depending on their disease conditions.

1. Dietary management as per the biochemical parameters.
2. Planning and preparation of the diet for the following conditions: Hepatitis; Hepatic coma, Chronic pancreatitis; Chronic renal failure; Renal Glomerulonephritis; Atherosclerosis (fat restricted diet); hypercholesteremia; Hypertension; AIDS

FOOD PRESERVATION

Course outcome:

At the end of this course students will acquire the-

CO 1. Skill to use different food preservation techniques by employing techniques in product formulation and also analysis of the food product for its quality standards and shelf-life.
CO 2. Knowledge to understand main goal of this course is to provide students with fundamental knowledge of food preservation and shelf-life studies.
CO 3. Skills to work in food industry through practical knowledge and problem solving approach
CO 4. Skills in preparing different food products like jams, jelly, pickling, tomato ketchup and many more by following different preservation techniques like drying methods, preservation with sugar, salt, oil and chemicals.

1. Food preservation techniques (different methods and analysis of food products for quality standards).
2. Preservation of fruits and vegetables by various methods – pickling, high concentration, freezing
3. Sun drying and dehydration-cereals, legumes, vegetables, fruits.
4. Preservation with sugar-jams, jelly, preserves
5. Preservation with salt, oil, vinegar – pickling.
6. Preservation of foods using chemicals –tomato ketchup, squash.

PROJECT WORK /INTERNSHIP

Course Outcomes:

After successful completion of the course, students will be able to:

CO 1. Carry out a research/data-based study - select a problem, frame the objectives, conduct literature review, tabulate, represent and interpret the results.
CO 2. Collection samples/data/carry out questionnaire-based surveys in clinics/hospitals/ community
CO 3. Apply research methodologies, techniques and tools to conduct lab/industry-based work
CO 4. Write the dissertation, present and interpret the data scientifically.
CO 5. Build up the capacity to carry out an independent research project.
CO 6. Get skilled to be appointed based on work carried out.

I/II /III/ IV Semester M.Sc. Degree (CBCS) Examination, Month, Year
FOOD SCIENCE AND NUTRITION
FNH: / FNS: / FNE:

Time: 3 Hours Max. Marks: 70

1. Write short notes on **any five** of the following: **(5x3=15)**

a)

b)

c)

d)

e)

f)

g)

h)

2. Write explanatory notes on **any five** of the following: **(5x5=25)**

a)

b)

c)

d)

e)

f)

g)

h)

3. Answer **any three** of the following: **(3x10=30)**

a)

b)

c)

d)

e)

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