Government of Karnataka

Structure of B.Sc.

Food Nutrition and Dietetics

as a Subject

V and VI Semesters

Model Curriculum

Name of the Degree Program: B.Sc. (Basic)
Discipline Core: Food Nutrition and Dietetics
Total Credits for the Program:
Starting year of implementation: 2021

Program Outcomes (POs)

After successful completion of this program, graduates of Food Nutrition and Dietetics will have the following attributes:

1. Scientific Knowledge: Apply the knowledge of food science, chemistry, nutrition, physiology and dietetics in a competent manner to innovate in the field of nutrition and dietetics.
2. Design and Development of Solutions: Design nutrition and dietetics strategies as per the specified requirements of regulatory bodies related to food, health, environment, hospitals, families and communities.
3. Problem Analysis: Identify, formulate, rationalise, and analyse nutrition-related problems in the community and hospitals so as to reach substantiated diet-based conclusions using the principles of food nutrition and dietetics.
4. Modern Tool usage: Create, select, and apply modern nutrition and dietetics tools, techniques, and resources of relevance in nutrition and dietetics.
5. Environment and Sustainability: Evolve nutrition and dietetics approaches in the context of food security and environmentally sustainable development goals.
6. Teamwork: Function objectively as an individual and as a member in diverse teams.
7. Communication: Effectively document and communicate nutrition and dietetics approaches and plans with individuals, patients and communities.
8. Lifelong learning: Independently engage in continuous learning to adapt to newer concepts in nutrition and dietetics.

Program Specific Outcomes (PSOs):

After successful completion of this program, graduates of Food Nutrition and Dietetics will have the following specific attributes:

- Utilize the knowledge from the physical and biological sciences as a basis for understanding the role of food and nutrients in health and disease processes
- Evaluate the food product and the application of necessary preservation techniques to increase the shelf life of the product and also be a part in the auditing industry
- Work in Research laboratories on the fortification and enrichment of existing product as well as the development of new product
- Apply the nutrition and dietetics-based knowledge and skills in the planning and assessment of suitable diets for individuals of every age, patients and the community in a sustainable manner.
- Provide nutrition counselling and education to individuals, groups, and communities throughout the lifespan using a variety of communication strategies
- Apply technical skills, knowledge of health behaviour, clinical judgment, and decision-making skills when assessing and evaluating the nutritional status of individuals and communities and their response to nutrition intervention.
- Implement strategies for food access, procurement, preparation, and security for individuals, families, and communities.
- Apply food science knowledge to describe functional properties of food ingredients.

- Apply the knowledge of principles and techniques of nutrition and dietetics for research-based approaches.
- Apply skills gained in nutrition and dietetics for research, development, and entrepreneurship.

Assessment:

Weightage for assessments (in percentage)

Type of Course	**Weightage in Marks**	
	Formative Assessment	**Summative Assessment**
Theory	40	60
Practical	25	25
Projects	40	60
Experiential Learning (Internships etc.)	40	60

Content of Courses for B.Sc. Degree in Food Nutrition and Dietetics

Semester	**Course Code**	**Category of Course**	**Theory/ Practicals**	**Credits**	**Course/Paper Titles**	**Marks**	
						IA	**SA**
V		DSC	Theory	4	Quality Control - II	40	60
			Practical	2		25	25
		DSC	Theory	4	Therapeutic Nutrition - I	40	60
			Practical	2		25	25
		DSC	Theory	4	Food Microbiology	40	60
		DSE	Theory	3	Community Nutrition OR Diet Counselling OR Nutritional Assessment and Surveillance	40	60
		VOC	Theory/Practical	3	Food product development and sensory analysis OR Food Sanitation and Hygiene OR Food Technology	40	60
	Total credits			22	Assessment	250	350
VI		DSC	Theory	4	Therapeutic Nutrition II	40	60
			Practical	2		25	25
		DSC	Theory	4	Food Preservation	40	60

			Practical	2		25	25
		DSC	Theory	4	Nutritional Biochemistry II	40	60
		DSE	Theory	3	Functional Foods and Nutraceuticals OR Food Biotechnology OR Food packaging	40	60
		VOC	Theory/Practical	3	Food Service Management OR Post harvest Technology OR Food processing and preservation	40	60
	Total credits			22	Assessment	250	350

Program Name	**B Sc Food Nutrition and Dietetics**	Semester	**Fifth Semester**
Course Title	**Quality Control II**		
Course Code:	**DSC**	No. of Theory and Practical Credits	**4+2**
Contact hours	**60 hrs**	Duration of ESA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Diploma with minimum 45%

Course Outcomes:

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

CO 1. Gain an insight into quality of food and importance of quality control

CO 2. Understand the role of food additives, colouring and flavoring agents

CO 3. Describe principles of enhancement and fortification of foods

CO 4. Conduct appropriate sensory evaluation tests to answer specific questions regarding food attributes or consumer preferences

Content of Theory	**60Hrs**
Unit–1	15
Food quality and quality control: Definitions. Principles of quality control. Food quality. Sample and sampling methods. Industrial quality control: Raw material control, Process control, Finished. Product control and inspection.	
Unit-2	15
Food additives: Definitions. Principles and objectives. Classification and uses. Colouring agents: Natural, Synthetic and non-certified colours. Leavening agents: Classification and uses. Flavouring agents: Natural and Synthetic flavours.	
Unit -3	15
Food fortification and enhances: Definition and importance. Principles. Commonly fortified and enriched foods. Non-nutritional constituents and food safety: naturally occurring toxicants, microbial toxins, bacterial food poisoning and contamination arising from processing	
Unit -4	15
Sensory evaluation of food quality: Sensory characteristics of food, Types of tests. Objective evaluation: Types of tests, Texture evaluation. Conducting sensory tests and preparation of evaluation card	

Pedagogy

Formative Assessment:

Assessment Occasion/ type	**Weightage in Marks**
Test 1	10
Test 2	10
Assignment / Seminar	5+5

Project	10
Total	**40 Marks**

Course Title	**Quality Control II (Practical)**	Practical Credits	**2**

Course Outcomes:

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

CO 1. Detect common adulterants found in food samples
CO 2. Evaluate the quality of egg based on certain indices
CO 3. Determine water parameters
CO 4. Evaluate moisture content in foods
CO 5. Evaluate foods based on sensory evaluation
CO 6. Determine fat content in foods
CO 7. Evaluate quality of oils using standard methods

Content of Practicals

1. Detection of common adulterants present in the food sample – spices and condiments, food grains, sugars, preserves, fats and oils
2. Quality analysis of egg – Candling, yolk index, albumin index
3. Detection of hardness of water by titration method
4. Determination of moisture content of various food stuff
5. Quality evaluation of milk – lactometer reading and tests to detect adulteration of milk
6. Iodine test
7. Determination of fat using butyrometer
8. Sensory evaluation of foods - Sweet, sour, bitter, salt. Different tests employed in sensory evaluation
9. Quality of fats and oil. Iodine value. Acid number
10. Visit to a food industry

Pedagogy

Formative Assessment	
Assessment Occasion/ type	**Weightage in Marks**
Test 1	05
Test 2	05
Practical Record	10
Participation and Involvement	05
Total	**25 Marks**

References

- Keister DC (1977) Food and beverage control, Prentice Hall Inc, New Jersey
- Coltman MM (1977) Food and beverage cost control, Prentice Hall Inc, New Jersey

- Kotas R (1973) An approach to food costing, Nelson Thornes, London
- Ranjanna S (1985) Handbook of analysis and quality control for fruit and vegetable products
- Martin EH (1986) Standard methods for the examination of dairy products
- Lees R (1978) Food analysis, analytical and quality control methods for food manufacturers and buyers

Program Name	**B Sc Food Nutrition and Dietetics**	Semester	**Fifth Semester**
Course Title	**Therapeutic Nutrition – I**		
Course Code:	**DSC**	No. of Theory + Practical Credits	**4+2**
Contact hours	**60 hrs**	Duration of ESA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Diploma with minimum 45%

Course Outcomes:

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

CO 1. Understand the role of the dietician in preventive, promotive and curative health care

CO 2. Appropriate dietary modification for various disease conditions based on physiology

CO 3. Interpret the role of the dietician through dietary management in disorders associated with pancreas, liver and gall bladder.

CO 4. Assay the role of dietician through dietary management in kidney dysfunction

Content of Theory	**60 Hrs**
Unit–1	15

Definition of metabolic disorders. Definition of Diabetes mellitus. Classification and types – IDDM, NIDDM, Gestational Diabetes and MRDM, impaired Glucose tolerance (IGT), Prediabetes, MODY. Insulin resistance. Aetiology and symptoms. Diagnosis tests – Urinary sugar test, Glycosuria, Ketonuria RBS, OGTT, Glycosylated Hemoglobin test (HbAlc). Metabolism. Complications in diabetes - Acute complication, hypoglycaemia, hyperglycaemia, ketoacidosis; Chronic complications –heart disease, diabetic retinopathy, diabetic nephropathy, diabetic neuropathy, infections and wound healing. Treatment – biochemical criteria: urine sugar testing and blood glucose monitoring. Drug therapy – commonly used hypoglycaemic drugs, Insulin and its types. Management of diet in Diabetes – objectives, factors to be considered for planning diabetic diet, macronutrients, micronutrients, dietary fiber, foods permitted/avoided. Glycemia index (GI): definition, formula for GI, factors affecting GI, glycaemic indices of some common foods, Glycaemic load. Special concerns – alcohol, hypoglycaemia, illness or sick days, travel, eating out, stress. Diabetes and physical activity. Artificial sweeteners – low calorie sweeteners and non-calorie sweeteners. Dietary guidelines

Unit -2	15

Functions of liver. Agents responsible for liver damage. Damage caused to the liver. Malnutrition in liver disease. Infective hepatitis: definition, viruses responsible for hepatitis, aetiology for acute and chronic hepatitis. Dietary management – objectives, macronutrients, micronutrients, general considerations, foods allowed/not allowed. Cirrhosis of liver. Definition, aetiology, symptoms. Pathogenesis of alcoholic liver disease (ALD). Complications – ascites, portal hypertension, oesophageal varices, hepatic coma: Dietary management – objectives, macronutrients, micronutrients, general considerations, foods allowed/not allowed. Hepatic coma – Definition, aetiology, symptoms. Clinical stages: Dietary management – objectives and recommendations.

Unit -3	15

Gall bladder diseases: terms – cholestasis, cholelithiasis, cholecystitis, cholecystectomy, biliary sludge. Functions of gall bladder. Cholecystitis – definition, types – acute and chronic phases, risk factors. Types of gallstones – Cholesterol stones, pigment stones and mixed stones. Dietary management – objectives, macronutrients, micronutrients, general considerations, foods allowed/not allowed. Pancreatitis – definition, clinical features. Acute pancreatitis – aetiology, symptoms, complications and dietary management. Chronic pancreatitis – aetiology, symptoms, dietary management, special considerations and guidelines.

Unit -4	15
Functions of the kidney. Glomerulonephritis (Nephritis) – acute and chronic: definitions, causes, symptoms and metabolic changes. Dietary management – objectives, macronutrients, micronutrients, general considerations, foods allowed/not allowed. Renal failure – acute and chronic – definition, causes, symptoms and metabolic changes. Dietary management – objectives, macronutrients, micronutrients, general considerations, foods allowed/not allowed. Nephrotic syndrome – definition, symptoms, metabolic changes. Dietary management – objectives, macronutrients, micronutrients, general considerations, foods allowed/not allowed. Urolithiasis (Kidney stones / uremia) – definition, causes, symptoms, types of kidney stones. Dietary management – objectives, macronutrients, micronutrients, general considerations, foods allowed/not allowed. Dialysis – definition, types of dialysis. Dietary management – objectives, macronutrients, micronutrients, general considerations, foods allowed/not allowed.	

Pedagogy

Formative Assessment:	
Assessment Occasion/ type	**Weightage in Marks**
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	**40 Marks**

Course Title	**Therapeutic Nutrition I (Practical)**	Practical Credits	**2**

Course Outcomes:

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

CO 1. Plan, prepare and calculate major nutrients in therapeutic nutrition
CO 2. Carry out the 24 hrs recall method
CO 3. Formulate diet for Diabetes mellitus and kidney dysfunction/renal disease
CO 4. Prepare diets for pancreatic and gall bladder disease

Content of Practical

Planning, preparing and calculating the major nutrient of the following (2 case studies)

1. 24 hrs recall method
2. Diabetes mellitus
3. Liver disease

4. Renal disease
5. Pancreatic disease
6. Gall bladder disease

Pedagogy

Formative Assessment	
Assessment Occasion/ type	**Weightage in Marks**
Test 1	05
Test 2	05
Practical Record	10
Participation and Involvement	05
Total	**25 Marks**

References

- Anderson L, Dibble MV, Turkki PR, Mitchall HS, Rynbergin HJ (1982) Nutrition in health and disease, 17th Ed., JB Lippincott and Co., Philadelphia
- Antia FP (1973) Clinical dietetics and nutrition, 2nd Ed., Oxford Univ. Press, Delhi
- Williams SR (1989) Nutrition and diet therapy, 6th Ed., Time, Mirror, Mosby College Publ., St Louis
- Raheen Begum (1989) A textbook of foods, nutrition and dietetics, Sterling Publ., New Delhi
- Joshi SA (1992) Nutrition and dietetics, Tata McGraw Hill Publications, New Delhi
- Srilakshmi B (2011) Dietetics, 6th Ed., New Age International Publ., New Delhi

Program Name	**B Sc Food Nutrition and Dietetics**	Semester	**Fifth Semester**
Course Title	**Food Microbiology (Theory)**		
Course Code:	**DSC**	No. of Theory Credits	**4**
Contact hours	**60 hrs**	Duration of ESA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Diploma with minimum 45%

Course Outcomes:

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

CO 1. Understand the nature of microorganisms involved in food - spoilage, food infections and intoxication

CO 2. Comprehend the significance of microorganisms and methods used in food industry to sterilize

CO 3. Discuss the relevance of bacteria in food and understand life cycle of viruses

CO 4. Appreciate the importance of yeast and the problem of molds in food.

CO 5. Understand the important pathogens and spoilage microorganisms in foods, and the most likely sources of these organisms.

CO 6. Evaluate water quality based on microbiological content and apply treatment procedures.

CO 7. Apply preventive measures based on an understanding of the factors affecting growth of microorganisms in food

CO 8. Describe food contaminants, food poisoning and food borne infections caused by microorganisms

Content of Theory	**60 Hrs**
Unit–1	15
Definition and history of microbiology - Introduction, historical developments in food microbiology, Contributions of various scientists to the development of microbiology. Instrumentation in microbiology - Construction and working principles of autoclave, hot air oven, pH meter, laminar air flow, incubator, bacterial colony counter, spectrophotometer and membrane filter unit. Sterilization - Physical methods - heat, irradiation, filtration, solarisation, ultrasonic vibration. Chemical methods - alcohol, aldehydes, dyes, halogens, phenols, metallic salts, surface active agents, gases	
Unit -2	15
Culture media used in culturing of microorganisms, The common nutrient requirement for bacteria - macro and micronutrients, Isolation of microorganisms- serial dilution, streak plate, pour plate and spread plate methods. Growth curve, Measurement of growth. Factors affecting kinds and numbers of microorganisms in food. Factors affecting the growth of microorganisms in food. Bacteria - classification according to Bergey's manual upto levels of section, ultrastructure, reproduction - asexual and sexual methods, importance of bacteria in food.	
Unit -3	15
Yeast - morphology, reproduction - haplobiontic, diplobiontic and haplodiplobiontic cycle, physiology and nutrition in yeast. Importance of yeast in food. Mold - outlines of classification	

and reproduction - asexual and sexual modes. Type study of Aspergillus, Penicillium Rhizopus and Mucor. Importance of molds in food. Viruses - structure and classification - plant, animal, bacterial and cyanophycean viruses, life cycle in virus - lytic and lysogenic cycle.

Unit -4	15

General principles underlying spoilage of food; Causes for spoilage. Contamination and kinds of organisms causing spoilage of fruits and vegetables. Contamination and kinds of organisms causing spoilage of meat, poultry, fish and eggs. Contamination and kinds of organisms causing spoilage of milk and milk products. Contamination and spoilage of fats and oils, bottled beverages, spices and condiments. Types of food borne diseases- Food borne intoxications- Staphylococcal poisoning, Streptococcal poisoning, *Clostridium perfringens* botulism, *Bacillus cereus.* Food borne infections - Salmonellosis, Shigellosis, Vibrio, EPEC, hepatitis and Shell fish poisoning. Food borne toxic infections- Campylobacter, Listeria, Cholera, yersiniosis.

Pedagogy

Formative Assessment:

Assessment Occasion/ type	**Weightage in Marks**
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	**40 Marks**

References

- Frazier WC, Westoff DC (1998), Food Microbiology 4th Ed., Tata Mc Graw Hill Publ. Co. Ltd.
- Jay J M (1986) Modern Food microbiology, 3rd Ed., Van No Strand Reinhold Co. Inc.
- Pelezer ML, Reid RD (1978) Microbiology, McGraw Hill Book Co., New York
- Brown A, Smith H (2015) Benson's Microbiological applications, McGraw Hill Publ.

Program Name	**B Sc Food Nutrition and Dietetics**	Semester	**Fifth Semester**
Course Title	**Community Nutrition (Theory)**		
Course Code:	**DSE**	No. of Theory Credits	**3**
Contact hours	**45 hrs**	Duration of ESA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Diploma with minimum 45%

Course Outcomes:

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

CO1. Learn the concept of malnutrition and nutritional epidemiology

CO2. Understand major nutritional problems prevalence, prevention and control

CO3. Understand policies and programs to combat community nutrition

CO4. Know the role of organizations working towards combating malnutrition.

Content of Theory	**45 Hrs**
Unit–1	15
Meaning and scope of community nutrition; Multidisciplinary approach of public health nutrition; Concept of food security, nutrition security, nutrition monitoring, nutrition surveillance, health economics, epidemiological studies, nutritional epidemiology. Malnutrition: etiology, prevalence, vicious cycle of malnutrition, economics of malnutrition. Major Nutritional problems: Prevalence at national and international level; Prevention and control of: Vitamin A deficiency, IDD, Anaemia, Diarrhoea, low birth weight, Child, and maternal malnutrition; Prevalence of Zn and Cu deficiency.	
Unit -2	15
National nutrition policy: need for nutrition policy, policy strategies and their implementations. National Nutrition programs- Objectives and functions of National Anaemia prophylaxis programs; Vitamin A prophylaxis programs; Goitre control program ; ICDS; SNP; ANP Sustainable development goals; National nutrition policy-Aims, Short term and long-term intervention, implementation, Vision for the 21st century.	
Unit -3	15
Objectives and functions, National organizations concerned with Food and Nutrition- ICMR, NIN, CFTRI, DFRL, NIPCCD International organizations concerned with Food and Nutrition- FAO, WHO, UNICEF, WORLD BANK Approaches and strategies for improving nutritional status and health: Health–based interventions, Food–based interventions including fortification and genetic improvement of foods, sup	

Pedagogy

Formative Assessment:

Assessment Occasion/ type	**Weightage in Marks**

Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	**40 Marks**

References

- Bamji SM, Rao NP and Reddy V, Text book of human nutrition, oxford and IBH publishing co., New Delhi.
- Gopalan C, (1987). Combating undernutrition-basic issues and practical approaches, Nutrition Foundation of India
- Gopalan C, (1992) Women and nutrition in India, NFI, New Delhi.
- Jelliffe D.D. (1966). The assessment of Nutritional Status of the Community. WHO monograph series.
- Jelliffe D.D. (1966). The assessment of Nutritional Status of the Community. WHO monograph series.
- Michael, J.G, Barrie, M.M (2005) Public health nutrition, Blackwell publishing
- Nweze E N. (2009) Community Nutrition – planning health promotion and disease prevention, Jones and Bartlett publishers
- Park, K, (2009) Park's textbook of preventive and social medicine, 12th Ed. M/s Banarsidas Bhanot publishers.
- Reddy V, Prahlad Rao N, Sastry G and Nath KK. (1993) Nutrition trends in India, Hyderabad, NIN
- https://www.thelancet.com/journals/lanchi/article/PIIS2352-4642(19)30273-1/fulltext
- Swaminathan S. (2019). The burden of child and maternal malnutrition in India and trends in its indicators in the states of India: The global burden of disease study 1990-2017.

OR

Program Name	**B Sc Food Nutrition and Dietetics**	Semester	**Fifth Semester**
Course Title	**Diet Counselling (Theory)**		
Course Code:	**DSE**	No. of Theory Credits	**3**
Contact hours	**45 hrs**	Duration of ESA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Diploma with minimum 45%

Course Outcomes:

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

CO 1. Understand the principles of nutritional or dietary counselling.

CO 2. Gain knowledge about the arts and skills of a Counsellor.

CO 3. Apply the use of computers to collate and analyse information.

CO 4. Demonstrate diet counselling techniques to facilitate behaviour change and lifestyle modification

Content of Theory	45 Hrs
Unit–1	15
Nutrition counselling - Definition, expectations, goals, scope and limits. Practical consideration in giving dietary advice and counselling - Factors affecting and individual food choice, Communication of dietary advice, Consideration of behaviour modification, motivation Dietitian – Classification, code of ethics, responsibilities. The Counselling Process - Techniques for obtaining relevant information- Clinical Information, Medical History and General Profile, nutritional assessment	
Unit -2	15
Dietary assessment - Assessing food and nutrient intakes, Lifestyles, physical activity, stress. Implementation - Counselling the client/patient – client concurrence, co-ordination of care plans-the provision of learning experience. Evaluation - Measuring the success of performance of client and evaluating the counselling process.	
Unit -3	15
Computer application - Use of computers by dietitian in dietary computations, dietetic management, education/ training, information storage and administration, Research, Execution of software packages. Straight line, frequency table, bar diagram, pie chart, Preparation of dietary charts for patients. Statistical computation- mean, median, standard deviation	

Pedagogy

Formative Assessment:	
Assessment Occasion/ type	**Weightage in Marks**
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	**40 Marks**

References

- Antia FP (2008) Clinical dietetics and nutrition., Oxford University Press, New Delhi.
- Mahan LK, Escott-Stump S (2000). Krause's Food Nutrition and Diet Therapy 10th Ed., W.B. Saunders Ltd.
- Zeeman, FJ. (1998) Applications of clinical nutrition. Englewood cliffs: Prentice Hall International Inc.,
- Thomas B (1995) Blackwell Manual of Dietetic practice, 2nd Ed., Oxford: New York
- Robinson (2006) Normal and therapeutic nutrition, Macmillan Pub. Company New York
- Mudambi SR, Rajagopal MV (2015) Fundamental of food, nutrition and diet therapy. New age International Publ., New Delhi,
- Srilakshmi B (2014) Dietetics, New age international Publ., New Delhi.

OR

Program Name	**B Sc Food Nutrition and Dietetics**	Semester	**Fifth Semester**
Course Title	**Nutritional Assessment and Surveillance (Theory)**		
Course Code:	**DSE**	No. of Theory Credits	**3**
Contact hours	**45 hrs**	Duration of ESA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Diploma with minimum 45%

Course Outcomes:

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

CO 1. Assess nutritional status using rapid assessment procedures

CO 2. Use anthropometrics and interpret the same

CO 3. Develop nutritional assessment and surveillance protocols in the community, carry out data survey and analysis and develop dietary counselling strategies

CO 4. Perform role of professional dietician

Content of Theory	**45 Hrs**
Unit–1	15
Nutritional status assessment and surveillance - Meaning, need, objectives and importance. Community, regional, national and international surveillance systems. Rapid assessment procedures - Need, importance, techniques, interpretation and steps in RAP. Sources of secondary health data - sources of relevant vital statistics, importance of infant, child, maternal mortality rates, and epidemiology of nutrition related disease.	
Unit -2	15
Growth chart - Meaning, WHO Chart, and charts used in India, uses, use of growth charts for various age groups. meaning of reference curve and growth curve. Anthropometry: Need, importance, standards for reference, techniques of measuring height, weight, head circumference, chest circumference, mid-arm circumference, skin fold thickness, waist hip ratio, calculation of BMI, interpretation of the measurements	
Unit -3	15
Nutritional assessment - Diet Surveys: need, importance, methods, interpretation, concept of conception unit, intra inter individual distribution in the family, verifying the adequacy of the diet with respect to RDA, concept of family food security. Clinical signs, biochemical and biophysical methods: need, importance, identifying signs of deficiency diseases, interpretation of the clinical signs, biochemical and biophysical values in major diseases. Nutritional care process - Medical History assessment. Assessment of patient needs. Role of Dietitian – Professional code and ethics of a dietitian. Problems in feeding children at the hospitals. Psychology of feeding the patient	

Pedagogy

Formative Assessment:

Assessment Occasion/ type	**Weightage in Marks**

Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	**40 Marks**

References

- Antia FP (2008) Clinical dietetics and nutrition., Oxford University Press, New Delhi.
- Mahan LK, Escott-Stump S (2000). Krause's Food Nutrition and Diet Therapy 10th Ed., W.B. Saunders Ltd.
- Zeeman, FJ. (1998) Applications of clinical nutrition. Englewood cliffs: Prentice Hall , International Inc.,
- Thomas B (1995) Blackwell Manual of Dietetic practice, 2nd Ed., Oxford: New York
- Robinson (2006) Normal and therapeutic nutrition, Macmillan Pub. Company New York
- Mudambi SR, Rajagopal MV (2015) Fundamental of food, nutrition and diet therapy. New age International Publ., New Delhi,
- Srilakshmi B (2014) Dietetics, New age international Publ., New Delhi.

Program Name	**B Sc Food Nutrition and Dietetics**	Semester	**Fifth Semester**
Course Title	**Food product development and sensory analysis (Theory)**		
Course Code:	**VOC**	No. of Credits	**3**
Contact hours	**45 hrs**	Duration of ESA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Diploma with minimum 45%

Course Outcomes:

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

CO 1. To apply knowledge to assess consumers' food preferences and choices

CO 2. To design processes to improve existing products or new products

CO 3. To understand the knowledge base for product development

CO 4. To evaluate produced foods based on sensory evaluation of foods

Content of Theory	**45 Hrs**
Unit–1	15
New Food Product Development (NPD) process and activities, The Stage-Gate model NPD success factors, new product design, food innovation case studies, market-oriented NPD methodologies, organization for successful NPD; Recipe Development; use of traditional recipe and modification; involvement of consumers, chefs and recipe experts; selection of materials/ingredients for specific purposes; modifications for production on large scale, cost effectiveness and return on investment, nutritional needs or uniqueness; use of novel food ingredients and novel processing technologies.	
Unit -2	15
Process design, equipment needed; establishing process parameters for optimum quality; Lab requirements; different techniques and tests; statistical analysis; application in product development and comparison of market samples; stages of the integration of market and sensory analysis.	
Unit-3	15
Sensory Evaluation: Introduction, Historical Background, Development of Sensory Evaluation, Defining Sensory Evaluation, A Physiological, anatomical and Psychological Perspective. Sensory evaluation: Selection of sensory panelists; Factors influencing sensory measurements; Sensory quality parameters -Size and shape, texture, aroma, taste, color and gloss; Detection, threshold and dilution tests. Different tests for sensory evaluation–discrimination, descriptive, affective; Flavor profile and tests; Ranking tests; Methods of sensory evaluation of different food products. Computer-aided sensory evaluation of food & beverage, statistical analysis of sensory data.	

Pedagogy

Formative Assessment:	
Assessment Occasion/ type	**Weightage in Marks**

Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	**40 Marks**

References

- Beckley J.H., Foley, M.M. Topp, E.J., Huang J.C. (2007). Accelerating New Food Product Design and Development. Blackwell Publishing Company. IFT Press. USA
- Moskowitz H. R., Saguy I. S. & Straus T (2009). An Integrated Approach to New Food Product Development. Taylor and Francis Group, LLC.USA
- Earle M.D., and Earle R.L. (2008). Case studies in food product development Wood head Publishing Limited and CRC Press LLC.USA
- Earle M.D., and Earle R.L. (2001). Creating New Foods. The Product Developer's Guide: Chadwick House Group Ltd. New Zeeland.
- Lyon D.H., Francombe M.A., Hasdell T.A. and Lawson K. (1992). Guidelines for sensory analysis in food product development and quality control. Chapman & Hall, 2-6 Boundary Row, London.
- Early R. (1995). Guide to Quality Management Systems for Food Industries. Blackie Academic.
- Krammer A & Twigg BA. (1973). Quality Control in Food Industry. Vol. I, II. AVI Publ
- 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.
- Kirk, R.S and Sawyer, R. (1991): Pearson s Composition and Analysis of Foods, Longman Scientific and Technical. 9th Edition, England.
- Food and Agricultural Organization (1980): Manuals of Food Quality Control. 2 Additives Contaminants Techniques, Rome.

OR

Program Name	**B Sc Food Nutrition and Dietetics**	Semester	**Fifth Semester**
Course Title	**Food sanitation and hygiene (Theory)**		
Course Code:	**VOC**	No. of Credits	**3**
Contact hours	**45 hrs**	Duration of ESA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Diploma with minimum 45%

Course Outcomes:

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

CO 1. To apply knowledge to assess consumers' food preferences and choices

CO 2. To design processes to improve existing products or new products

CO 3. To understand the knowledge base for product development

CO 4. To evaluate produced foods based on sensory evaluation of foods

Content of Theory	**45 Hrs**
Unit–1	15
Personal Hygiene & Importance of Water: General principles of food hygiene. Necessity for personal health and Hygiene (Hands and skin, hair, nose, mouth and ears, cuts, boils etc), medical checkup. Habits, Importance of Rest, Exercise and Recreation. Protective Clothing. GMP & GLP and Sanitary aspects of building and equipment. Equipment for personal hygiene.	
Unit -2	15
Sources of water, contamination of water. Importance of water and Purification of Water, Different methods of purification, potable water. Water quality standards, Criteria for judging water quality. Sanitary aspects of water supply, water sewage treatment	
Unit -3	15
Food Contamination, Poisonings: Different Types of contamination - Bacterial, Physical, Chemical Food Poisoning - common types and its symptoms (Salmonella, *Clostridium perfringens*, Botulism, Staphylococcus). Prevention of food poisoning. Cross contamination in food plants. Food Borne Diseases/ Illness - Amoebiasis, Acute diarrhoea/dysentery, Typhoid	

Pedagogy

Formative Assessment:	
Assessment Occasion/ type	**Weightage in Marks**
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	**40 Marks**

References

- Johns N (1991) Managing Food Hygiene, Palgrave Macmillan.
- Sprenger RA (2000) The Food Hygiene Handbook, High Field Publication
- Park K (2015) Park Textbook of preventive & social medicine 24th Ed., Banarsidas Bhanot Publ.
- Bedi YP (1977) A handbook of social and preventive medicine, Anand Publ.
- Roday S (2011) Food Hygiene and Sanitation with case studies, 2nd Ed., TATA McGraw Hill Education Pvt. Ltd. New Delhi.

OR

Program Name	**B Sc Food Nutrition and Dietetics**	Semester	**Fifth Semester**
Course Title	**Food technology (Theory)**		
Course Code:	**VOC**	No. of Credits	**3**
Contact hours	**45 hrs**	Duration of ESA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Degree with minimum 45%

Course Outcomes:

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

CO 1. Understand concepts in food technology

CO 2. Evaluate the various types of food preservation and packaging

CO 3. Differentiate techniques used in milk processing

CO 4. Use sensory evaluation to study the quality of foods

Content of Theory	**45 Hrs**
Unit–1	15
Introduction to food technology, Physico-chemical properties of food, classification of food groups, Food ingredients, different techniques and equipments used in preservation of food: Drying, refrigeration, thermal treatments. Innovative techniques used in food processing: RTE, RTS, edible coatings, edible film, instant premixes. Different packaging requirements and its importance.	
Unit -2	15
Milk: Definition, different techniques used in processing of milk products: UHT, Pasteurization, Clarifications. Different types of milk products and processing. Sensory evaluation of the food products its importance, E-Noise & E-tongue.	
Unit -3	15
Application of enzymes for production in biochemical and food processing industries, industrial application of microbial enzymes; production of amylase, lipase and pectinase; immobilized enzymes and their applications. Food regulations and licencing requirements.	

Pedagogy

Formative Assessment:

Assessment Occasion/ type	**Weightage in Marks**
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	**40 Marks**

References

- Flickinger MC, Drew SW (1999) Encyclopedia of Bioprocess Technology, A Wiley Inter Science Publ.
- Webb BH, Johnson AH (1988) Fundamentals of Dairy Chemistry, 3rd Ed., CBS Publ., New Delhi
- Robinson RK (2012) Modern Dairy Technology, Springer-Science

Program Name	**B Sc Food Nutrition and Dietetics**	Semester	**Sixth Semester**
Course Title	**Therapeutic Nutrition II (Theory + Practical)**		
Course Code:	**DSC**	No. of Theory +Practical Credits	**3+2**
Contact hours	**60 hrs**	Duration of ESA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Certificate with minimum 45%

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1 Understand the modifications of normal diet for therapeutic purposes by applying principles of diet therapy to cardiovascular diseases

CO2 Formulate dietary management for cancer after thorough understanding of cancer progression

CO3 Prepare diets for specific genetic and metabolic disorders

CO4 Evolve dietary management approaches for neurological disorders

Content of Theory	**45 Hrs**
Unit–1	15
Diseases of the Cardiovascular system: Definition of coronary heart disease (CHD) - Clinical features and Risk factors - modifiable and non-modifiable. Common disorders of Coronary heart disease: Dyslipidaemia/ hyperlipidaemia/ hypercholesterolemia - Definition, classes of lipoproteins and other parameters in CHD, aetiology, symptoms - xanthoma, complications. Dietary management- objectives, macronutrients, micronutrients, foods allowed/ not allowed. Atherosclerosis - Definition, aetiology, Role of fat in the development of atherosclerosis - Cholesterol, Saturated fatty acids, Trans fatty acids, Physical activity and heart diseases. Functional foods. Dietary guidelines. Hypertension: Definition, classification and stages. Pathogenesis, aetiology, symptoms, complications. Dietary management- objectives, macronutrients, micronutrients, foods allowed/ not allowed, High and low sources of sodium. Lifestyle modifications to manage hypertension; Dietary Approach to Stop Hypertension (DASH)	
Unit -2	15
Cancer: Definition, Steps in development of cancer, characteristics of cancer, tumours - benign and malignant. Classification of malignant tumours. Risk factors, dietary and non- dietary factors. Symptoms of specific cancers. Metabolic alterations and its associated nutritional problems. Carcinogenic foods. Role of food in the prevention of cancer. Nutrition problems of cancer therapy. Feeding problems in cancer patients. Dietary management - objectives, macronutrients, micronutrients.	
Unit -3	15
Genetic and metabolic disorders: Definition of metabolic disorders. Gout - definition, aetiology, metabolic changes, clinical features and symptoms, Dietary management- objectives, macronutrients, micronutrients, foods allowed/ not allowed. Inborn errors of metabolism. Galactosemia – Definition, metabolic changes, diagnosis, Aetiology and dietary management -	

objectives, macronutrients, micronutrients, galactose containing foods and low galactose foods.	
Unit -3	15
Genetic and neurological disorders: Phenylketonuria (PKU) - Definition, aetiology, metabolic changes, diagnosis, Prognosis, Dietary management- objectives, macronutrients, micronutrients, low phenylalanine foods, PKU formulae. Neurologic disorders- nutritional and non-nutritional. Epilepsy – definition, aetiology, clinical features. Dietary Management- Ketogenic diet- mechanism of the diet, short term and long term side effects, foods allowed and not allowed	

Pedagogy

Formative Assessment:	
Assessment Occasion/ type	**Weightage in Marks**
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	**40 Marks**

Course Title	**Therapeutic Nutrition - II (Practical)**	Practical Credits	**2**
Content of Practical			
Planning, preparing and calculating the major nutrient of the following (2 case studies) – 1. Cardiovascular diseases- atherosclerosis 2. Dyslipidaemia 3. Hypertension 4. Cancer 5. Phenylketonuria 6. Galactosemia 7. Epilepsy			

Pedagogy

Formative Assessment	
Assessment Occasion/ type	**Weightage in Marks**
Test 1	05
Test 2	05
Practical Record	10
Participation and Involvement	05
Total	**25 Marks**

References

- Anderson L, Dibble MV, Turkki PR, Mitchall HS, Rynbergin HJ (1982): Nutrition in health and disease, 17th Ed., JB Lippincott and Co., Philadelphia
- Antia FP (1973) Clinical dietetics and nutrition, 2nd Ed., Oxford Univ. Press, Delhi
- Williams SR (1989) Nutrition and diet therapy, 6th Ed., Time, Mirror, Mosby College Publ., St Louis
- Raheen Begum (1989) A textbook of foods, nutrition and dietetics, Sterling Publ., New Delhi
- Joshi SA (1992) Nutrition and dietetics, Tata McGraw Hill Publications, New Delhi
- Srilakshmi B (2011) Dietetics, 6th Ed., New Age International Publ., New

Program Name	**B Sc Food Nutrition and Dietetics**	Semester	**Sixth Semester**
Course Title	**Food Preservation (Theory + Practical)**		
Course Code:	**DSC**	No. of Theory and Practical Credits	**3+2**
Contact hours	**60 hrs**	Duration of ESA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Diploma with minimum 45%

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO 1. Understand the basic concepts, principles, methods and parameters of food preservation

CO 2. Describe the types and variety of foods based on spoilage and factors that favour the growth of microbes

CO 3. Differentiate between the various preservation techniques based on food type

CO 4. Evaluate factors affecting preservation and effects on food quality

CO 5. Understand basic concepts of food preservation by increasing or decreasing temperature

CO 6. Assess the types of heating and high temperatures to understand the advantages in food preservation

CO 7. Evaluate types of freezing suitable for food preservation

CO 8. Understand and describe chemical preservation of foods including impacts on health

Content of Theory	**60 Hrs**
Unit–1	15

Definition, Importance of food preservation. Causes of food spoilage - microorganisms, enzymes, insects, parasites and rodents, environmental factors and measures to control them. Classification of food by ease of spoilage. General principles of food preservation. Methods of food preservation - asepsis (keeping out of microorganisms), maintenance of aseptic condition, removal of microorganisms - clarification, filtration, centrifugation and other emerging techniques. Classification of food for processing.

Preservation by use of low temperature: Refrigeration: Definition, general principles, selection of refrigerant. Freezing: Definition, general principles, methods of freezing, pre-treatment prior to freezing, air freezing, indirect freezing, direct contact freezing, immersion freezing, ice formation. Selection and preparation of foods for freezing. Freezer burn. Thawing. Effects of freezing on food.

Unit -2	15

Preservation with high concentrations: Concept of food concentration. Sugar concentrates - general principles. Methods of preparation of jam, jellies and marmalade, tests of doneness, problems in jam and jelly preparation. Factors affecting gel formation. Definition, preservation and preparation of crystallized and glazed fruits, squashes and syrups. Types of syrups. Temperature test for syrups and candies. Salt concentrates - general principles. Role of ingredients in preparation of pickles. Types of pickles.

Preservation with chemicals: Characteristics of chemical preservatives, Classification of preservatives, Types of organic and inorganic preservatives, uses, natural preservatives, antibiotics, antioxidant, anti-browning, cleaning, sanitizing and fungicidal agents – mode of action, uses. Health impacts due to excessive use of chemical preservatives.

Unit -3	15

Types of heating: Conduction and convention heating. Microwave heating – advantages and disadvantages. Preservation of semi-moist foods / intermediate moist foods. Non-thermal Processing-Definition, principles, application, merits and demerits of Ohmic heating, High pressure processing, Pulsed electric field. Hurdle Technology-Principles, application, advantages and disadvantages

Preservation by use of high temperature: High temperature: Effect of heat on texture, nutrient composition and microbial population. Definition, methods, advantages and disadvantages– Blanching, pasteurization and sterilization. Canning – definition, General principles, steps in canning, Advantage and disadvantages of canning, Storage of canned foods.	
Unit -4	15
Drying: Definition, General Principle, Methods of drying – Sun/solar drying, artificial drying. Types of driers: air convection drier, drum/roller drier, vacuum drier, freeze drier, vacuum belt driers, osmotic drying. Factors controlling drying and dehydration. Dehydration: Definition, principles, pre-treatments for drying, changes during drying, effects of drying on nutritive value. Irradiation: Definition, principles, Sources of radiation, mechanism of irradiation, Units of irradiation, Dosimetry. Advantages and disadvantages. Uses, Effect of irradiation on food.	

Pedagogy

Formative Assessment:	
Assessment Occasion/ type	**Weightage in Marks**
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	**40 Marks**

Course Title	**Food Preservation (Practical)**	Practical Credits	**2**

Content of Practical

Course Outcomes:

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

CO 1. Perfect preservation techniques for fruits and vegetables

CO 2. Estimate acidity in fruit juices

CO 3. Prepare food stuffs using preservation techniques learnt

CO 4. Understand the role and functioning of food industry

1. To estimate lactic acid in milk
2. Iodometric estimation of milk lactose.
3. Qualitative tests for milk samples - Methylene Blue Reduction Test, Resazurin test, Phosphatase test, Turbidity test.
4. Isolation of microorganisms from food samples
5. Sampling of water-Membrane filtration technique.
6. Standard Plate Count for water and milk samples.
7. Coliform count for water and milk samples.
8. Sampling of food handlers.
9. Determination of microbial count of milk products.

10. Prepare the following recipes – jellies, jams, squashes, pickles, dehydrated vegetables
11. To estimate the acidity of fruit juice
12. Prepare the following: Tutti frutti, ketchups & sauces, Chutneys, Chutney powder, Frozen fruits and vegetables
13. Visit to food industry

Pedagogy

Formative Assessment	
Assessment Occasion/ type	**Weightage in Marks**
Test 1	05
Test 2	05
Practical Record	10
Participation and Involvement	05
Total	**25 Marks**

References

- Frazier WC, Westoff DC (1998) Food Microbiology 4th Ed., Tata Mc Graw Hill Publ. Co. Ltd
- Prescott SC, Proctor BE (1937) Food Technology, McGraw Hill
- Potter NN, Hotchkiss JH (1966) Food Science, 5th Ed., CBS Publisher and Distributors, Delhi
- Desroier NV (1963) The technology of food preservation, AVI Pub. Co
- Lal G, Siddappa GS, Tandon GL (1960) Preservation of food and vegetables, ICAR, New Delhi
- Johnson R, Anderson MT (2012) Food Preservation,
- Manay NS, Shadaksharaswamy M (2010) Foods - Facts and principles, New Age International Publ., New Delhi

Program Name	**B Sc Food Nutrition and Dietetics**	Semester	**Sixth Semester**
Course Title	**Nutritional Biochemistry II (Theory)**		
Course Code:	**DSC**	No. of Theory Credits	**3**
Contact hours	**60 hrs**	Duration of ESA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Certificate with minimum 45%

Course Outcomes:

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

CO 1. Obtain an insight into the biochemistry of major nutrients and physiologically important compounds such as proteins and hormones

CO 2. Understand the principles of biochemistry (as applicable to human nutrition).

CO 3. Appreciate types and changes in protein structure and associated malnutrition

CO 4. Comprehend the role of vitamins and minerals and associated disorders

Content of Theory	**60Hrs**
Unit–1	15
Proteins – Amino acids, chemical bonds (peptide, ionic, hydrogen bonds, van der Waal's forces and hydrophobic interactions) involved in protein structure, Protein configuration – primary, secondary, tertiary and quaternary structures with suitable examples, biological role of proteins. Classification of proteins – simple, conjugated proteins, derived proteins with examples. Biosynthesis, protein digestion and absorption, protein malnutrition.	
Unit -2	15
Nucleic acids: Introduction, components, nucleosides, nucleotides - DNA, base composition, double helical structure, DNA – Denaturation, DNA replication mechanism, DNA Repair Mechanisms, Transcription – requirements and mechanism. RNA – Types, structure and functions	
Unit-3	15
Hormones: Biological role of hormones of pituitary, adrenal cortex and medulla, thyroid parathyroid and pancreas. Hypo- and hyper-secretory effects. Diseases associated and clinical significance.	
Unit -4	15
Vitamins: Chemistry and biochemical role of fat soluble vitamins – A,D,E and K. Water soluble vitamins B1,B2, B3, B6 and C. Storage of vitamins in the body, daily human requirements, deficiency disorders. Minerals: Biochemical role of inorganic elements – Fe, Ca, Na, K, Mg, deficiency disorders.	

Pedagogy

Formative Assessment:	
Assessment Occasion/ type	**Weightage in Marks**
Test 1	10

Test 2	10
Assignment / Seminar	5+5
Project	10
Total	**40 Marks**

References

- West ES, Todd WR, Mason HS, Van Bruggen JT (1974) Text book of Biochemistry, 4th Ed., Amerind Publ. Co. Pvt. Ltd.,
- Lehninger AL, Nelson DL, Cox MM (1993) Principles of Bio Chemistry, 2nd Ed. CBS Publ., and distributors.
- Devlin TM (1986) Text book of Biochemistry with clinical correlations, 2nd Ed., Wiley and sons.
- Stryer L (1995) Biochemistry, Freeman WH and Co.
- Jain JL (2012) Fundamentals of Biochemistry, S. Chand and Company Ltd.

Program Name	**B Sc Food Nutrition and Dietetics**	Semester	**Sixth Semester**
Course Title	**Functional Foods and Nutraceuticals (Theory)**		
Course Code:	**DSE**	No. of Theory Credits	**3**
Contact hours	**45 hrs**	Duration of ESA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Degree with minimum 45%

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1 Understand the health benefits of primary and secondary metabolites
CO2 Comprehend the role of nutraceuticals and prioritize their inclusion in menu planning
CO3 Understand antioxidants and their role in health management
CO4 Assess role of functional foods, pro, pre and syn-biotics

Content of Theory	**45 Hrs**
Unit–1	15
Definition, primary metabolites – pigments, sources, classification, functions. Flavor and odor components, pheromones, fatty acids and structural lipids. Secondary metabolites: alkaloids, terpenoids, glycosides, natural phenols – resveratrol. Isoprenoid derivatives. Polyphenols – sources, classification and functions.	
Unit -2	15
Action of nutraceuticals: Health benefits of functional ingredients existing in food- dietary fibre, oligosaccharides, sugar alcohols, poly unsaturated fatty acids, peptides and proteins, glycosides, isoprenoids and vitamins, alcohols and phenols, cholines, lactic acid bacteria, minerals and others. Biological effects of commonly used functional foods.	
Unit -3	15
Functional Foods: millets, infant formula, fibre rich foods, beverages, herbal foods, probiotic foods – sources and health benefits. Antioxidants: sources, classification and functions; Antioxidant paradox. Definition, characteristics, spectrum of activity, health claim, dosage, safety, and role as functional ingredient with examples of Prebiotics, Probiotics and Synbiotics. Functional dairy foods: Bioactive peptide- definition, sources; probiotic and bioactive peptide based functional foods.	

Pedagogy

Formative Assessment:

Assessment Occasion/ type	**Weightage in Marks**
Test 1	10
Test 2	10
Assignment / Seminar	5+5

Project	10
Total	**40 Marks**

References

- Schmidl MK, Labuza TP (2000) Essential of functional Foods Culinary and Hospitality Industry Publications Services
- Mazza G (1998) Functional Foods Biochemical Processing Aspects and Culinary and Hospitality Industry Publications
- Goldberg I (2001) Functional Foods Designer Foods Pharma Food, Nutraceuticals Culinary and Hospitality Industry Publications
- Wildman REC (2001) Handbook of Nutraceuticals and functional Foods Culinary and Hospitality Industry Publications
- Watson DH (2003) Performance Functional Foods Culinary and Hospitality Industry Publications
- Chadwick R, Hensen S, Moseley B, Koenen G, Liakopoulos M, Midden C, Palou A, Rechkemmer G, Shroeder D, von Wright A (2003) Functional Foods, Springer Publ.
- Nath KG, Vijayalakshmi D (2014) Nutraceuticals: Challenges and opportunities in 21st century, Agrotech Publ. Academy, Udaipur.
- Mangaraj S, Tripati MK, Ali Nawab (2013) Handbook of Nutraceuticals and functional foods- Soybean as an example, Satish serial Publ. house, Delhi.
- Wildman REC (Ed) (2006) Handbook of Nutraceuticals and Functional Foods, 2nd Ed. CRC Press Taylor and Francis Group
- Ferguson LR (2013) Nutrigenomics and Nutrigenetics in Functional Foods and Personalized Nutrition, CRC Press Taylor and Francis Group

OR

Program Name	**B Sc Food Nutrition and Dietetics**	Semester	**Sixth Semester**
Course Title	**Food Biotechnology (Theory)**		
Course Code:	**DSE**	No. of Theory Credits	**3**
Contact hours	**45 hrs**	Duration of ESA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Degree with minimum 45%

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO 1. Understand the application of biotechnology in food processing.
CO 2. Learn about the new trends in biotechnological applications in food items
CO 3. Prepare fermented food products
CO 4. Comprehend regulations and guidelines pertaining to biotechnology and IPR.

Content of Theory	**45 Hrs**
Unit–1	15
Biotechnology- Meaning and importance, history of biotechnology- traditional and modern	

biotechnology. Genetically modified foods- Definition and examples, advantages, disadvantages and safety aspects of foods produced by genetic engineering. Food biotechnology- Single cell protein, algae and spirulina: production and uses; Mushroom production and processing..	
Unit -2	15
Genomics and proteomics- Meaning, types and future; bioinformatics- meaning, sequences and nomenclature; information sources; uses. Bioethics: Necessity of bioethics, different paradigms of bioethics- national and international. Enzymes- Role in food processing, importance; applications- industrial application of microbial enzymes; production of amylase, lipase and pectinase; immobilized enzymes and their applications.	
Unit -3	15
Fermentation- Types, advantages, factors controlling; batch fermentation and continuous fermentation; Fermented products- citric acid, lactic acid, vinegar, wine, beer, oriental fermented foods- tempeh and tofu. Biotechnology and biosafety- Introduction to Intellectual Property Rights, IP laws; TRIPS. Forms of IPR like patent, design and copyright trademark	

Pedagogy

Formative Assessment:	
Assessment Occasion/ type	**Weightage in Marks**
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	**40 Marks**

References

- Dubey RC (2005) A text book of Biotechnology, S. Chand and company, New Delhi,
- Tripathy SN (2006) Food biotechnology, Dominant Publ., and distributors,
- Kumar HD (2004) A text book of Biotechnology, 2 nd Ed., Affiliated East-West Press Pvt. Ltd., New Delhi,
- Kumaresan V (2005) Biotechnology, Saras Publication

OR

Program Name	**B Sc Food Nutrition and Dietetics**	Semester	**Sixth Semester**
Course Title	**Food Packaging (Theory)**		
Course Code:	**DSE**	No. of Theory Credits	**3**
Contact hours	**45 hrs**	Duration of ESA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Degree with minimum 45%

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO 1. Understand requirements and types of food packaging
CO 2. Know about recent trends in packaging materials and labeling.
CO 3. Develop insights into biodegradable and aseptic food packaging
CO 4. Become skilled in labelling standards and regulations

Content of Theory	**45 Hrs**
Unit–1	15
Food packaging Definition, functions of packaging materials for different foods, characteristics of packaging material. Food packages – bags, pouches, wrappers, tetra packs- applications. Packaging materials Packaging materials - Introduction, purpose, requirements, types of containers. Modern packaging materials and forms-Glass containers, metal cans, composite containers, aerosol containers, rigid plastic packages, semi rigid packaging, flexible packaging.	
Unit -2	15
Packages of radiation stabilized foods Introduction, rigid containers, flexible containers, general methods for establishing radiation stabilization. Radiation- measurement of radiations. Biodegradable packaging material – biopolymer based edible firm. Packages of dehydrated products Orientation, metallization, co-extrusion of multilayer films, stretch, package forms and techniques.	
Unit -3	15
Aseptic packaging, retortable containers, modified and controlled atmosphere packaging, skin, strink and cling film packaging, micro-ovenable containers, other package forms and components of plastics. Packaging of finished goods Weighing, filling, scaling, wrapping, cartooning, labelling, marking and trapping. Labelling: Standards, purpose, description types of labels, labelling regulation barcode, nutrition labelling, health claims, and mandatory labelling provision.	

Pedagogy

Formative Assessment:

Assessment Occasion/ type	**Weightage in Marks**
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	**40 Marks**

References

- Khader V (2001) Text book of food science and technology, ICAR, New Delhi,
- Sacharow S, Griffin RC (1980). Principles of food packaging 2nd Ed. Avi pub Co. Westport.

- Paine FA, Paine HY, Hill L (1992) A hand book of food packaging. Blackie Academic and Professional Publ.
- Paine FA (Ed.) (2012) The packaging user's handbook, Blackie Academic & Professional Publ.
- Sacharow S (1976) Handbook of packaging materials. Avi Pub Co. Westport.
- Crosby NT (1981) Food packaging materials. Applied Science pub Ltd. London.
- Paine FA (1977) The packaging media. Blackie & Sons Ltd. London.
- NIIR (2012) Food packaging technology Handbook, Delhi

Program Name	**B Sc Food Nutrition and Dietetics**	Semester	**Sixth Semester**
Course Title	**Food service management (Theory)**		
Course Code:	**VOC**	No. of Credits	**3**
Contact hours	**45 hrs**	Duration of ESA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Degree with minimum 45%

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO 1. Understand the scope of food service management in commercial and welfare organizations.

CO 2. Learn the concepts and skills of management, marketing and entrepreneurship with reference to food service

CO 3. Acquire knowledge about the process of food preparation and service.

CO 4. Design an optimal kitchen layout for food service

Content of Theory	**45 Hrs**
Unit–1	15
Development and growth of the food service Industry. Classification of food service operations. Recent trends in food service. Systems approach to food service organizations. Types of food service systems. Menu Planning. Types of Menus, Menu presentation, Writing, Design and format Menu Marketing. Concept of Food flow.	
Unit -2	15
Procurement, Concept of Market, Buyer, Vendor and Marketing Channel Purchasing: Methods of purchasing, purchasing process. Receiving: Facilities needed for good receiving practices. Storage and Inventory. Production: Recipe formulation, Standardization, Forecasting, Scheduling and control. Energy Management and Conservation	
Unit -3	15
Kitchen Design and Layout. Service Factors affecting the choice of distribution systems. Styles of service and Service management. Food Safety and hygiene. Control of microbial quality of food throughout the food flow. Food Handling and prevention of food borne illness. Personal Hygiene. Environmental Sanitation. Waste disposal and pest control. Standards for food safety and sanitation	

Pedagogy

Formative Assessment:

Assessment Occasion/ type	**Weightage in Marks**
Test 1	10
Test 2	10

Assignment / Seminar	5+5
Project	10
Total	**40 Marks**

References

- Longree K, Balaker BC (1979) Sanitary Techniques in Food Service, Wiley, New York,
- Longree K (1973) Food Service Sanitation, John Wiley and Sons.
- Sethi M, Malham S (1987) Catering Management – an Integrated approach, Wiley Eastern limited, New Delhi,
- West BB, Wood L, Hager, VF, Shugart G (1987) Food Services in institutions, Wiley and Sons, New York,
- Bhojwani M (2007) Food service management: Principles and practice
- Eckel PJ (1985), College and University Food Service Management
- Delfakis H, Nancy L, Van Burns J (1992), Food Service Management
- Spears M. C, Vaden A. E (1985), Food Service Organizations - A management and systems approach
- Drummond K (1997) Nutrition for the Food Service Personnel
- National Association Institute (1998) Handbook for Food Service Management
- Verghese B (1999) Professional Food and Beverage Service Management
- Singh YP (2001) Effective Food Management, Anmol Publications Pvt. Ltd.
- Fox A (1971) Hygiene and Food Production, Churchill Livingstone

OR

Program Name	**B Sc Food Nutrition and Dietetics**	Semester	**Sixth Semester**
Course Title	**Post Harvest Technology (Theory)**		
Course Code:	**VOC**	No. of Credits	**3**
Contact hours	**45 hrs**	Duration of ESA/Exam	**2 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Degree with minimum 45%

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO 1. Comprehend the need for preservation and processing

CO 2. Understand the rationale behind processing leading to a final product with enhanced characteristics and shelf life.

CO 3. Evaluate the reactions and changes taking place during freezing and refrigeration

CO 4. Apply the methodologies of drying to preserve the harvest and turn it into multiple uses.

Content of Theory	**45 Hrs**
Unit–1	15

Introduction to food processing: Historical development of food processing, Definition of food processing, aims and objectives of food processing, preparation of raw material for processing,

introduction to different processes employed in food processing- milling, cooking, boiling, steaming, braising, stewing, roasting, frying, grilling, baking, fermentation, pickling, refining, canning, definition of shelf life, perishable foods, semi perishable foods, shelf stable foods	
Unit -2	15
Freezing and Refrigeration: Introduction to refrigeration, cool storage and freezing, definition, principle of freezing, freezing curve, changes occurring during freezing, types of freezing, introduction to thawing, changes during thawing and its effect on food. Sterilization: Principle and applications: commercial sterilization, Pasteurization, ultra high temperature sterilization, aseptic processing and blanching, Hurdle technology, microwave processing.	
Unit -3	15
Drying and Dehydration: Definition, drying as a means of preservation, differences between sun drying and dehydration (i.e. mechanical drying), types of drying, factors affecting rate of drying, normal drying curve, names of types of driers used in the food industry. Evaporation: Definition and principle of evaporation, factors affecting evaporation, names of evaporators used in food industry. Irradiation: Introduction, units of radiation, kinds of ionizing radiations used in food irradiation, mechanism of action, uses of radiation processing in food industry. Fermentation: Principles of fermentation, Types of fermentation, curing and pickling, Advantages	

Pedagogy

Formative Assessment:	
Assessment Occasion/ type	**Weightage in Marks**
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	**40 Marks**

References

- Frazier WC, Westoff DC (1998), Food Microbiology 4th Ed., Tata Mc Graw Hill Publ. Co. Ltd
- Desroier NV (1963) The technology of food preservation, AVI Pub. Co
- Lal G, Siddappa GS, Tandon GL (1960) Preservation of food and vegetables, ICAR, New Delhi Potter NN, Hotchkiss JH (1966) Food Science, 5th Ed., CBS Publisher and Distributors, Delhi Prescott SC, Proctor BE (1937) Food Technology, McGraw Hill
- Johnson R, Anderson MT (2012) Food Preservation,
- Manay NS, Shadaksharaswamy M (2010) Foods - Facts and principles, New Age International Publ., New Delhi

OR

Program Name	**B Sc Food Nutrition and Dietetics**	Semester	**Sixth Semester**
Course Title	**Food Processing and Preservation (Theory)**		

Course Code:	**VOC**		No. of Credits	**3**
Contact hours	**45 hrs**		Duration of ESA/Exam	**2 Hours**
Formative Assessment Marks		**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Degree with minimum 45%	
Course Outcomes (COs): After the successful completion of the course, the student will be able to: CO 1. Understand nature of raw foods and food processing CO 2. Apply techniques to reduce spoilage and deterioration of foods CO 3. Apply principles and current practices of processing and effect on product quality CO 4. Understand unit operations required to produce a given food product	
Content of Theory	**45 Hrs**
Unit–1	15
Scope and importance of food processing; Historical developments in food processing; Factors affecting various food spoilage: Physical, Chemical, Microbial & miscellaneous. Heat preservation and processing: UHT and HTST. Thermal death time: Determination of process time. Types of heat treatments and its effects on foods; Canning: Introduction, principles and processing of foods. Packaging materials designed for processed foods. Water activity: Role of water activity in food preservation; Intermediate Moisture Foods (IMF): Principles, Characteristics, advantages and problems of IM foods. Food Frying: Principles and process: shallow frying, deep frying and frying oils. Mechanism of Oil uptake during frying: Factors affecting the frying process.	
Unit -2	15
Food preservation: Types, uses and effects of class I and class II preservatives in foods. Conventional preservation methods: Pickling, Salting, Smoking and Sugar addition. Dehydration and Concentration: Drying, Drying curves, Different drying methods and type of dryers; Separation and concentration of food components. Different types of evaporators and ultra-filtration; Difference between dehydration and concentration; Changes during dehydration and concentration in foods. Rehydration and reconstitution of food Refrigeration: Principles, components, refrigeration load and storage; Changes in foods during refrigeration. Freezing: Freezing curves, slow and quick freezing, freezing methods, factors determining freezing rate, frozen storage, changes in food during freezing. Chilling: Equipment, Cold storage, Application in fresh and processed foods.	
Unit -3	15
Green Technologies for Food Processing: Super critical fluid extraction & Ultrasound treatment, High pressure processing (HPP), Pulse electrical field (PEF), Ohmic heating, Microwave processing, Food irradiation (x-rays, gamma rays and electron beam), Interaction of radiation with food components, Principles and applications of Hurdle technology	

Pedagogy

Formative Assessment:	
Assessment Occasion/ type	**Weightage in Marks**

Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	**40 Marks**

References

- Barbosa-Cánovas, G.V., Tapia, M.S., Cano, M.P. (2004). Novel food processing technologies. CRC
- Irudayaraj, J. M. (2001). Food processing operations modeling: design and analysis. CRC press.
- Kalia M., Sangita, S. (1996). Food Preservation and Processing, Kalyani Publishers, New Delhi.
- Khetarpaul N. (2005). Food Processing and Preservation, Daya Publishing House, New Delhi.
- Ramaswamy H., Marcott M. (2006). Food Processing Principles and Applications. CRC Press
- Sivasankar, B. (2002). Food Processing and Preservation, Prentice Hall of India Pvt. Ltd, New Delhi.
- Smith, J. S., Hui, Y. H. (2008). Food processing: principles and applications. John Wiley & Sons.