VIDYASAGR UNIVERSITY

MIDNAPORE – 721 102
WEST BENGAL

Syllabus for M.Sc. Programme (NEP 2020)

In

Food Science & Nutrition

With effect from 2025-26

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Preamble

Post-graduate (M. Sc.) teaching of Food Science & Nutrition in Midnapore City College under Vidyasagar University was initiated in the year 2018. The Department is now well established, with four sanctioned faculty strengths. Extramural grants from ICMR, Govt of India as well as intramural grants from the Institute, have strengthened the Department's research. The infrastructure facility of this department is quite good. Neat and clean lecture gallery, laboratory rooms, instrument room, faculty rooms and a big computer laboratory facility fulfil up-to-date standards of this department. The M.Sc. in Food Science & Nutrition programme offered by the University is two years' duration and is divided into four semesters. The courses are assigned credits on the basis of teaching hours, which in turn is linked to course content and structure. The various courses of the programme are designed to include classroom teaching and lectures, laboratory work, project work, seminars, community and industrial survey.

Program Outcomes (POs)

Post Graduates (M. Sc.) students after completion of the program will be able to achieve:

1. Acquired knowledge for the solution of complex natural and personal problems.

2. Attend profound knowledge to Identify, formulate, review research literature, and analyse complex problems reaching substantiated conclusions.

3. Nutrition and Dietetics provides concepts related to human nutrition and helps you become an effective learner and practitioner in all fields of dietetic practice.

4. The course also gives you the opportunity to develop advanced skills in the design and implementation of research in the field of human nutrition and dietetics.

5. It is designed to impart advanced knowledge and skills that is life oriented, career and community oriented.

6. It has special relevance to industry and hospital application with the help of weekly field work, rural camp and hospital/industry internship programme Demonstrate high-level disciplinary skills and knowledge, ensuring work readiness for employment in a diverse range of nutrition and dietetics environments, including entrepreneurial endeavours.

7. Critically analyse and solve problems by gathering, synthesising and evaluating information from a range of sources, including the use of big data, and apply evidence-based approaches to the practice of nutrition and dietetics for individuals, populations and in food service management.

8. Translate leading-edge food and nutrition science into practical recommendations to promote health and wellbeing for individuals, groups and populations by changing knowledge, skills, attitudes and behaviours.

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9. Effectively communicate science, nutrition and dietetics, using a variety of communication media including digital technologies and social marketing, to positively influence health outcomes.

10. Demonstrate professionalism, life-long learning, commitment to quality improvement, ethical practice, effective collaboration and teamwork across interdisciplinary settings.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1. Understand the concepts of biochemistry, food chemistry and food microbiology

PSO2. Comprehend methods of assessing human nutritional requirements, nutritional assessment and diet planning

PSO3: Apply theoretical concepts in laboratory setting as per standard methods in the above mentioned areas

PSO4: Understand the applications of nutritional sciences in clinical interventions, communication for health promotion, food service management, food science and processing

PSO5: To equip students to plan diets for clinical and therapeutic conditions within a hospital, fitness center or gym setting.

PSO6: To impart students a systematic approach to basic and applied aspects of food processing and technology.

PSO7: To provide students with an opportunity to conduct independent research

PSO8: Effectively interact with Aboriginal and Torres Strait Islander peoples, and people across diverse cultures through appreciation of cultural values and beliefs surrounding food and diet.

PSO9. Advocate on behalf of individuals, groups and communities to inspire and positively influence the wider political, social and commercial environment that underpin food systems and the practice of nutrition and dietetics.

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Course Structure
for
M. Sc in Food Science & Nutrition

FIRST SEMESTER

Course code	Course	Course Content	Credits	Marks	No of Hours	Credit (L-T-P)
FSNC401X1	DSC 1T	Biostatistics & Bioinformatics	2	25(T20+IA5)	20	2 (2-0-0)
FSNC402X1	DSC 2T	Applied Physiology	2	25(T20+IA5)	20	2 (2-0-0)
FSNC403X1	DSC 3T	Functional foods, nutraceuticals and oxidative stress management	4	50 (T40+IA10)	40	4(4-0-0)
FSNE404A1	DSE 1T	Food Product Development and Evaluation	4	50 (T40+IA10)	40	4(4-0-0)
FSNE404B1	DSE 1T	Environmental and Occupational Health	4	50 (T40+IA10)	40	4(4-0-0)
FSNE405A1	DSE 2T	Advances in Food Processing	2	25(T20+IA5)	20	2 (2-0-0)
FSNE405B1	DSE 2T	Dairy Technology	2	25(T20+IA5)	20	2 (2-0-0)
FSNC401X8	DSC 1P	Biostatistics & Bioinformatics	2	25(P25)	20	2 (0-0-2)
FSNC402X8	DSC 2P	Applied Physiology	2	25(P25)	20	2 (0-0-2)
FSNE405A8	DSE 2P	Advances in Food Processing	2	25 (P25)	20	2 (0-0-2)
FSNE405B8	DSE 2P	Dairy Technology	2	25 (P25)	20	2 (0-0-2)
FSNO406VC	Com 1	Indian Knowledge System (IKS)	2	25 (T20 + IA5)	20	2 (2-0-0)
FSNO407NC	Com 2	Vidyasagar: Life and Philosophy	Compulsory Non-Credit Course			
		TOTAL		**275**		

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SECOND SEMESTER

Course code	Course	Course Content	Credits	Marks	No of Hours	Credit (L-T-P)
FSNC451X0	DSC 4T	Research Methodology	4	50(T40+IA10)	40	4(4-0-0)
FSNC452X1	DSC 5T	Therapeutic Nutrition	2	25(T20+IA5)	20	2(2-0-0)
FSNE453A1	DSE 3T	Techniques in Molecular Nutrition	2	25(T20+IA5)	20	2(2-0-0)
FSNE453B1	DSE3T	Advance Human Nutrition	2	25(T20+IA5)	20	2(2-0-0)
FSNE454A0	DSE 4T	SDGs in relation to Nutrition	4	50(T40+IA10)	40	4(4-0-0)
FSNE454B0	DSE 4T	Food Hygiene and Sanitation	4	50(T40+IA10)	40	4(4-0-0)
FSNE455A1	DSE 5T	Concept of Smart Food	2	25(T20+IA5)	20	2(2-0-0)
FSNE455B1	DSE 5T	Nutrition counselling	2	25(T20+IA5)	20	2(2-0-0)
FSNC452X8	DSC 5P	Therapeutic Nutrition	2	25(P25)	20	2(0-0-2)
FSNE453A8	DSE 3P	Techniques in Molecular Nutrition	2	25(P25)	20	2(0-0-2)
FSNE453B8	DSE 3P	Advanced Human Nutrition	2	25(P25)	20	2(0-0-2)
FSNE455A8	DSE 5P	Concept of Smart Food	2	25 (P25)	20	2(0-0-2)
FSNE455B8	DSE 5P	Nutrition counselling	2	25 (P25)	20	2(0-0-2)
FSNE456X9	FV	Organic Farm Visit/ Research Institute Visit/ Food Industry Visit	2	25(P25)	20	2 (0-0-2)
		TOTAL		**275**		

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THIRD SEMESTER

Course code	Course	Course Content	Credits	Marks	No of Hours	Credit (L-T-P)
FSNC 501X1	DSC 6T	Food Microbiology	2	25(T20+IA5)	20	2(2-0-0)
FSNC 502X1	DSC 7T	Food Items and its Constituents	2	25(T20+IA5)	20	2(2-0-0)
FSNC 503X0	DSC 8T	Health Modulating Nutrients	4	50(T40+IA10)	40	4(4-0-0)
FSNC 504X1	DSC 9T	Drug and nutrient interaction	2	25(T20+IA5)	20	2(2-0-0)
FSNC 501X8	DSC 6P	Food microbiology	2	25(T20+IA5)	20	2(0-0-2)
FSNC 502X8	DSC 7P	Food Items and its Constituents	2	25(P25)	20	2 (0-0-2)
FSNC 504X8	DSC 9P	Drug and nutrient interaction	2	25(P25)	20	2(0-0-2)
FSNO 505	**MOOCs**		4	50		
FSNO 506	**SS/CV**	Community Out-reach Program and Report Submission	2	25(P25)	20	2 (0-0-2)
		TOTAL	**22**	**275**		

FOURTH SEMESTER

Course code	Course	Course Content	Credits	Marks	No of Hours	Credit (L-T-P)
FSNC 551X0	DSC 10T	Genetically Modified Foods and Food Toxicology	4	50(T40+IA10)	40	4(4-0-0)
FSNC 552X0	DSC 11T	Nutritional genomics, Proteomics, & foodomics,	2	25(T20+IA5)	20	2(2-0-0)
FSNC 553X0	DSC 12T	Food Standards and Entrepreneurship Development	2	25(T20+IA5)	20	2(2-0-0)
FSNC 554	RP/D	Project Work	8	100 (P100)	80	8 (0-0-8)
FSNC 555	Start-up Proposal	Research/ Start-up Proposal Design	4	50 (P50)	40	4(0-0-4)
FSNC 556	SEC	Internship Training	2	25(P25)	20	2(0-0-2)
		TOTAL	**22**	**275**		

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FIRST SEMESTER

FSNC401X1 DSC 1T BIOSTATISTICS & BIOINFORMATICS

Course Outcome (COs):

CO 1: Students can analyze and interpret biological and health data using modern statistical methods.

CO 2: Students can apply both descriptive statistics (like mean, median, and standard deviation) and inferential statistics to analyze complex datasets.

CO 3: Students can introduce statistical methods and their applications in biological sciences**.**

CO 4: Students can represent data effectively through various graphs and diagrams, such as bar charts, histograms, and scatter plots.

CO 5: Students can explain descriptive and inferential statistical tools and apply them to biological data.

CO 6: Students can use use bioinformatics databases and algorithms (FASTA, BLAST) for sequence analysis.

Course content:

1. **Presentation of data**: Idea of statistical graphics
2. **Statistics of dispersion:** range, mean deviation, standard deviation and error, variance
3. **Characteristics of distributions:** probability distribution, normal distribution, skewness, kurtosis
   Mean median, mode and percentile and percentile rank
4. **Testing hypotheses:** Null Hypothesis, levels of significance, error of inference and computation of Z scores
5. **Test for Parametric and non parametric tests of difference between means:** t-test, ANOVA test
   Wilcoxon composite ranksum test, Chi square test, Correlation and Regression
6. **Basics of computer:** Generations of computer and types of computer b) computer hardware – CPU, Peripherals devices, computer memory, Computer software: system software, application software, Basic idea on Operating systems and Computer Languages, software,
7. **Basic idea of Word processing and data management**
8. **Concept of internet** – components, uses. WWW, browsing, Searching nutritional information
9. **Basic Bioinformatics** – Introduction to bioinformatics, its importance and scope, Biological databases, primary and secondary sequence databases, Genbank, EMBL, PDB.
   Current advancements in bioinformatics: Bbioinformatics, Cheminformatics, Immunoinformatics.

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Sequence-based Database Searches: what are sequence-based database searches, BLAST, FASTA and algorithms.

FSNC402X1 DSC 2T APPLIED PHYSIOLOGY

Course Outcomes (COs):

CO 1: Students can learn about the physiological systems and functions and their regulation in human body

CO 2: Students can able to identify different physiological changes occur due to any type of physical illness.

Course Content:

1. Biological membranes: Membrane receptors, fundamentals of signal transduction.

2. Digestive system: Secretory, Digestive and Absorptive functions - Role of liver, pancreas and gall bladder and their dysfunction - Motility and hormones of GIT. Regulation of food intake – role of hunger and satiety centres, effect of nutrients.

3. Nervous System: Review of structure and function of neuron - conduction of nerve impulse, synapses, and role of neurotransmitters - Gastro intestinal reflexes

4. Endocrine system: Hormones on carbohydrates, protein, fat metabolism

5. Respiratory system: Review of structure and function. Role of lungs in the exchange of gases. Transport of oxygen and CO2. Buffer systems. Cardio-respiratory response to exercise and physiological effects of training.

6. Circulatory and Cardio Vascular system: Blood - formation, composition, clotting and haemostasis. Formation and function of plasma proteins. Erythropoiesis. Blood groups and histocompatibility. Blood indices - Use of blood for investigation and diagnosis of specific disorders, Structure and function of heart and blood vessels - Regulation of cardiac output and blood pressure, heart failure, hypertension.

7. Excretory system: Structure and function of nephron - Urine formation - Role of kidney in maintaining pH of blood -Water, electrolyte and acid base balance – diuretics. Endocrine role of Kidney**.**

8. Immune system: Cell mediated and humeral Immunity - Activation of WBC and production of antibodies. Role in inflammation and defence, Autoimmunity, Immunodeficiency, Hypersensitivity, Structure of Ab.

FSNC403X1 DSC 3T FUNCTIONAL FOODS, NUTRACEUTICALS AND OXIDATIVE STRESS MANAGEMENT

Course Outcomes (COs):

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CO 1: Students will be able to know about sources and application of functional foods and nutraceuticals and can apply them for improving health condition of the community.

CO 2: Students will acquire knowledge on the uses of nutraceuticals for the management and treatment of different diseases.

CO 3: Students will gain knowledge on the several plant based bioactive compounds and their role for health promotion and prevention of illnesses.

CO 4: Students can provide information on the uses of functional foods, sources of antinutritional substances in foods, oxidative stress management using nutraceuticals to the community people.

Course content:

1. **Nutraceuticals:** a) Use of neutraceuticals in traditional health sciences. Their role in preventing /controlling diseases. B) Definition, classification, food and non food sources, mechanism of action. Role of Omega-3 fatty acids, carotenoids, dietary fiber, phytoestrogens; gulcosinolates; organosulphur compounds as neutraceuticals.
2. **Functional foods:** Definition, development of functional foods, benefits and sources of functional foods in Indian diet. Effects of processing conditions and storage. Development of biomarkers to indicate efficacy of functional ingredients.
3. **Development of nutraceutical and functional foods**: Standards for health claims. Process of developing - preclinical and clinical studies, marketing and regulatory issues.
4. **Other food components with potential health benefits:** Polyphenols: flavonoids, catechins is flavones tanning. Phytoesterogens, Phytosterols, Glucosinolates, Pigments: Lycopene, Curcumin etc. Organosulphur compounds, Other components – Phytates, Protease inhibitions, saponins, amylase inhibitions, haemagglutinins, active biodynamic principles, in spices, condiments and other plant materials.
5. **Probiotics and Symbiotics as functional foods**: Nutrient Vs. non nutrients, metabolism. Important features of probiotic microorganisms & prebiotic. Health effects of probiotics and prebiotics including mechanism of action, Probiotics in fermented milk product and non-milk products, Quality assurance of probiotics and safety.
6. **Oxidative stress management:** Oxidants and Free Radical Production, Detrimental Effects of Free Radicals on Human Health, Exogenous Antioxidants and management of oxidative stress, Role of Vitamin E, Vitamin C, Polyphenols, Flavonoids.

FSNE404A1 DSE 1T FOOD PRODUCT DEVELOPMENT AND EVALUATION

Course Outcomes (COs):

CO 1. Identify, categorize, and analyze major trends in product development.

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CO 2: Understand new products from consumer viewpoint, identify and assess "gaps" in the current and future food market.

CO 3: Develop a new food product from concept to prototype or pilot-scale production with inclusion of a critical analysis of the quality, safety, shelf-life, packaging, labelling and cost of the product.

CO 4: Understand the role of sensory and objective evaluation in product development, quality control, research in the food and other consumer industries.

CO 5 Apply the knowledge and skills acquired in sensory and objective evaluation of developed products.

Course content:

1. Introduction to food product development

New food products & food product development- Concepts, definitions & characteristics. Factors to consider for food product development (external and internal factors); Reasons for food product development- market concerns, consumer demands, societal changes, technological concerns, corporate influences, governmental influences; Types of new food products- Line extensions, "me toos", new to world products, innovative/creative products,

2. Stages in food product development

Idea generation - internal & external sources; Screening - Course Objectives and criterion; Development of product prototype- market research, concept testing approaches, product formulation and specification, product optimization, process development & optimization, product attributes, scale up requirements; Product prototype testing - consumer testing, packaging testing, shelf life testing, product integrity and conformance to standards; Marketing plans - price structure, place & distribution system, promotional program, market positioning, test marketing, results evaluation.

3. Concepts in sensory evaluation of foods

Sensory attributes of foods: Chemical senses (olfactory and gustatory); physical, kinesthetic and tactile senses (appearance, color, texture, & overall taste). Planning and conducting sensory evaluation: Physical setup for conducting sensory analysis; Panel development for sensory evaluation-selection and training; performance appraisal of panel. Preparation and presentation of samples; Score card development. Role of sensory analysis in product development & quality control.

4. Sensory evaluation methods

Subjective and objective methods- Definition, advantages and disadvantages. Correlation between sensory and instrumental data. Subjective tests: Analytical tests (sensitivity tests, difference tests, ranking tests), descriptive tests, consumer/ preference tests.

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FSNE404B1 DSE 1T ENVIRONMENTAL AND OCCUPATIONAL HEALTH

Course Outcomes (COs):

CO 1: Students will be able to understand the complications occur during any type of adverse environmental conditions.

CO 2: Students can understand the problems occur with different types of occupational activities.

CO 3: Students can identify the risk and assess them to minimize the complications associate with environmental and occupational hazards.

Course content:

1. **Fundamentals of Environment:**
   Concept, types and component of environment. Environmental Health. Effects of the environment on health. Global environmental Issues. Scope of Environmental Health.

2. **Environmental Factors and Human Health**:
   - Hygiene and sanitation: basic concept and different aspects of hygiene and sanitation. Interrelationship of hygiene, sanitation and health.
   - Housing: Criteria for healthful housing. Housing and health. Indicators of housing.
   - Food and nutrition: Interrelationship of food, nutrition and environment.
   - Transmission of diseases: Environmental factors and disease transmission.

3. **Environmental issues and Human Health**:
   - Water pollution: Contaminants of water and their effects on human health. Control of water pollution. Purification of water.
   - Air pollution: Sources of air pollution. Different types of air pollutants. Effects of air pollution on human health. Prevention and control of air pollution.
   - Noise pollution: Sources and properties of noise. Effects of noise exposure. Control of noise pollution.
   - Solid waste: Sources of solid waste. health hazards caused by solid waste. Methods of disposal.
   - Biomedical waste: Sources and types. Health hazards caused by biomedical waste. Treatment and disposal.
   - Industrial waste: Sources and types. Effects on environment and human health. Management and treatment.
   - Radioactive waste: Sources. Effects on environment and human health. Management of radioactive waste.
   - Global warming: Causes of global warming. Effects of global warming on environment. Measures to prevent global warming.

4. **Occupational Health**
   - Basic concept of occupational health: Meaning and importance of occupational health. Occupational environment and its impact on human health.
   - Occupational hazards: Physical, chemical, biological, mechanical and psychosocial hazards.
   - Occupational diseases: Pneumoconiosis (silicosis, asbestosis and farmer's lung), occupational cancer, occupational dermatitis. Prevention of occupational diseases.

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- Occupational safety: Key aspects and importance.

FSNE405A1 DSE 2T ADVANCES IN FOOD PROCESSING

Course Outcome (COs):

CO 1: A holistic and comprehensive view of the advances in food processing which will be instrumental in future for food industries.

CO 2: An in-depth understanding of the principles underlying the food processing techniques and applying them in solving food processing problems and product quality.

CO 3: Apply novel /innovative food technologies to design and improve products and processes.

CO 4: Design/develop/adapt and critically analyze scope and limitations of thermal and non- thermal processing methods in food processing.

Course content:

1. Concept and principle of food processing: Principles of food processing - physical and chemical principles. Emerging issues and sustainability in food processing. Importance and significance of microorganisms in food safety, intrinsic and extrinsic factors affecting the growth of micro-organisms in food. Protection and preservation of foods: Hurdle technology, chemical, modified atmosphere, irradiation, thermal and non-thermal techniques**.** Food dehydration and concentration: methods of drying and concentration, types of dryers, factors affecting drying process. Heat processing: sterilization, pasteurization, blanching, canning. Cold preservation; refrigeration, freezing, freeze drying, refrigerated gas storage.
Food irradiation: technology, application and safety assessments B. Chemicals in food preservation, safety of preserved foods.
2. Processing of major food items: Processing technology of foods and nutritional implications for cereals and pulses, fruits and vegetables, milk & products meat, fish & egg.
3. Food spoilage: Classification of food in relation to shelf life-Spoilage in food and its control: spoilage Caused by microorganism (bacteria, fungi and virus), enzymes, pets and rodents.
4. Enzyme technology for food processing: Use of enzymes in food and beverage industry (e.g., Cheese, fruit, juice, Wine, Meat tenderizing and dairy)

FSNC401X9 DSE 2T DAIRY TECHNOLOGY

Course Outcome (COs):

The students will be able to:

CO 1: 1. Acquire the basic knowledge in milk Technology.

CO 2: Perceive the different properties of milk and milk products.

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CO 3: Apprehend the thermal processing of milk.

Co 4: Acquire the knowledge in manufacturing of different dairy products.

Co 5: Gain knowledge regarding hygiene and sanitation practices in the milk and milk products industry.

Course contents:

1. **Dairy industry:** Review of dairy development in India (Amul model, National Dairy Development. Board and Operation Flood program). Dairy industry in India and abroad. Market survey and analysis: milk production & consumption pattern, national and global markets.
2. **Milk:** Definition of milk. Composition, constituents & processing characteristics. Factors affecting composition of milk. Physico-chemical properties of milk. Clean milk production & hygienic handling of raw milk. Milk collection/procurement & pricing (2-Axis basis). Judging and grading. Flavor defects in milk; their causes and prevention. Platform test and quality.

3. **Fluid Milk:** Milk processing**:** Pasteurization, sterilization, homogenization. Sterilized, homogenized, aseptic packaged milk. Full cream, standardized, toned & double toned milk. Reconstituted, rehydrated & recombined milk. Flavoured milk. 6h
4. **Indian milk products**: Introduction to Indian milk products and profile. Technology for manufacture. Desiccated milk products (eg. khoa/mawa, gulabjamun, burfi, kalakand, milk cake, etc). Heat-acid coagulated products (paneer/channa, rassogulla, rasmalai, chamcham, etc). Cultured milk products (dahi, yoghurt, srikhand, chakka, lassi, etc). Fat rich products (ghee, makkhan, malai, chocolate burfi, etc). Milk- based puddings/desserts (kheer, payasam, phirni, gajar-ka-halwa, etc.
5. **Dried milks**

Introduction. Definition & composition. Types of dried milk. Flow diagram of production. Spray and roller drying. Judging and grading.

FSNC401X8 DSC 1P BIOSTATISTICS & BIOINFORMATICS

Course Outcome (COs):

CO 1: Students can perform statistical data analysis of mean, median, mode etc from their practical experiments

CO 2: Students can able to do statistical analysis from any biological and experimental data by using t test, chi square test, anova.

CO 3: Students will be able to analyse experimental data statistically and graphically using software tools.

CO 4: Students will acquire proficiency in bioinformatics methods for sequence analysis, alignment, primer design, and phylogenetic tree construction.

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CO 5: Students will gain competence in bridging computational biology with laboratory techniques such as PCR and structural prediction.

Course content:

1. Computation of mean, median and mode of grouped and ungrouped data
2. Data representation by, bar diagram, histogram and pie diagram
3. Formulation Bar diagram, Pie diagram, Line diagram from the supplied data using MS Excel.
4. Use of Ms Word – data representation in tabular form, manipulation of tables
5. Use of Ms Excel – data tabulation, data representation by charts
6. Use of Ms power point
7. Computation of mean, median, mode, SD, SE, correlation coefficient, regression and ANOVA using available software.
8. Performing BLAST and interpretation of the results.
9. Nutritional assessment by using free software.

FSNC402X8 DSC 2P APPLIED PHYSIOLOGY

Course Outcomes (COs):

CO 1: Students can learn about the changes in different physiological parameters and relate them with causes of any type of illness.

CO 2: Students can able to know the normal and abnormal levels of physiological data related to human health and diseases

Course content:

1. Microscopic examination of various tissues
2. Determination of clotting and bleeding time
3. Enumeration of RBC and WBC
4. Estimation of hemoglobin and Red blood cell indices
5. Determination of blood group and Rh factor
6. Determination of pulse rate and Blood pressure
7. Determination of Respiratory Rate
8. Lung function test

FSNE405XA8 DSE 2P ADVANCES IN FOOD PROCESSING

Course content:

1. Determining frying quality of different oils.
2. Manufacturing of different sweets, candies and biscuits.
3. Studying the textural characteristics of curds prepared using different milk (cow, buffalo and dairy milk).
4. Preparation of sugar and Jaggery based Indian sweets.
5. Demonstrate the different methods of cooking (frying, boiling, grilling and baking) on the quality of chicken, fish and meat.
6. Assessment of some important nutraceuticals in foods.
7. Antioxidative sensor of foods: Estimation of antioxidative compounds in foods like Vitamin C, Vitamin E, Zinc and other natural antioxidants
8. Proximate analysis of foods: Ash content, Moisture content, PH etc.

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FSNE405XB8 DSE 2P DAIRY TECHNOLOGY

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. Visit to dairy plant

INDIAN KNOWLEDGE SYSTEM

Code: FSNO406VC Course: COM1 FULL MARKS-25 CREDIT: 2

Course Content:

a. Introduction to IKS: What is knowledge System, Characteristic Features of Indian Knowledge System).
b. Importance of IKS: Macaulay's Education Policy and its impact, Need of revisiting Ancient Indian Traditions.
c. Scope of IKS: The Universality of IKS (from Micro to Macro), development form Earliest times to 18th Century CE.
d. Tradition of IKS: Ancient Indian Education System: Home, Gurukul, Pathashala, Universities and ancient educational centres. Relevant sites in the vicinity of the Institute: Water Management System, Temple Management, etc.
e. Medicine (Ayurveda), Alchemy, Mathematics, Logic, Art of Governance (Arthashastra).
f. Aesthetics, Town Planning, Strategic Studies, Krishi Shastra, Vyakaran & Lexicography, Ancient Sports, Yoga and Wellbeing
g. Traditional and Ancient food culture: Culture specific food, Fermented food, Folk food cum medicine, Food Taboos, Tribal food culture, Food diversity in India.

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SECOND SEMESTER

FSNC451X0 RESEARCH METHODOLOGY

Course Outcome (COs):

CO 1: A research methodology course aims to equip students with the skills to conduct independent research, including formulating research questions, designing studies, and collecting and analyzing data.

CO 2: Key outcomes include performing literature reviews, understanding and applying various research designs and statistical tools, and effectively communicating findings through reports and proposals. Ethical considerations and intellectual property rights are also integral parts of these outcomes.

CO 3: Conduct effective literature searches, critically analyze existing research, and prepare a comprehensive review with proper citation and referencing.

CO 4: Students gain experience with data collection instruments and apply statistical tools to analyze and interpret research findings.

CO 5: Students may develop and write a formal research proposal with a clear plan, justification, and a full-length research report or paper.

Course Content:

1. **Objectives of research:** definition, objectives, types of research, quantitative and qualitative research in
food and nutrition.
2. **Basic Principles of research design:** Meaning and need, types of research designs – exploratory, descriptive, experimental, survey and case study - cross–sectional and longitudinal, Study design issues, sampling methods and sample size.
3. **Instruments of data collection;** Observation, questionnaire, interview: reliability and validity of measuring instruments, data management and quality control
4. **Research Strategies in food and Nutrition:** Issues in design, conduct, analysis and interpretation a) descriptive studies (case studies, case-control and cohort studies – prospective and retrospective)
5. Ethics in nutrition research
6. Scientific writing as a means of communication: a) Different forms – research articles / notes, review articles, monographs, dissertations, and reports b) components of dissertation / research report / article c) Methods of presenting research findings – oral / poster

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7. Background of Literature review, aims and objectives, Methodology, Expenditure, Bibliography of project proposal formulation, PERT chart.

8. Pilot project and its importance.

9. Implementation of project proposal and its evaluation.

FSNC452X1 DSC 5T THERAPEUTIC NUTRITION

Course Outcome (COs):

CO 1: The students will be able to Analyse and understand the relationship between healthy eating and prevention and treatment of illness and disease.

CO 2: Demonstrate knowledge and skills to enable individuals to work in public health and health promotion. Apply the knowledge in primary care in managing dietary needs in long term health conditions.

CO 3: Students will be able to manage nutrition related disease and/or disease related malnutrition.

CO 4: Student may exhibit the techniques of writing menus and different types of food services. They can demonstrate knowledge and understanding regarding hospital food service system & food delivery

Course Contents

Unit I Introduction to therapeutic nutrition and dietetics Nutritional assessment in clinical care – goals and methods (SGA). Modification of normal diets (normal, soft and fluid diets), types and factors to be considered in planning therapeutic diets, general principles of dietary calculation. Principle involved in planning menu. Techniques of writing menus, Food service management in hospitals- Types (centralized and decentralized systems of service), management of delivery and service of food in different systems.

Unit II Dietary management of metabolic syndrome and associated disorders Metabolic syndrome: Concept; Pathophysiology of insulin resistance. Obesity- introduction, etiology, clinical assessment, treatment approaches, consequences of obesity and its prevention. Diabetes mellitus – types, etiology, symptoms and diagnosis, aims of dietary treatments, special dietary consideration for type I and II diabetics, complications of diabetes. Diseases of the heart and blood vessels- etiology, symptoms and diagnosis; atherosclerosis, lipids and other dietary factors and coronary heart diseases (CHD). Diet in CHD, hypertension, congestive heart failure and hyperlipidemia.

Unit III Dietary management of gastrointestinal tract disorders Structure and function of gastrointestinal tract, dietary treatment for constipation, diarrhea, peptic ulcer, celiac disease, tropical enteropathy, tropical sprue, inflammatory bowel disease, irritable bowel syndrome and diverticular disease.

Unit IV Nutritional management in liver. Diseases of the liver - functions of liver, clinical assessment of liver function. Pathogenesis, signs and symptoms of hepatitis, acute liver failure, cirrhosis and encephalopathy. Nutritional management in liver diseases. Dietary management in gallbladder diseases.

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Unit V Diseases of the kidney - functions of kidney, clinical assessment of kidney function. Pathogenesis, signs and symptoms of acute and chronic renal failure, nephrotic syndrome and renal calculi. Nutritional management in kidney diseases and during renal replacement therapy.

Unit VI Diet principles in other diseases Infectious diseases (typhoid, malaria, tuberculosis, HIV), arthritis, gout, hypothyroidism, food allergy, surgery and trauma.

FSNE453A1 DSE 3T INSTRUMENTATION IN MOLECULAR NUTRITION

Course Outcome (COs):

CO 1: An "Instrumentation in Molecular Nutrition" course focuses on the advanced laboratory techniques and analytical instruments used to study how diet and nutrition affect gene expression, metabolic pathways, and cellular functions.

CO 2: Key outcomes include the specific syllabus and learning outcomes can vary, but generally cover a range of molecular and biochemical methods.

CO 3: This skill based course will teach the students the various instrumentations that are used in the analytical laboratories.

CO 4: This course covers both fundamental and applications of the instruments that are routinely used for the characterization of biomolecules

CO 5: At the end of the course, the student has the basic knowledge on the theory, operation and function of analytical instruments.

Course contents:

UNIT I Spectrometric methods

Principles and applications of UV and visible spectrophotometry, flame photometry-Atomic Absorption Spectrophotometry (AAS) and Atomic Emission Spectrophotometry (AES), Spectrofluorimetry and brief mention (principle and applications) of Nuclear Magnetic Resonance (NMR), Electron Spin Resonance (ESR) spectrometry, Mass spectrometry (MS), Fourier Transform Infrared Spectrometry (FTIR) and Electron microscopy.

UNIT II Chromatographic techniques

Principle and applications of paper, thin layer, adsorption, gel, gas, ion exchange, affinity chromatography, HPLC and HPTLC techniques.

UNIT III Electrophoretic techniques

Principle and applications of paper, starch gel, agar gel and polyacrylamide gel electrophoresis. Isoelectric focusing, Immuno-electrophoresis, Enzyme linked immunosorbant assay (ELISA), Radio-immuno assay (RIA).

UNIT IV Centrifugation techniques

Basic principles, preparative centrifugation techniques, analytical ultracentrifugation techniques, application-determination of molecular weight and purity of macromolecules.

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UNIT V PCR and related techniques:

Standard PCR, gradient PCR, and RT-PCR, along with gel documentation systems.

FSNE453B1 DSE 3T ADVANCE HUMAN NUTRITION

Course Outcomes (COs):
The students will be able to:
CO 1: Assess the nutritional status and determine nutrition related conditions and diseases.
CO 2. Critique and effectively communicate nutrition information.
CO 3. Describe methods used in assessing the nutritional status.
CO 4. Understand adult human body composition and demonstrate the techniques for the measurement of body compositions.
CO 5. Apply knowledge in the assessment of energy expenditure for various activities.
CO 6. Understand inborn errors of various metabolism

Course Contents

Unit I Concepts in nutrition and metabolism
Nutrient balance, turnover, flux, metabolic pools and adaptation to altered nutrient supply.
Unit II Body composition and energy expenditure
Composition of human adult body, techniques for the measurement of body 6 h composition, primary influences on body composition (nutrition, physical activity, hormones, trauma and disease).
Energy balance- Components of energy intake and expenditure; Control of food intake and regulation of energy balance- internal and external factors; Assessment of energy expenditure at rest and work- calorimetry and computation of energy requirements.
Unit III Carbohydrates
Carbohydrate metabolism and regulation, disorders related to carbohydrate metabolism, Inborn errors of carbohydrate metabolism; Glycemic and non- glycemic carbohydrates, glycemic response of foods - factors affecting glycemic index and measurement. Dietary fiber and non-starch polysaccharides- classification, digestion, absorption and mechanisms of health effects.

Unit IV Proteins
Protein and amino acid composition of foods, amino acid metabolism and its regulation; Protein turnover, factors influencing protein turnover- body size, age, metabolic rate, deficiency and imbalance of amino acid, pathological states; Inborn errors of amino acid metabolism; Protein quality evaluation of foods; Computation of protein requirements of individuals.
Unit V Lipids
Classification of dietary lipids, structural and physiological aspects; dietary lipid uptake, digestion – gastric and intestinal step; Absorption of lipids – role of small intestine; transport and secretion of lipids; Postprandial lipid metabolism, disorders related to lipid metabolism; Essential fatty acids: functions and role in eicosanoid metabolism, deficiency conditions.
Unit VI Body fluid and electrolyte balance

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Water distribution in the body, preformed and metabolic water; maintenance 4 h and regulation of fluid and electrolyte balance.

Unit VII Minerals

Dietary sources, absorption, bioavailability, transport and storage; functions and mechanisms of action; interaction with other nutrients, requirements, deficiency, toxicity and clinical assessment of minerals such as calcium, phosphorus, magnesium, iron, zinc, copper, selenium, iodine and fluorine. Mineral antagonists in foods.

Unit VIII Vitamins

Nomenclature, chemistry, dietary sources, absorption, bioavailability, transport and storage; loss in preparation and handling; functions and mechanisms of action; interaction with other nutrients, requirements, deficiency, toxicity and clinical assessment of vitamins: Fat soluble vitamins - A, D, E, K; water soluble- B and C vitamins. Vitamin antagonists in foods.

FSNE454A0 DSE 4T SDGs in relation to Nutrition

Course Outcome (COs):

CO 1: Brief understanding of Sustainable development goals.

CO 2: Role of SDGs in Nutrition and health.

Course content:

Sustainable development goals (SDG) on health: Targets of SDG – 3 (Good Health and Well-being), Maternal & Child Health, Communicable & Non-communicable Diseases, Universal Health Coverage, Addressing emerging issues, Support research, development and universal access to affordable vaccines and medicines, Tobacco control.

SDGs on nutrition: Sustainable Development Goal 2 (SDG 2: Zero Hunger), universal access to safe and nutritious food, Target malnutrition, Increase productivity and incomes of small-scale food producers, Genetic diversity in food production, invest in rural infrastructure, Investment in agricultural research, technology, SDG 12 (Responsible Consumption and Production).

SDGs for positive nutrition outcomes: Sustainable food production, Strong infrastructure systems, Improving health systems, Equity and inclusion of vulnerable group, Peace and stability

Essential 2026/2030 Nutrition Targets: Reducing hunger, anemia and stunting in childhood, Exclusive breastfeeding,

Disease management: Ending epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases, NCDs & Mental Health, Ensure healthy lives and promote well-being for all, SDG 6 (Clean Water and Sanitation),

Food Security: Causes and factors of food insecurity, Consequences of Food Insecurity, Environmental sustainability, Promote sustainable agriculture, Minimize food waste, Modern information technology for monitoring food insecurity.

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FSNE454B0 DSE 4T FOOD HYGIENE AND SANITATION

Course Outcome (COs):

CO 1: Describe the basic principles of food hygiene and sanitation.

CO 2: To understand the importance of maintaining hygiene and sanitation in domestic and industrial purposes.

CO 3: Understanding different methods of maintaining personal hygiene and sanitation for the prevention of foodborne diseases.

Course content

1. **The relationship of micro organisms to sanitation**. Role of microbiology – Environmental effects of microbial growth. Effects of micro- organisms on food degradation and food borne illnesses- bacteria, virus, molds, yeasts, and parasites. Microbiology of food safety.
2. **Other food hazards** – chemicals, antibiotics, hormones, metal contamination poisonous foods.
3. **Food contamination-** sources and transmissions. Water, air, sewage and soil as reservoirs of infection and ways of spread. Other agents of contamination - Humans, domestic animals, vermins, birds.
4. **Importance of personal hygiene of food handler** - habits -clothes, illness. Education of food handler in handling and serving food.
5. **Food Safety system and quality assurance**, Safety in food procurement, storage, handling and preparation – control of spoilage – safety of left over foods, Food laws and regulatory framework.
6. **Cleaning methods** – sterilization, and disinfection –products and methods –use of detergents, heat, chemicals, and tests for sanitizer strength.
7. **Control of infestation**: rodent control- rats, mice; vector control- use of pesticides.

8. Food sanitation, control and inspection-planning and implementation of training programme for health personnel, sanitary design of food premises.

9. Community Water and Waste Management: Importance of water to the community, etiology and effects of toxic agents, water borne infectious agents, sources of water, safe drinking water/portability and tests for portability, community, waste and waste disposal, sewage disposal and treatment, solid waste and disposal, liquid waste disposal.

10. **Air & health**- Indices of thermal comfort, Pollution a) Sources b) Pollutants c) Monitoring d) Effects e) Prevention & control, AQI, standard levels of AQI..

FSNE455A1 DSE 5T CONCEPT OF SMART FOOD

Course Outcome (COs):

CO1: Understanding of smart foods and its application

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CO 2: Importance of millets and sorghum as a nutrient dense climate resistant smart food

CO 3: Understanding key govt initiatives in smart foods and organic farming

Course Contents

1. **Smart food**: Classification, importance, Significance, Challenges, FAO identified future smart foods, Strategies involved in the Smart Food initiative, The Green Revolution, Smart Food Feeding, Eat Smart Nutrition, Smart Food Packaging, Energy-Smart Food.
2. **Millets and Sorghum**: Initiative for Nutritional Security through Intensive Millets Promotion, Millet and sorghum based products, Processing technology, Steps taken for promoting millets and sorghum, Rain-fed Area Development Programme, Karnataka Millet Mission, Odisha Millet Mission, Role of CFTRI, ICMR, ICAR and non Govt organizations in production of millet and sorghum based products.
3. **Organic farming:** Components of organic farming, Principle of organic farming, Characteristics of organic farming, Importance of organic farming for human health, Chemical-free, Sustainable, and Eco-friendly practices, nutrient-dense, climate-resilient crops, environmental sustainability, Smart technology, Challenges and limitations, Organic farming and sustainable development, Green revolution- Positive and the negative impact of green revolution, Government initiatives- Paramparagat Krishi Vikas Yojana (PKVY) and Mission Organic Value Chain Development for North Eastern Region (MOVCDNER).
4. **Smart food initiatives:** Climate-resilient foods, Nutri-cereals, Eat Right India movement, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).

FSNE455B1 DSE 5T NUTRITION COUNSELLING

Course Outcomes (COs)

CO 1: Understand the principles and procedures of nutrition counseling and the role of the counsellor.

CO 2: Develop an understanding how: (a) lifestyles influence health and well-being; (b) acute and chronic disease affects the emotional and psychological state and the behavior of the individuals.

CO 3: Be familiar with various techniques used in counseling.

CO 4: Be able to use various types and techniques of counseling to motivate patients to achieve well-being

CO 5: To apply counselling methods to patients with different diseases as well as to promote body's potential towards health, wellness and disease prevention

Course contents:

- Nutrition Counseling: definition, concept, the role of clinical dietician, the recipients, counseling environment. A systems approach to nutritional care:

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overview of the system, components of the system. Dietician as part of the medical team and outreach services

- Factors for Counseling: dietary diagnosis and tests for nutritional status – correlation, clinical and dietary information, nutritional and health conditions including cares of skin, hair, face, hands, feet etc. Psychological conditions, food allergies, aging, gender related and other problems. Aesthetic attributes of diets.
- Assessment and planning component: medical history assessment – techniques of obtaining relevant information for patient. Methods of interview – verbal and nonverbal techniques. Counseling models – data analysis (dietary, biological, environmental, behavioral data). Facilitator resource analysis – culmination of the assessment process. Designing of counseling plans – goals and objectives, classifying objections, resource planning – client care plan and designing evaluation instruments.
- Implementation and evaluation component: resources and aids of counseling the client/patient – client concurrence, co-ordination of care plans - the provision of learning experience. Measuring the success of performance of client and evaluating the counseling process. Patient education and counseling – assessment of patient needs, establishing report, counseling relationship. Follow up visits and patient education
- Nutrition Advocacy: concepts and practices in nutrition advocacy – steps for success concept of mainstreaming nutrition in all child survival programs and in national health and development programs.
- National policies and nutrition advocacy – Nutrition Mission of various states and its implications, need for revision in state nutrition policies.

FSNC452X8 DSC 5P THERAPEUTIC NUTRITION

1. Therapeutic diet preparation for metabolic disease

a. Therapeutic diet chart preparation for Diabetes

b. Therapeutic diet chart preparation for Hypertension

c. Therapeutic diet chart preparation for Atherosclerosis

d. Therapeutic diet chart preparation for Nutritional anaemia

2. **Therapeutic diet preparation for Gastro Intestinal Diseases**

a. Therapeutic diet chart preparation for Diarrhoea

b. Therapeutic diet chart preparation for Dysentery

c. Therapeutic diet chart preparation for Flatulence

d. Therapeutic diet chart preparation for Jaundice

e. Therapeutic diet chart preparation for Hepatitis

f. Therapeutic diet chart preparation for Irritable bowel Syndrome, Inflammatory bowel disease

g. Therapeutic diet chart preparation for Constipation

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h. Therapeutic diet chart preparation for Colitis

i. Therapeutic diet chart preparation for Ulcer.

7. **Therapeutic diet preparation for rheumatic diseases**

a. Therapeutic diet chart preparation for Arthritis.

b. Therapeutic diet chart preparation for Osteoarthritis**.**

FSNE453A8 DSE 3P TECHNIQUES IN MOLECULAR NUTRITION

1. Application of UV and visible spectrophotometry,
2. DNA Extraction From Eukaryotic Cells (Human Blood Cells).
3. DNA Extraction From Different Tissues (Bovine Spleen, Liver, Plant)
4. RNA Extraction From Different Tissues (Bovine Spleen, Liver and Plant).
5. DNA Extraction from Bacterial Cells (Bacterial Plasmid Extraction).
6. DNA and RNA Concentration and Quantification By UV Spectro-Nano Drop Method. Electrophoresis Analysis
7. Applications of paper, thin layer Chromatography, HPLC and
8. Agarose Gel Electrophoresis
9. Basic Concept Polymerase Chain Reaction (PCR)
10. Extraction and Purification of Native Proteins
11. Separation and Estimation of Proteins

FSNE453B8 DSE 3P ADVANCE HUMAN NUTRITION

1. Demonstration of blood glucose monitoring using glucometer.
2. Estimation of Protein, GOT, Cholesterol triglyceride, Creatinine in urea in serum using biochemical analyzer
3. Body composition analysis: Anthropometric and bioelectrical impedance methods.
4. Physical activity measurement using standard questionnaire.
5. Computation of total energy expenditure using factorial method.
6. Development of low-cost protein food supplements and protein quality evaluation by computational method (PDCAAS).

FSNE455A8 DSE 5P CONCEPT OF SMART FOOD

- Preparation of Millet-based cookies, cakes, biscuits, muffins using ragi (finger millet) and bajra and analyse nutritional significance
- Preparation of Ready-to-Eat (RTE) & Instant Mixes like upma, dosa, idli and and namkeen using millets and analyse nutritional significance
- Preparation of Probiotic-enriched millet soups, millet milk, yoghurt, fermented foods and their nutritional significance

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FSNE455B8 DSE 5P NUTRITION COUNSELLING

1. Preparation of case history of a patient.

2. Understanding the use of conventional and non-conventional methods of counselling

i. Face to face counseling.

ii. Use of software for counseling e.g Dietcal.

iii. Use of any one Diet App for counseling and assessing food intake.

3. Planning Nutrition counseling sessions and identifying ways to adhere to dietary changes for the following conditions:
Lactation counseling, SAM. Eating disorders. Overweight / Obesity in School children, adolescent and adults. Metabolic syndrome. Diabetes- Gestational Diabetes. Renal disease, Liver disorders.

4. Organizing health camps and patient feedback – both at hospital level and community

5. Visit to and training at hospital/ nursing home/ medical college/ clinic where dietitians work

FSNC456X9 FV ORGANIC FARM VISIT OR RESEARCH INSTITUTE VISIT OR FOOD INDUSTRY VISIT

CO1: Develop a knowledge base about the physical facilities needed for different types of food service units.

CO2: Acquire skills to manage the financial aspects in food service units.

CO3: Acquire skills to develop marketing strategies.

CO4: Acquire skills to start their own food service unit as entrepreneurs

CO5: Understand the practical operations of some food service units.

CO6: Acquire knowledge about Modern and sophisticated equipment used in food processing

Course Content

Students are required to visit any type of local organic farm or food industry or nutrition research institute to learn about the new techniques and instruments, processing and packaging of foods etc.

A report should be prepared according to the visit. Evaluation of the report shall be made on the viva-voce examination.

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Third Semester

DSC 6T FOOD MICROBIOLOGY

Course Outcomes (COs)

CO 1: Understand the interactions between microorganisms and food.

CO 2: Learn the basics of microbiology causes and consequences of food contamination, methods of preservation.

CO 3: Develop skills in identification, testing and control of microorganisms in relation to food safety.
CO 4: Evaluate the microbiological quality of foods by qualitative and quantitative microbiological analyses.

CO 5: Correlate food spoilage during preparation, processing, and storage to potential spoilage microorganisms.

CO 6: Know the various physical and chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement.

Course Contents:

1. **Fundamentals of Microbiology**
a. Bacteria- growth curve and biochemical changes in bacteria.
b. Yeast- process of hybridization, physiology, classification and importance of yeast.
c. Moulds-, significance of moulds and common household moulds.
d. Viruses-, human viral disease, identification and control and viruses in relation to food science.

2. **Microbiology of natural products**
a. Water-sources and Bacteriology.
b. Bacteriological examination and purification of water

3. **Microbiology of milk and milk products**
a. Kinds of microorganisms in milk, sources of contamination, pathogens in milk, control of microorganisms, quality & methods of study.
b. Microbiology of dairy products-fermented milk, butter & cheese.

4. **Microbiology of fruits and Vegetables**
a. Fruits and vegetables –external contamination,
b. Preservation, Spoilage & control of microorganism

5. **Microbiology of cereals & cereal products**
a. Cereal & cereal products- organism associated with grains
b. Classification & control of moulds in bread

6. **Microbiology of Fleshy Foods**
Flesh Foods- Microbiology of meat & meat products, poultry, fish & eggs

7. **Role of sugar, spice & salt**
a. Effect of salt on microorganism

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8. **Principle of Food Spoilage**
a. Food spoilage- microbiological, biochemical, biological, physical & chemical factors
b. Spoilage & examination of Canned Foods.

DSC 7T FOOD ITEMS AND ITS CONSTITUENTS

Course Outcomes (COs)

CO 1: Demonstrate an understanding of the different types of foods items present in our diet every day from various groups

CO 2: Relate the microstructure of foods to their quality and understand the chemistry of colour and flavor compounds.

CO 3: Describe the manufacture of a variety of foods and food products, including formulated and specialty foods as well as those within the main commodity groups

CO 4: Understand the role of fractionation and manipulation of food components to produce new products or ingredients

CO 5: Evaluate processing technologies for their appropriate application

Course Contents

1. **Processing of foods**: Primary, secondary and tertiary processing, historical perspective, traditional technologies used in food processing. Effects of processing on components, properties and nutritional value of foods.
2. **Processing of wheat**: Structure, composition, primary processing, study of preparation/ manufacture of common unleavened and leavened products like chapathi, bread, cake etc.
3. **Rice**: Structure, composition, primary and secondary processing, rice processed products. **Millets**: Types, composition, malting, other food uses.
4. **Legume**:Types, composition, cooking & processed products. **Oilseeds**: Use of oilseeds and oilseed meals, soya bean and groundnut - composition, processing and food uses.
5. **Fruits and vegetables**: Composition, pectins, plant acids, types of pigments, effect of cooking on colour and texture of vegetables.
6. **Fats and oils**: Properties, manufacture, uses in food systems (as cooking media and shortening). Rancidity- types, mechanism and prevention. Uses of fat replacers in processed foods.
7. **Milk and milk products**: Composition, functionality in food system, processing of different products like ghee, butter, milk powders, khoa, paneer, cheese, milk products and ice creams.
Eggs: Quality grading, structure, composition, functional properties and products.
8. **Flesh foods**: Types, composition, structure of muscle, conversion of muscle to meat-physio –chemical changes, cooking and processing.
Marine foods: Types, composition, cooking and processing.
9. **Sugar and Jaggery**: Principles of sugar crystallization, stages of cookery and role in Indian traditional sweet preparations, manufacturing of candies and sweets.
Brief manufacturing process of coffee, tea, cocoa, alcoholic beverages (fruit wines). Ready to serve beverages.
10. Fast foods, Junk foods

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11. **Sensory evaluation of foods:** Texture, Colour, Aroma, flavour etc of different foods

DSC 8T HEALTH MODULATING NUTRIENTS

Course Outcomes (COs)

CO 1: Explain the science: Describe the classification, sources, chemical composition, and physiological effects of various nutraceuticals and functional foods.

CO 2: Relate nutrients to health and disease: Understand how these bioactive compounds can prevent or manage specific chronic conditions, including cardiovascular disease, diabetes, and certain types of cancer.

CO 3: Evaluate evidence: Critically analyze and interpret research related to the health benefits of health-modulating nutrients.

CO 4: Consider product development: Understand the processes involved in developing and formulating nutraceutical products and functional foods.

CO 5: Navigate regulation: Discuss the regulatory landscape, safety issues, and labelling requirements for functional food products.

1. **Nutrients & Cardiovascular activities including pathophysiology:**

a. Biogenesis of cardiovascular activities like TG, TC, HDL, LDL & VLDL.

b. Atherosclerosis, Role of nutrients for its protection

c. Role of PUFA & MUFA on cardiovascular disease.

2. Nutrients as Immunomodulators:

a. Immuno-Supression: Role of Nutrients

3. Nutrients on Endurance & Performance modulators:

a. Bio-energetics & Metabolism in exercise

b. Hormonal response & Exercise

c. Ergogenic aids

d. Body composition & Performance

4. Xenobiotic and its metabolism

a. Sources of xenobiotics

b. Xenobiotics in the environment

c. Role of xenobiotics

5. Nutrition and body fat

a. White and brown adipose tissue and their hormone

6. Formulated foods: Definition, Criteria, Applied value

a. Polymeric foods: Types, characters and application

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b. Monomeric foods: Types, characters and application

7. Inborn Error of Metabolism

Phenylketonuria, MSU, Galactosemia, Albinism

DSC 9 T DRUG AND NUTRIENT INTERACTION

Course content

1. **Drugs and pharmaceutical compounds**-natural and synthetic, use of excipients.

2. **Characteristics of drugs action:** Pharmacodynamics, pharmacokinetics, route and form of excretion. Drug abuse and drug resistance

3. **Drug-nutrient interaction**s–effect of drugs on ingestion, digestion, absorption and metabolism of nutrients, effect on nutritional status, effect on organ function, drug dosage and efficacy.

4. **Nutrient effects on drug therapy–**effects of dietary composition, interactions between medication and milk, iron, fruit juices, antacids.

5. Intestinal micro flora and nutrition of hosts, pre-biotics and probiotics.

6. Nutrient as medicine (Pharmacologic use of nutrients)

DSC 6P FOOD MICROBIOLOGY

1. Identification of microorganism - Yeast, mould, algae.
2. Simple staining, grams staining and hanging drop preparation.
3. Identification of microorganisms in curd.
4. Identification of mould in bread.
5. Bacteriological testing of milk.
6. Observation of culture characteristics and preparation of culture media.

DSC 7P FOOD ITEMS AND ITS CONSTITUENTS

Study of preparation variables and quality factors of products from the following food commodities

1. Determination of glucose contents from various rice, wheat and millets
2. Determination of Protein from various pulses and legumes
3. Determination of fat from food products.
4. Estimation of Calcium in Milk.
5. Estimation of Ascorbic acid in lemon
6. Determination of acid number from fresh and used oils.
7. Determination of saponification value from fresh and used oils.
8. Determining frying quality of different oils.
9. Manufacturing of different sweets, candies and biscuits.

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10. Studying the textural characteristics of curds prepared using different milk (cow, buffalo and dairy milk).
11. Preparation of sugar and Jaggery based Indian sweets.
12. Demonstrate the different methods of cooking (frying, boiling, grilling and baking) on the quality of chicken, fish and meat.
13. Estimation of Lactose in Milk.
14. **Sensory evaluation of foods:** Analysis of texture, colour, aroma, flavour etc of different foods

DSC 9 P DRUG AND NUTRIENT INTERACTION

Course content

1. Animal handling, animal health check-up
2. Different route of administration of drugs
3. Dose response relationship of a drug
4. Acute toxicity study of a drug, studying wellness parameters
5. Study of LD50 and therapeutic dose
6. Effect of toxicity exposure to any drugs in acute and chronic administration

MOOCs

An PG level online course should be completed from SWAYAM platform having 4 credits

SS/CV COMMUNITY OUT-REACH PROGRAM AND REPORT SUBMISSION

Course content

The Students should participate in a nutritional survey in the community and submit a report during examination. The Survey may be made on the following topics:

- Determination of socioeconomic status
- Determination of energy requirement of sedentary persons
- Determination of energy requirement of light, moderate and heavy workers
- Determination of nutritional consumption by questionnaire method
- Determination of nutritional status by weighing method / cooked food method
- Study on nutritional status of the beneficiaries under National nutritional Programme

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Fourth Semester

DSC 10T GENETICALLY MODIFIED FOODS AND FOOD TOXICOLOGY

Course Outcomes (COs):

CO 1: Identify and classify genetically modified (GM) foods based on their characteristics and the specific traits that have been introduced.

CO 2: Assess the benefits of GM crops, such as enhanced nutritional value (e.g., Golden Rice), increased yield, and resistance to pests, diseases, and environmental stresses like drought.

CO 3: Analyze the public health impact of food fortification programs in addressing micronutrient deficiencies, often referred to as "hidden hunger".

CO 4: Outline the fundamental concepts of toxicology, including toxicokinetics (absorption, distribution, metabolism, excretion) and toxicodynamics (mechanisms of action).

CO 5: Identify potential toxicological hazards in food, which can be biological (e.g., microbial toxins, allergens), chemical (e.g., pesticides, additives), or naturally occurring (e.g., plant and animal toxins).

Course Contents:

A. Genetically modified foods

a. GM food- concept, Definition, available GM foods in India.

b. Fundamental techniques for GM food preparation

c. Food fortification through genetical modification

d. Steps adopted for acceptability of GM food.

B. Food Toxicology

1. Sources of hazardous substances in Food-Mycotoxin, Natural Toxin, Environmental Toxin, Industrial toxin, Agricultural Toxin, Adulterants.

2. Principles of Toxicology Classification of toxic agents; characteristics of exposure; spectrum of undesirable effects; interaction and tolerance; biotransformation and mechanisms of toxicity. Evaluation of toxicity: Risk vs. benefit: Experimental design and evaluation: Prospective and retrospective studies: Controls: Statistics (descriptive, inferential): Animal models as predictors of human toxicity: Legal requirements and specific screening methods: LD50, ED50 and TD50: In vitro and in vitro studies; Clinical trials.

3. Natural Toxins in Food: Natural toxins of importance in food- Toxins of plant and animal origin; Microbial toxins (e.g. Algal toxins, bacterial toxins and fungal toxins). Natural occurrence, toxicity and significance. Food poisoning; Mycotoxicosis of significance. Determination of toxicants in foods and their management, Sea food toxin- PSP, DSP

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4. Environmental Contaminants and Drug Residues in Food: Fungicide and pesticide residues in foods; heavy metal and their health impacts; use of veterinary drugs (e.g. Malachite Green in fish and β- agonists in pork); other contaminants in food. Radioactive contamination of food, Food adulteration and potential toxicity of food adulterants.

5. Food Additives and toxicants added or formed during Food Processing: Safety of food additives; toxicological evaluation of food additives; food processing generated toxicants: nitroso compounds, heterocyclic amines, Dietary Supplements and Toxicity related to Dose: Common dietary supplements; relevance of the dose; possible toxic effects.

DSC 11T NUTRITIONAL GENOMICS & PROTEOMICS

Course Outcomes (COs):

CO 1: Explain the foundational of nutrigenomics and nutrigenetics

CO 2: Relate macro- and micronutrients, as well as nutraceuticals on regulating gene expression.

CO 3: Acquire knowledge of major "omics" fields, including transcriptomics (mRNA expression), proteomics (protein expression), and metabolomics (metabolites), and how they are used to study diet-gene interactions.

CO 4: Appreciate genetic variations: Understand the importance of genetic variations, such as Single Nucleotide Polymorphisms (SNPs), and how they influence nutritional requirements and disease susceptibility.

Course content

1. Fundamentals of DND– structure and function
2. Fundamental of genetic engineering
3. Fundamental of PCR, RTPCR, and Q-PCR for gene expression

a) Nutrient and Gene expression with special reference to vitamin and other macronutrient, b) role of nutrient and dilatory component in regulation of genome structure expression and stability.

4. Role of individual nutrient requirement on genetic variation,

a) Idea about nutriogenomics. Nutrition is only one player in the epigenetic repertoire,

b) Epigenetic effect of nutritional supplement to pregnant mother to regulate the undesirable gene expression of foetus like cancer, obesity and diabetes.

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DSC 12T FOOD STANDARDS AND ENTREPRENEURSHIP DEVELOPMENT

Course Outcome (COs):

CO 1: Know about the principles of Hazard Analysis and Critical Control Points (HACCP), Good Manufacturing Practices (GMP), and Good Hygiene Practices (GHP) to ensure food safety from sourcing to distribution.

CO 2: Identify common food adulterants and toxicants and perform relevant tests to ensure food authenticity and safety.

CO 3: Understand the various types of hazards (biological, chemical, physical) and the measures needed to control them at different stages of food production and handling.

CO 4: Explain the Food Safety and Standards Act (FSSA) and associated regulations concerning labeling, packaging, and food additives.

CO 5: Analyze the food industry to identify gaps in the market and develop innovative food products or processing techniques.

Course Contents:

A. FOOD STANDARD AND QUALITY CONTROL

1. Principles of quality control - Raw material process control and Product inspection.

2. Standards for foods - Milk and milk products, Fruits and Vegetables, Beverages and Fleshy foods.

3. Food Laws, Consumerism - Definition, Consumer protection, Consumer Education, Legal modes of protection and Machinery for redressal of consumer grievances.

B. EVALUATION OF QUALITY OF FOODS

1. Sensory Evaluation of foods - Requirement for conducting sensory tests, Types of test, limitation of sensory evaluation.

2. Objective methods of evaluation of food.

3. Improvised instruments used for Indian recipes.

C. ENTREPRENEURSHIP DEVELOPMENT

a. Definition, Characteristic, Meaning of entrepreneur, Importance of entrepreneur in economic Development

b. Steps, Quality of successful entrepreneur, Contents of training programme

c. Women entrepreneur, Problems measures, taken for the development of women entrepreneur in India.

d. Concepts of small industries, Objectives, Problems, Measures taken for the promotion of SSI

e. Procedures to start SSI-market survey, raw material collection, food production, packing, labelling and marketing.

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f. Project formulation steps involve.

RP/D PROJECT WORK

Course content

(An independent research project work undertaken by student under the guidance of a teacher, can either be a survey or Laboratory oriented research. The research should be submitted at the end of session in the form of a dissertation. The project work can be undertaken at University departments, affiliated research institutions, quality control laboratories, food industries or other institutions with prior approval).

(The student should appear before examiners board and the dissertation shall be evaluated by means of presentation and viva – voce).

Start-up Proposal Research/ Start-up Proposal Design

Course content

A grant proposal on any relevant topic in biology will have to be prepared by students following the format of DST/DBT/ICMR, India. The students will also be required to defend the proposal before a panel of experts. Both the written proposal and its defense will be taken into consideration for evaluation.

SEC Internship Training

Course content

Students are required to perform internship in hospitals / foods service institutions / Clinics and they have to submit a report on the internship training during examination. Evaluation of internship shall be made on the basis of report and viva-voce examination.

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