Master of Science (M.Sc.) Food and Nutrition

SYLLABUS

OUTCOME BASED EDUCATION

BASED ON

REVISED BLOOMS TAXONOMY

(Under Choice Based Credit System)

For the Students Admitted in the

Academic year 2021-2022

PG DEPARTMENT OF FOOD AND NUTRITION

BISHOP HEBER COLLEGE (AUTONOMOUS)

(Affiliated to Bharathidasan University)
(Reaccredited with 'A' Grade (CGPA – 3.58/4.0) by the NAAC &
College of Excellence by the UGC)
DST – FIST Sponsored College & DBT Star College
TIRUCHIRAPPALLI - 620017
TAMILNADU, INDIA

xxxxx- Revised Content

PG DEPARTMENT OF FOOD AND NUTRITION
BISHOP HEBER COLLEGE
TIRUCHIRAPPALLI-17

Programme Outcomes – M.Sc., FOOD SCIENCE AND NUTRITION

VISION

The department seeks to function with mutual love, social commitment to educate and engage students in research and extension activities to serve the community

MISSION

- Provide in-depth knowledge on nutrients so as to rule-out disorders and diseases at cellular and systemic levels, ultimately promoting good health.
- Ignite curiosity and inquiry on the interrelationship between theoretical knowledge obtained with field exposure, leading to innovative discoveries and application of knowledge in the areas of nutrition, as well as food product development.
- Transform the academic knowledge obtained to social benefits, thus helping the nation in eradication of malnutrition and improving the quality of life of citizens.
- Achieve academic excellence in the area of food and nutrition, making them full-fledged professionals in the area of research, teaching, clinical and community nutrition, dietetics, food science and food safety and quality control.

Programme Outcomes – M Sc. Food Science and Nutrition

On Successful completion of M.sc Food Science and Nutrition Program, the Post Graduates will be able to:

Knowledge:

PO1: Apply the principle of science and technology thus understanding the complex and heterogeneous aspect of food in treating diseases, as well as inventing new innovative food products.

PO2: Evaluate, adopt and apply best practices relating to health, safety, quality, food industry and client satisfaction in the field of Food Science and nutrition.

PO3: Appraise the concepts on systematic research in Food Science and Nutrition, Analysis of Nutrients, Nutritional Assessment and Diet Planning to combat malnutrition.

Attitude:

PO4: Develop critical thinking, decision making attributes and aesthetic skills to enhance professional competency by updating and applying emerging trends and technology in the areas of clinical nutrition, dietetics, community nutrition and food science.

Skills:

PO5: Deliberate critically and apply appropriate contemporary Research techniques, resources and demonstrate skills, attitudes in development of novel food products.

PO6: Apply the concept of nutraceuticals in treating diet-related diseases and metabolic disorders, as well as bring forth cost-effective innovative health drinks and sport drinks, which are the need of the hour.

PO7: Face the global challenge of meeting the demand for skilled professionals in the area of nutrition, dietetics and food science by fostering entrepreneurial skills, and enabling the pursuit of higher education, research and career in the area of food science and nutrition.

PO8: Implement technical skills of health behavior, clinical judgement and decision making skills in validating the data of vulnerable groups, organoleptic evaluation, quantitative, qualitative evaluation of food products, evaluating the nutritional status of individuals, communities and their response to nutrition intervention.

Ethical and Social responsibility:

PO9: Develop management skills and entrepreneurial skills in the field of Food Science and Nutrition and the ability to work effectively and to live responsibly in a global context of cross-

cultural life and capability, to value human diversity and lead life of timeless learning and endless opportunities.

Programme Specific Outcomes – M Sc. Food Science and Nutrition

On successful completion of M Sc. Food Science and Nutrition program, the Post Graduate student will be able to

Intellectual Skills:

PSO 1: Obtain skills in the fields of food science and nutrition and to provide innovative solutions to problems related to the food processing industry, as well as the field of clinical nutrition.

Practical Skills:

PSO 2: To develop skill and necessary confidence to work in hospitals /food processing industries with the ultimate goal of ensuring safe food and good health.

PSO 3: Apply knowledge of advance Food science and Nutrition, to develop practical skills of management of dietary departments in various organizations and food production units.

Transferable Skills:

PSO 4: Apply the principles of advanced food science to produce innovative food products with value addition for commercial value `to the benefit of the individual, firm and society honing the entrepreneur skills in students.

M.Sc., Food Science and Nutrition – Programme Structure

Programme Articulation Matrix

Course Title	Course Code	Correlation with Programme Outcomes and Programme Specific Outcomes												
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
Advanced Food Science	P21FS101	H	H	H	H	-	-	L	-	L	H	H	M	H
Macronutrients & Micronutrients	P21FS102	H	H	H	H	-	-	L	-	L	L	H	L	-
Nutritional Biochemistry	P21FS103	L	L	H	-	-	H	L	-	L	L	-	-	-
Food Microbiology	P21FS104	H	H	H	M	M	L	-	-	H	-	L	M	-
Advanced Food Science Practical	P21FS1P1	H	M	H	M	L	-	L	L	L	H	L	H	L
Food Microbiology Practical	P21FS1P2	H	H	H	M	M	L	-	-	H	-	L	M	-
Nutrition Through Life Span	P21FS205	M	M	H	M	H	H	H	H	L	L	H	H	-
Therapeutic Nutrition	P21FS206	-	M	H	H	H	H	M	H	H	H	H	H	-

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Community Nutrition and Public Health	P21FS207	M	-	H	M	H	-	M	M	L	L	-	L	-
Nutraceuticals and Functional Foods	P21FS2:1	L	M	L	L	-	H	-	-	-	M	-	-	L
Nutrition through life span practical	P21FS2P3	M	M	H	M	H	H	H	H	L	L	H	H	-
Therapeutic Nutrition Practical	P21FS2P4	-	M	H	H	M	M	H	L	H	H	H	M	-
Analytical Instrumentation	P21FS308	L	L	-	H	-	-	-	-	L	H	M		
Food Toxicology	P21FS309	H	M	L	-	M	-	L	M	-	L	-	M	L
Research Methodology and Statistics	P21FS310	L	-	H	L	H	-	H	M	-	M	-	-	M
Food product development and Food Processing	P21FS3:2	H	H	M	L	H	-	-	H	L	H	M	M	H
Food Safety and Quality control	P21FS3:3	L	H	-	L	-	-	L	-	M	L	L	-	-
Food Analysis practical	P21FS3P5	M	H	L	-	-	H	-	-	L	H	M	H	M
Internship	P21FS3F2	H	H	H	-	M	-	L	M	-	H	M	L	M

xxxxx- Revised Content

Nutrition in Fitness	P21FS411	L	M	H	M	-	H	M	M	H	L	-	L	-
Food Packaging	P21FS4:4	L	H	-	M	L	-	L	M	H	L	-	-	-
Nutrition During Emergency	P21FS4:5	L	L	M	H	-	-	L	M	H	L	M	-	-

xxxxx- Revised Content

FOOD SCIENCE AND NUTRITION

Sem.	Course	Course Title	Course code	Hours / week	Credits	MARKS		
						CIA	ESE	Total
I	Core-I	Advanced Food Science	P21FS101	6	4	25	75	100
	Core-II	Macro and Micro Nutrients	P21FS102	6	4	25	75	100
	Core-III	Nutritional Biochemistry	P21FS103	6	4	25	75	100
	Core-IV	Food Microbiology	P21FS104	6	4	25	75	100
	Core Practical – I	Advanced Food Science	P21FS1P1	3	3	40	60	100
	Core Practical – II	Food Microbiology practical	P21FS1P2	3	3	40	60	100
				30	**22**			
II	Core-V	Nutrition Through Life Span	P21FS205	6	4	25	75	100
	Core – VI	Therapeutic Nutrition	P21FS206	6	4	25	75	100
	Core-VII	Community Nutrition and Public Health	P21FS207	5	4	25	75	100
	Elective – I	Nutraceuticals and Functional Foods	P21FS2:1	5	4	25	75	100
	Core Practical-III	Nutrition Through Life Span Practical	P21FS2P3	3	3	40	60	100
	Core Practical-IV	Therapeutic Nutrition Practical	P21FS2P4	3	3	40	60	100
	VLO	RI/MI	P17VL2:1/ P17Vl2:2	2	2	25	75	100
	Internship	Internship Hospitals	P21FS2F1	-	2	---	---	100
				30	**26**			
	Core – VIII	Analytical Instrumentation	P21FS308	6	4	25	75	100

IIII	Core – IX	Food Toxicology	P21FS309	6	4	25	75	100
	Core-X	Research Methodology and Statistics	P21FS310	5	4	25	75	100
	Elective – II	Food Product Development and Food Processing	P21FS3:2	5	4	25	75	100
	Elective – III	Food Safety and Quality Control	P21FS3:3	5	4	25	75	100
	Core Practical-V	Food Analysis Practical	P21FS3P5	3	3	25	75	100
	Internship	Internship – Food Industry	P21FS3F2	---	2	---	--	100
				30	**25**			
IV	Core XI	Nutrition In Fitness	P21FS411	6	4	25	75	100
	Elective- IV	Food Packaging	P21FS4:4	5	4	25	75	100
	Elective –V	Nutrition During Emergency	P21FS4:5	5	4	25	75	100
	Core Project	Project	P21FS4PJ	14	5	--	--	100
				30	**17**			
TOTAL CREDITS					**90**			
Core Theory : 11 Elective : 5 Value Education : 1 Core Practical : 5 Core Project : 1						**Total Courses : 23**		
• **INTERNSHIP : OFF CAMPUS (Summer and ODD semester Vacation)**								

CORE COURSE-I : ADVANCED FOOD SCIENCE

Semester : I **Code : P21FS101**

Credits : 4 **Total Hours : 60**

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1. Course Outcomes

On completion of this course the students will be able to:

CO.No	Course Outcomes	Level	Unit
CO1	Illustrate the role of physico-chemical changes in food science for the formation of various compounds	K2	I
CO2	Identify the properties of various starch and sugars and quality of flour	K3	II
CO3	Evaluate the physico-chemical changes of vegetable and animal protein	K6	III
CO4	Evaluate various properties and changes of different fats and oils	K5	IV
CO5	Analyze the different types of pigments and physico-chemical changes of plant foods	K4	V
CO6	Determine the structural, functional and physico-chemical characterization of food components	K5	I to V

2. A. Syllabus

Unit I: Physio Chemical Changes in Foods (10 Hours)

Physical properties of water- – Role of water in food systems, Bound water in Food products, Hydrogen ion concentration(pH), Solubility, Solutions, Crystallization, Emulsification, ***Osmosis, Enzyme action (SS),*** Oxidation – reduction, Colloids – Stabilizations and properties, Denaturation and coagulation of proteins .,

Unit II: Starch and Sugars (13 Hours)

A. Components and characteristics of food starches, Swelling of starch granules, Gel formation, factors affecting gelatinization, Retrogradation, syneresis, effect of sugar, acid, fat and Surface Active Agents on starch Rheology of food dispersion foam structure formation and stabilization. Flour and Flours quality, **Science behind dough making techniques food additives, Aroma compounds etc.,**

B. **Stages of sugar cookery (SS)**, Crystal formation, factors affecting, types of candies, Action of Acid, Alkalies and Enzymes

Unit III: Vegetable and Animal Protein **(12 Hours)**

A. Physiochemical properties of amino acids, structure, - Nutritional importance and functional properties of protein, Gluten Formation Effect of soaking, fermentation and germination.

B. Action of Heat, Acid, Alkalies on vegetable and animal proteins – egg, milk, meat and fish.

Unit IV: Fats and Oils **(13 Hours)**

A. Physico – chemical properties of fats and Oils- Rancidity, Hydrogenation, winterization, decomposition of triglycerides, ***Shortening power of Fats (SS)***

B. Tests for evaluation of fat (melting point, smoke point, saponification value, acid value, iodine value, acetyl value, Reichart-Meissl number, tests for stability of oils and fats, etc.); Changes in Fats and Oils during heating and storage, Factors affecting fat absorption of foods

Unit V: Chemistry of pectin's, gums, pigments of plants and food additives (12 Hours)

A. Pectin, phenolic components, vegetables enzymatic browning reactions in fruits and vegetables, preventive measures Volatile compounds from cooked vegetables, ***Different types of Plant Pigments (SS)***, water and fat soluble pigments, Action of heat, acid and alkali on vegetable pigments, properties and active principles of spice and condiments.

B. Food Additives: definition, functions and additives in food processing.

2. B. Topics for self-study

Advances in Dairy Ingredients-Advances in Fermented Foods and Beverages - Improving Quality, Technologies and Health Benefits-Advances in Flavours and Fragrances - From the Sensation to the Synthesis

2. C.Text Book:

1. Srilakshmi, M., Foodscience, New Age International (P) Ltd., Publishers 2010.
2. Brown. A. Understanding Food, Wadsworth, Thomson Learning Publications, 2000.
3. Mehas, K.Y., and Rodgers, S. L., Foodscience and You. Mcmillan Mcgraw Hill Company, 2000.
4. Owen R. Fennema ,2006, Food Chemistry , Academic Press.
5. P. Fellows, First published: 2000,Genres: Technology · Art
6. J. Fellows ISBN-13: 9781845692162 Edition: Woodhead Publishing Ltd Date of issue: 6 July 2009.

7. Brown.A:Understanding Food-Principles and Preparation;2nd edition, Thomson Wadsworth. 2004.
8. Potter, N. and Hotchkiss HJ, Food Science, 5th edition, CBS Publisher, 2007.

2. D. References:

1. Potter, N. and Hotchikiss, J.H. (1996), Food Sciences, Fifth edition, CBS publishers and Distributors, New Delhi.
2. Fennema OR.1996. Food Chemistry. Marcel Dekker
3. Paul, P.C., and Palmer, H. H., Food Theory and Applications. John Wiley and Sons, Newyork, 2000 Revised Edition
4. Mahan, Kathleen L. Krause‟s Food, Nutrition and Diet Therapy, W.B.Saunder‟s, 11th Edition 2004.

2. E. Reference Link:

5. https://app.knovel.com/web/browse-a-subject-area.v/catid:216/cat_slug:food-science/

3. Specific Learning Outcomes (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
I	**Physico Chemical Changes in Foods**		
1.1	Physical properties of water-Role of water in food systems, Bound water in Food products**.**	Explain the chemistry underlying the properties and reactions of various food components	K2
		Discuss the importance of water for stability and quality of foods.	K6
		Outline the relation of food stability with its water activity	K2
		Describe Water Activity and Reaction Rate	K3

1.2	Hydrogen ion concentration (Ph), Solubility, Solutions, Crystallization.	Describe the chemical function and chemical interactions of food components.	K3
		Compare the interaction between water and ions	K2
		Illustrate reactions involved in processing and reactions with alkali	K2
		Analyze extensive denaturation affects certain functional properties like solubility and other related properties.	K4
1.3	Emulsification, *Osmosis, Enzyme action (SS),* Oxidation – reduction, Colloids – Stabilizations and properties, Denaturation and coagulation of proteins	Explain the theory of emulsification, role of emulsifying agents in food emulsions.	K2
		Outline the classification and Functions of Colloidal Systems in Food, Types of Colloidal System in Food, Stability.	K2
		Analyze the changes of denaturation and coagulation of protein.	K4
II	**Starch and Sugars**		
2.1	Components and characteristics of food starches, Swelling of starch granules	Identify the Structural Features of Starch Granules	K3
		Classify the enzymes and Their Action on Starch	K4
2.2	Retrogradation, syneresis, Gel formation, factors affecting gelatinization	Demonstrate the structural Transitions and Related Physical Properties of Starch	K2

		production	
		List Starch Use in Foods, Properties and Applications	K4
		Evaluate the effects on sensory and nutritional quality, functional properties, and safety of foods.	K5
2.3	Effect of sugar, acid, fat and Surface Active Agents on starch, Rheology of food dispersion foam structure formation and stabilization.	Outline the significance of the Maillard Reaction, production of flavour and off flavor	K2
		Demonstrate the palatability appearance and physical properties of the brown products.	K2
		Categorize the rheology of Colloidal and Non colloidal Food Dispersions	K4
2.4	Flour and Flours quality, Science behind dough making techniques food additives, Aroma compounds etc.,	Analyze various quality tests of flour	K4
		List the types of Flour, and additives used	K4
		Evaluate the consumption, nutrition and food safety of types of flour.	K5
2.5	***Stages of sugar cookery (SS)***, Crystal formation, factors affecting, types of candies, Action of Acid, Alkalies and Enzymes	Identify the techniques, science and artistry behind the preparation of food products by using sugar.	K3

		Analyze the enzyme catalyzed reactions involving hydrolysis and proteolysis	K4
		Demonstrate the application of proteolytic enzymes in foods	K2
III	**Vegetable and Animal Protein**		
3.1	A. Physiochemical properties of amino acids, structure, - Nutritional importance and functional properties of protein	Identify scientifically the changes occurring in food during processing, handling and storage	K3
		List the properties, Structure, Classification and Functions of Amino Acids	K4
		Identify the benefits, food sources and role of aminoacids	K3
		Outline the functional roles of food proteins in food systems	K2
3.2	Gluten Formation, Effect of soaking, fermentation and germination.	Explain the types of gluten Importance and functions of gluten formation	K2
		Evaluate the major chemical reactions that occur during food preparation and storage	K5
3.3	Action of Heat, Acid, Alkalies on vegetable and animal proteins – egg, milk, meat and fish.	Analyze the major chemical reactions that limit shelf life of various foods	K4
		Interpret the prevention of undesirable changes in vegetables and animal proteins	K5
IV	**Fats and Oils**		
4.1	Physico – chemical properties of fats and Oils- Rancidity, Hydrogeneation, winterization, decomposition	Illustrate the basic techniques of manufacturing /refining of oil and demonstrate the behaviour of oil at various	K2

	of triglycerides, Shortening power of Fats (SS)	temperatures.	
		Outline the classification and chemical composition of edible fats and oils	K2
		Compare the chemical composition of fats of various species	K2
		Evaluate the factors and preventive measures of Autooxidation	K5
		Explain the refining, hydrogenation & winterization	K2
4.2	Tests for evaluation of fat (melting point, smoke point, saponification value, acid value, iodine value, acetyl value, Reichart-Meissl number	Describe the effect of heating on fats & oils with respect to smoke point	K3
4.3	Tests for stability of oils and fats, etc	Analyze Hydrolysis, oxidation and polymerization are due to the chemical reactions that take place during deep fat frying.	K4
4.4	Changes in Fats and Oils during heating and storage, Factors affecting fat absorption of foods.	Demonstrate the reactions involved during deep frying of food	K2
		Illustrate the reactions are responsible for various physical and chemical changes in the frying oil	K2
		Analyze the behaviour of food during frying	K4
V	**Chemistry of pectin's,gums, pigments of plants and food additives**		

5.1	Pectin, phenolic components, vegetables enzymatic browning reactions in fruits and vegetables, preventive measures Volatile compounds from cooked vegetables	Evaluate the post-harvest changes in fruits and vegetables	K5
5.2	Different types of Plant Pigments (SS), water and fat soluble pigments	Compare the composition and nutritive value of different fruits and vegetables and their role in cookery	K5
5.3	Action of heat, acid and alkali on vegetable pigments	Analyze the principles behind analytical techniques associated with food.	K4
5.4	Properties and active principles of spice and condiments.	Summarize the significance and active principles, types and their uses of spices and condiments	K2
5.5	Food Additives: definition, functions and additives in food processing.	Experiment with physical, sensory and chemical methods of food quality testing.	K3

4. Mapping scheme for PO, PSOs and COs
L-Low, M-Medium, H-High

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	H	H	H	L	L	-	H	M	H	L	H	L
CO2	H	H	H	H	L	L	-	H	M	H	L	H	L
CO3	H	H	H	H	L	L	-	H	M	H	L	H	L
CO4	H	H	H	H	L	L	-	H	M	H	L	H	L
CO5	H	H	H	H	L	L	-	H	M	H	L	H	L
CO6	H	H	H	H	L	L	-	H	M	H	L	H	L

5. COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator: Ms. Muneera .N

CORE COURSE-II : MACRONUTRIENTS & MICRONUTRIENTS

Semester : I **Code : P21FS102**
Credits : 4 **Total Hours : 60**

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1. Course outcomes

On completion of this course the students will be able to:

CO.NO	Course outcomes	Level	Unit
CO1	Identify macro and micronutrient and understand the energy metabolism and know about the carbohydrates and dietary fiber.	K4	I
CO2	Learn to critically evaluate the methodology and derivation of requirements for specific macro and micro nutrients	K5	II
CO3	Evaluate essential micro nutrients in food and their necessity in supporting human life and health.	K5	II
CO4	Analyse various disorders of nutrition among different age groups	K5	III
CO5	Evaluate nutrition information based on scientific reasoning and clinical knowledge acquired	K5	IV
CO6	Provide best nutrition based services for students and ultimately the entire society	K5	V

2. A. Syllabus

Unit I: Energy & Carbohydrate (12 Hours)

A. Energy - Energy Content of Foods, Basal metabolism, Total Energy Expenditure, Thermogenic Effect, Energy balance Energy utilization in cells-Role of Mitochondria Energy metabolism during Physical Activity, CED and Obesity, Energy Requirements for Strenuous Physical Activity -Sports, Expeditions.

B. Carbohydrates and Fibre - Nutritional Importance of Carbohydrates. Review of Classification, Function, Concept of Glycemic Index and Glycemic Load ,Fibre – Classification, Components, Sources (SS) Role of Dietary Fibre in Human Nutrition Abnormalities in the Regulation of Glucose Homeostasis, Inherited Disorders of Carbohydrate Metabolism,, Role of Multiple Transportable Carbohydrates

Unit II: Proteins and Aminoacids: (12 Hours)

A. Proteins - Functions and Classification, Sources, Digestion, Absorption and] Utilization of proteins Protein Turnover, Synthesis and Stores Computation of protein requirements through factorial method and balance study

B. Amino acids - Classification, Functions and Sources (SS), Evaluation of Protein Quality- Different methods based on albino rats and microbes – BV, DC, PER, NPR, NPU, PDCAAS, Supplementary value of Proteins, Novel Protein Foods, Role of specific proteins, their metabolites, transporters and inhibitors on specific body functions- growth, protection regulation, wound healing

Unit III: Fats and Lipids &Water (12 Hours)

A. Fats - Classification, functions**,** Lipotropic factors, role of essential fatty acids, transport of lipids in blood. Lipid transformation in the liver deposition of fat in the body, Free radical formation and role of antioxidant enzymes in mammalian cells, Consequences of high and low fat intake.

B. Lipids - Recent trends in lipid nutrition- saturated poly unsaturated and mono-unsaturated and transfat, fat burners and replaces.

C. Water - Distribution of Water, Functions, Requirements, Sources, Water Balance **(SS)**, Importance of Euhydration; Assessment of Hydration Status- Common indices Hazards of Hypo and Hyper Hydration with suitable examples

Unit IV: Vitamins (12 Hours)

A. Fat soluble vitamins - A, D, E and K- History, structure, chemistry, physiological actions, absorption, transport, utilization, storage, excretion and methods of assay, biopotency, **Dietary sources (SS)** conversion of carotenes into vitamin A in human beings, recommended intakes, human deficiency and diagnosis, hyper vitaminosis, antivitamins

B. Water soluble vitamins - Thiamine, riboflavin, niacin, vitamin B12, folic acid, pyridoxine, panthothenic acid, biotin, ascorbic acid and pseudovitamins – Sources, functions,biochemical utilization and storage, losses in preparation and handling, recommended intakes of human deficiency, **diagnosis, assessment of availability hypervitaminosis, antivitamins (SS)**

Unit V: Minerals **(12 Hours)**

A. Macro Minerals- Calcium, Phosphorus, Sodium and Potassium

Dietary sources, functions, requirement, deficiency and toxicity, calcium - phosphorus ratio, absorption and utilization, Phosphates in blood, therapeutic uses of phosphates, calcium balance, Hypocalcemia and hypercalcemia, **Sodium and potassium balance (SS)**

B. Micro minerals-Iron, Iodine, Fluorine and Zinc - Dietary sources, functions, requirement, deficiency and toxicity, transport and utilization, effect of excess retention and deficiency (SS**)**

2. B. Topics for self-study

Micronutrient malnutrition: a public health problem, Food Fortification, Basic principle of food fortification, Role of macronutrients and micronutrients in DNA damage.

2. C. Text book(s):

1. Swaminathan, M., "Essentials of food and Nutrition", Vol I & II, Bappco Publishers, Madras 2000.
2. Srilakshmi. B., "Nutrition Science", New age International (p) ltd, publishers, 2004.

2. D. Reference:

1. Frances sizer and Ellie whitney, "Nutrition Concepts and Controversies", Thomson wadsworth Publisher, New York, 2006.
2. MangaleKango, "Normal Nutrition, Curing Diseases through Diet", 1st Edition, CBS publication, 2005.
3. Bonnie, Worthington – Roberts and Sue Rodwell Williams, "Nutrition throughout the lifecycle", 3rd edition, WCB/MC Graw Hill Publisher, New York, 1996.
4. Paul. S., "Text of Bio Nutrition Fundamental and Management", RBSA Publishers, 2003
5. Mahan, Kathleen L. Krause"s Food, Nutrition and Diet Therapy, W.B.Saunder"s, 11th Edition 2004.

2. E Reference Links:

6.https://www.who.int/nutrition/publications/guide_food_fortification_micronutrients.pdf

7.https://www.edx.org/course/nutrition-and-health-micronutrients-and-malnutrition

8. **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5395264/**

3. Specific Learning Outcomes (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
I	**Energy & Carbohydrate**		
1.1	A. Energy content of foods, Basal metabolism, Total Energy Expenditure	Define food energy.	K2
		Determine the energy content of foods.	K5
		Define basal metabolism and explain that affect basal metabolic rate.	K2
		Estimate your daily energy requirement.	K5
		Summarize why the amount of food we eat is not completely under our conscious control.	K5
		Measure the total energy expenditure.	K4
1.2	Energy balance energy utilization in cells-Role of Mitochondria energy metabolism during physical activity, CED and Obesity, Energy requirements for strenuous physical activity – sports, Expeditions.	Explain the energy metabolism and ATP synthesis in human cells.	K2

		Explain the process involved in muscle metabolism during aerobic exercise.	K2
		Describe the role of mitochondria in health and disease.	K2
		Determine the energy imbalance including the role of physical activity lead to weight gain and obesity.	K5
		Investigate the nutritional status of women in India and its relation to the prevalence of chronic energy deficiency (CED) and obesity.	K4
		Estimates energy requirements based on physical activity levels.	K5
		Compare and contrast the metabolic effects of sustained strenuous physical activity (sports).	K4
		Predict the energy requirements of the expedition.	K5
1.3	Nutritional importance of carbohydrates. Review of classification, function, concept of Glycemic Index and Glycemic load.	Describe the nutritional importance of carbohydrates.	K2
		Define Glycemic index and glycemic load and determines health issues and their effect on diet-disease relationships.	K2 & K5
		Analyse the review of classification of Glycemic Index and Glycemic load.	K4
		Discuss the concept and function of glycemic index and glycemic load.	K4
		Differentiate the relationship between glycemic index and glycemic load.	K4

1.4	Fiber-Classification, components, sources (SS) Role of Dietary fibre in human nutrition	Define fiber with some examples	K2
		Classify the fiber based on soluble and insoluble fibres.	K3
		Discuss the components of fiber.	K2
		Identify the sources of dietary fiber.	K4
		Describe the role of dietary fibre in human nutrition.	K2
1.5	Abnormalities in the regulation of glucose Homeostasis, Inherited Disorders of carbohydrate metabolism, Role of Multiple Transportable carbohydrates.	Examine the mechanism of glucose regulation.	K4
		Explain the biochemical basis of inherited disorders with their associate of carbohydrate metabolism.	K2
		Define multiple transportable carbohydrates.	K2
		Describe the major role of multiple transportable carbohydrates.	K2
		Investigate the main outcome of carbohydrate consumption during long duration or endurance exercise.	K4
II	**Proteins and Aminoacid**		
2.1	Proteins –Functions and classification, sources, Digestion, absorption and Utilization of proteins.	Define proteins.	K2

		Classify proteins based on composition, functions and nutritional requirements.	K3
		List out the sources of proteins.	K2
		Explain the role of digestion, absorption of proteins.	K2
		Determines the concept of proteins utilization.	K5
2.2	Protein Turnover, synthesis and stores computation of protein requirements through factorial method and balance study.	Define protein turnover	K2
		Assess the protein turnover in health and disease.	K4
		Determines the protein requirements through factorial method and balance study.	K5
		Estimates the various methods of protein requirements.	K5
		Distinguish the relationship between energy and protein requirements.	K4
2.3	Classification, Functions and sources (SS). Evaluation of protein quality-Different methods based on albino rats and microbes- BV, DC, PER, NPR, NPU, and PDCAAS.	Explain about that the classification, functions and sources of amino acids.	K2
		Evaluate the protein quality.	K5
		Estimate the various methods based on albino rats and microbes.	K5
		Asses the biological value	K5
		Determination of Protein Efficiency Ratio (PER) and Net Protein Ration	K5

		(NPR).	
		Determination of Net Protein Utilization (NPU)	K5
		Estimate the protein digestibility corrected amino acid score (PDCAAS)	K5
2.4	Supplementary value of proteins, Novel protein Foods, Role of specific proteins, their metabolites, transporters and inhibitors on specific body functions –growth, protection regulation, wound healing.	Measure the value of supplementary proteins in foods.	K4
		Analyse the novel protein foods.	K4
		Describe the specific role of proteins and their metabolites, transporters and inhibitors on specific body functions growth.	K2
		Explain about the specific proteins of protection and regulation	K2
		Explain about the contribution of nutrients in would healing.	K2
III	**Fats and Lipids & Water**		
3.1	Classifications, functions, lipotropic factors, role of essential fatty acids, transport of lipids in blood.	Define lipids	K2
		Illustrate the different types of lipids	K2
		Discuss the lipotropic factors.	K2
		Identify the role of essential fatty acids	K4

		Describe the transport process of lipids in blood.	K2
3.2	Lipid transformation in the liver deposition of fat in the body, Free radical formation and role of antioxidant enzymes in mammalian cells, consequences of high and low fat intake.	Describe the role of lipid transport and deposition process in our human body.	K2
		Distinguish the relationship between free radicals and antioxidants.	K4
		Investigate the effect of free radicals on cells.	K4
		Analyse the role of antioxidant enzymes in mammalian cells.	K4
		Correlate the consequences of high and low fat intake.	K5
3.3	Recent trends in lipid nutrition –saturated poly unsaturated and monosaturated and trans - fat, Fat burners and replaces.	Evaluate the recent trends in lipid nutrition.	K5
		Elaborate about that the saturated poly unsaturated and monosaturated and trans fat.	K5
		Discuss the fat burners.	K2
		Find out the challenges of fat replaces.	K3
3.4	Water-Distribution of water, Functions, Requirements, Sources, Water balance (SS), Importance of Euhydration; Assessment of Hydration status-Common indices Hazards of Hypo and Hyper	Define water.	K2

	hydration with suitable examples.		
		Explain the distribution of water.	K2
		Discuss about that the functions, requirements and sources of water.	K4
		Define water balance.	K2
		Determine the various methods of water balance.	K5
		Describe the importance of Euhydration.	K2
		Assess the status of hydration	K5
		Identify the common indices Hazards of Hypo and Hyper hydration with suitable examples.	K4
IV	**Vitamins**		
4.1	Fat soluble vitamins- A, D, E and K-History, structure, chemistry, physiological act utilization, storage, excretion and methods of assay.	Define fat soluble vitamins	K2
		Discuss the origin of fat soluble vitamins.	K4
		Identify the structure and chemistry of fat soluble vitamins.	K4
		Explain the physiological act of fat soluble vitamins.	K2
		Investigate the storage and excretion part of fat soluble vitamins.	K4
		Determine the various methods of assay of fat soluble vitamins.	K5

4.2	Dietary sources (SS) conversion of carotenes into vitamin A in human being deficiency and diagnosis, hyper vitaminosis, antivitamins.	Find out the dietary sources of vitamins.	K3
		Explain the role of the Vitamin A in human metabolic process.	K2
V	**Minerals: Macro Minerals-calcium, phosphorus, sodium and potassium.**		
5.1	Dietary sources, functions, requirement, deficiency and toxicity, calcium-phosphorus ratio, absorption and utilization, phosphates in blood, therapeutic uses of phosphates, calcium balance, Hypocalcaemia and hypercalcemia, sodium and potassium balance (SS)	Describe the biochemical and nutritional importance of minerals in human body.	K2
		List major dietary source of macro minerals.	K4
		Identify the nutrient requirements and discuss the significant functions of minerals in the body.	K4
		Describe the consequences of deficiency disease and toxicity of macro minerals.	K2
		Determine the calcium-phosphorus ratio.	K5
		Discuss about the absorption and utilization process of minerals in our human body.	K4
		Evaluate the level of phosphorus in the blood.	K5
		Outline the therapeutic uses of	K3

		phosphates	
		Define calcium balance and sodium potassium balance	K2
		Explain about the disorders of calcium.	K2
5.2	Micro-minerals –Iron, Iodine, Fluorine and Zinc. Dietary sources, functions, requirement, deficiency and toxicity, transport and utilization, effect of excess retention and deficiency (SS).	List major dietary source of micro minerals.	K4
		Identify the functions of micro-minerals.	K4
		Examine the deficiency disease and toxicity level of micro minerals.	K4
		Describe the role of transport and utilization process of micro minerals.	K2
		Discuss the impact of excess intake of micro-mineral.	K5
		Evaluate the effect of micro-mineral retention.	K5
		Describe the roles of macro-micronutrients.	K2

4. Mapping scheme for PO, PSOs and COs
L-Low, M-Medium, H-High

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	L	L	M	-	-	-	-	-	L	L	-	L	L
CO2	L	L	L	L	-		-	L	-	L	L	L	L

CO3	L	M	H	-	-	-	-	-	L	-	-	-	-
CO4	M	-	L	-	-	L	-	-	-	L	-	-	-
CO5	L	L	M	L	-	L	-	L	-	M	L	-	-
CO6	L	L	M	L	-	-	-	L	-	L	L	-	M

5. COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator: Ms. Maheswari

CORE COURSE-III : NUTRITIONAL BIOCHEMISTRY

Semester : I **Code : P21FS103**

Credits : 4 **Total Hours : 60**

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1. Course outcomes

On completion of this course the students will be able to:

Co .No	Course outcomes	Level	Unit
CO1	Obtain in depth understanding of the biochemical reactions, major and metabolic pathway of carbohydrate	K5	I
CO2	Explain about digestion, absorption, disorders on lipid metabolism and their importance to human health	K5	II
CO3	Evaluate the inter-relationship between the amino acid, proteins and their metabolic pathways of detoxification	K4	III
CO4	Interpret the significance role of genetic material, structure, functions, molecular mechanism of nucleic acids and its biosynthesis	K5	IV
CO5	Introduce terminologies used in the study of enzymology and analyze the role of enzyme kinetics and inhibitors.	K5	V
CO6	Interpret the biochemical importance of the nutrient metabolism and their related disease conditions	K5	V

2. A Syllabus

Unit I: Carbohydrates (12 Hours)

A. Introduction, Classification. Structure and Properties of monosaccharides (hexoses and pentoses). Reactions of monosaccharides – oxidation, reduction and reaction with hydrogen cyanide, hydroxyl amine and phenyl hydrazine. Oligosaccharides – Sucrose, maltose, lactose, isomaltose, cellobiose.

B. Homopolysaccharides - Structures of storage polysaccharides (Starch and glycogen).Heteropolysaccharides – Structures of Hyaluronic acid, Heparin and Chondroitin sulphate. Metabolism – Glycolysis, TCA cycle, HMP Shunt and energy production in the above pathways. Oxidative phosporylation and Electron Transport Chain, Uronic acid pathway.

Unit II: Lipids **(12 Hours)**

Classification – Triglycerides (Fats), Phospholipids and other non phosphorylated lipids-cerebrosides, gangleosides, sulfolipids. Characterisation of fats. Rancidity of fats. Chemistry of Essential fatty acids. Metabolism – Oxidation of fatty acids, biosynthesis of fatty acids (palmitic acid).

Unit III: Aminoacids and Proteins **(12 Hours)**

Structure and classification of aminoacids. Classification of proteins – denaturation. Metabolism – phenyl alanine, tyrosine, tryptophan; metabolism of methionine, leucine, arginine. Urea cycle, ammonia circulation, ammonia transport to liver deamination, transamination, decarboxylation and urea formation.

Unit IV: Nucleic acids **(12 Hours)**

Composition and function. Structure and properties of DNA and RNA (t-RNA, m-RNA and r-RNA), minor RNA types. Metabolism – Biosynthesis and breakdown of purine nucleotides. Biosynthesis and breakdown of pyrimidine nucleotides. Defects in nucleic acid metabolism.

Unit V: Enzymes **(12 Hours)**

Classification of enzymes. IUB classification Enzyme kinetics – Michaelis Menten equation. Factors affecting enzyme activity (pH, temperature, substrate concentration and enzyme concentration). Enzyme inhibition – Competitive, Non- competitive and Uncompetitive (Kinetics).

2. B. Topics for Self study

Treatment of Metabolic syndrome by combination of physical activity and diet, Oxidation and reduction in the metabolism process and significance, Redox reaction and electron carrier in cellular respiration**,** Nutritional Genomics

2. C. Text Book(s):

1. Ambika Shanmugam, “Fundamentals of Biochemistry for Medical Students”, Seventh Edition, New age publishing Pvt.Ltd., New Delhi, 1986.

2. Deb.A.C., “Fundamentals of Bio chemistry”, 5th edition, New Central Book Agency (P) Ltd., 1992.
3. Sathyanarayana, U., Chakrapani, U., “Textbook of Biochemistry”. 3rd edition, Books and Allied (P) Ltd, Kolkata, 2010.

2. D. References:

1. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2003), Harper‟s Illustrated Biochemistry, 26th edition, International Edition.
2. Deb, A.C. (2002), Fundamentals of Biochemistry, New Central Book Agency (P) Ltd.
3. Nelson, L. and Michael.M.Cox. (2005), Lehninger Principles of Biochemistry, 4th Edition, W.H. Freeman and Company, NewYork.
4. Palmer, T. (1995), Understanding enzymes, 4th Edition, Prentice Halls, Ellis Horwood, London.
5. Voet, D., Voet, G.J. and Pralt, W.C. (2002), Fundamentals of Biochemistry, Upgrade edition, John Wiley and Sons, Inc.
6. West, E.S., Todd, W.R., Mason, H.Sand and Van Brugge, T.J. (1966), Biochemistry, 4th edition, The Macmillan Company, London.

2.E. Reference Link

7. **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1123385/**
8. **https://www.siirt.edu.tr/dosya/personel/beslenme-biyokimyasi-ders-kitabi-siirt-2018221143328398.pdf**
9. **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4158967/**
10. **file:///C:/Users/suriya/Downloads/2012Dutheil_NutrJ_TreatmentOfMetSbyCombinationOfPhysicalActivityDietNeedsAnOptimalProteinIntake.pdf**

3. Specific Learning Outcomes (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
I	**Carbohydrates**		
1.1	Introduction, Classification. Structure and properties of monosaccharides (hexoses and pentoses).	Define carbohydrates with chemical terms.	K3
		Describe the biochemical and nutritional importance of food carbohydrates.	K2
		Classify the different types of carbohydrates.	K2
		Describe the structural configuration of monosaccharides with special reference to glucose.	K2
		Discuss the physical and chemical properties of monosaccharides (hexoses and pentoses).	K4
1.2	Reactions of monosaccharides-oxidation, reduction and reaction with hydrogen cyanide, hydroxyl amine and phenyl hydrazine.	Explain the chemical reactions of monosaccharides.	K2
		Identify and analysis the chemical reactions between group of hydrogen cyanide, hydroxyl amine and phenyl hydrazine with sugars molecules	K4
		Determine the products when a monosaccharide react with a reducing	K5

		agent or with Benedict's agent.	
		Differentiate between reducing and non-reducing sugars.	K4
		Discuss the importance of sugar derivatives of monosaccharides	K4
1.3	Oligosaccharides-Surcose, maltose, lactose, isomaltose, cellobiose.	Explain about oligosaccharides in detailed manner with some examples.	K2
		Identify and analysis the significance of oligosaccharide sugars.	K4
		Elaborate about the sucrose, maltose , lactose , isomaltose and cellebiose	K4
		Differentiate sucrose from either lactose or maltose	K4
1.4	Homopolysaccharides –structure of storage polysaccharide (starch and glycogen) Heteropolysaccharides- Structures of Hyaluronic acid, Heparin and Chondroitin sulphate.	Defining polysaccharides and its types based on the sugar units.	K2
		Analysis the main structural difference between starch and glycogen.	K4
		Explain the structure and functions of homopolysaccharides and heteropolysaccharides with some examples.	K2
		Identify the structures of Hyaluronic acid, heparin and chondroitin sulphate with suitable examples.	K4
1.5	Metabolism-Glycolysis, TCA cycle, HMP shunt and energy	Apply the knowledge obtained in understanding glycolysis pathway in	K3

	production in the above pathways.	production of energy	
		Determine the main difference between glycolysis and gluconeogenesis.	K4
		Outline the sequence of reactions in the tricarboxylic acid (TCA) cycle and explain the purpose cycle.	K3
		Describe the mechanism of hexose monophosphate pathway and its role as a source of NADPH	K2
1.6	Oxidative phosphorylation and electron transport chain, uronic acid pathway	Discuss the importance of high energy compounds, electron transport chain synthesis of ATP under aerobic and anaerobic conditions.	K2
		Describe the synthesis of uronic acid pathway	K2
II	**Lipids**		
2.1	Classification-Triglycerides (Fats), Phospholipids and other non-phosphorylated lipids-cerebrosides, gangleosides, sulfolipids.	Define lipids and discuss the significance role of lipids in our body.	K2
		Classify the types of lipids with some examples.	K2
		Discuss about that phospholipids and non-phosphorylated lipids.	K2
		Differentiate the tabular form cerebrosides and gangliosides	K4
		Explain the biological importance of sulfolipids.	K2
2.2	Characterisation of fats. Rancidity of fats. Chemistry of Essential	List out the physical and chemical	K2

	fatty acids.	characterize of the fats	
		Determine the most important factors affecting properties of lipid.	K5
		Identify the causes of rancidity occurs in fats.	K2
		Discuss the chemistry of essential fatty acids.	K4
2.3	Metabolism-Oxidation of fatty acids, biosynthesis of fatty acids	Describe the metabolic pathway of lipid metabolism.	K2
		Explain and list the various methods by which fatty acids are oxidised in body.	K2
		Make use the source of energy for the activation of a fatty acid in β-Oxidation.	K3
		Describe the biosynthesis pathway of fatty acids.	K2
		Outline about short term and long term regulation of fatty acid synthesis	K2
		Analyse and list the various methods by which fatty acids can be synthesized in the body.	K4
III	**Aminoacids and Proteins**		
3.1	Structure and classification of aminoacids. Classification of proteins- denaturation	Explain the basics of structure of amino acids based on the polarity.	K2
		Classify the structure of amino acids	K2
		Classify the proteins.	K2
		Identify the types of attractive interactions that hold proteins in their most stable three structure	K4

		Explain what happens when proteins are denatured and identify how a protein can be denatured.	K2
3.2.	Metabolism-Phenyl alanine, tyrosine, tryptophan; metabolism of methionine, leucine, arginine.	Discuss the metabolism of phenyl alanine and tyrosine.	K4
		Describe the metabolic pathway of methionine, leucine and arginine.	K2
3.3	Urea cycle, ammonia circulation, ammonia transport to liver, deamination, transamination, decarboxylation and urea formation.	Explain the rationale of the urea cycle in ammonia excretion.	K2
		Explain the role of ammonia transport to liver, deamination, transamination reactions in amino acid synthesis.	K2
		List specific examples of ketoacid/amino acid transmination reactions (pyruvate/alanine, oxaloacetate/aspartate, alpha-ketoglutarate/glutamate), including the names of the enzymes	K2
IV	**Nucleic acids**		
4.1	Composition and function. Structure and properties of DNA and RNA (t-RNA, m-RNA and r-RNA), minor RNA types	Explain the molecular basics of nucleic acids.	K2
		Identify the composition and function of nucleic acids.	K2
		Integrate the terminology and defining structural features that distinguish different classes of nucleotide metabolites.	K5

		Compare and contrast the structure of DNA and RNA	K4
		Discuss the structure and properties of RNA types (mRNA, tRNA and rRNA).	K4
		Different types of RNA and their functions.	
4.2	Metabolism- Biosynthesis and breakdown of purine nucleotides. Biosynthesis and breakdown of pyrimidine nucleotides. Defects in nucleic acid	Describe the biosynthesis of the purine and pyrimidine nucleotide with emphasis on the key regulated steps.	K2
		Compare and contrast the structure and biosynthesis of purines and pyrimidines, highlighting difference between de novo and salvage pathways.	K4
		Apply the knowledge of nucleic acid metabolic pathway for further research (disease conditions).	K5
		Describe the catabolism of purine nucleotides and the associated metabolic disorders.	K2
		Identify inborn errors of purine metabolism (such as deficiencies of HPRTase and adenosine deaminase) and compare and contrast their primary clinical presentations.	K4
V	**Enzymes**		
5.1	Classification of enzymes. IUB classification Enzyme kinetics- Michaels Menton equation	Define and describe the roles of the enzyme-related terms.	K2
		Identify the general classification of enzymes.	K2

		Classify enzymes based on the IUB nomenclatures with examples.	K3
		Define kinetics of enzyme reactions.	K2
		Explain Michaelis-Menton kinetics and be able to apply the Michaelis-Menton equation to calculate velocity, maximum velocity(Vmax) and the Michalelis-Menton constant (Km)	K2
		Explain how an enzyme functions as a catalyst in lowering the activation energy of reactions	K2
5.2	Factors affecting enzyme activity (pH, temperature, substrate concentration and enzyme concentration). Enzyme inhibition-competitive, Non-Competitive and uncompetitive (kinetics)	Explain the factors affecting enzyme activity (pH, temperature, substrate concentration and enzyme concentration).	K2
		Define enzyme inhibition.	K2
		Identify and demonstrate the different types of enzyme inhibition.	K4
		Evaluate the differences between competitive versus non-competitive inhibitors.	K5
		Propose why some enzyme reactions are considered irreversible in the cell.	K5

4. Mapping scheme for PO, PSOs and COs

L-Low, M-Medium, H-High

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	L	L	M	L	-	H	-	-	-	L	-	-	-

CO2	M	L	L	-	-	H	-	-	-	L	-	-	-
CO3	L	L	M	L	-	H	-	-	-	L	-	-	-
CO4	L	L	M	L	-	L	-	-	-	L	-	-	-
CO5	L	L	M	L	-	L	-	-	-	L	-	-	-
CO6	L	L	M	L	-	L	-	-	-	L	-	-	-

5. COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator: Ms. Meera Muralitharan

CORE COURSE-IV : FOOD MICROBIOLOGY

Semester : I **Code : P21FS104**

Credits : 4 **Total Hours : 60**

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1. COURSE OUTCOMES

At the end of the course, the students will be able to:

CO. No	Course Outcomes	Level	Unit
CO1	Obtain a depth understanding on the scope of microbiology and the different culture techniques.	K2	I
CO2	Evaluate the physical and chemical methods involved in the detection of fermented foods.I	K3	II
CO3	Interpret the activity of food borne pathogens and toxins present in food.	K3	II, III
CO4	Analyse the microbiological quality standards and basic concepts of environmental microbiology.	K4	IV
CO5	Acquire knowledge on the industrial microbial products and diagnostic tools of medical microbiology	K5	V
CO6	Gain intense knowledge on the microbial culture and foods, detection methods and techniques involved.	K6	V

2.A. SYLLABUS

Unit- I Introduction to Microbiology:

A. Introduction to Microbiology Structure, Growth and Multiplication of micro-organisms Definition and History: Microscopy, General Morphology and Types of microorganisms

B. Bacteria, Fungi, Algae, Yeast and Virus - Bacteriophage. Growth curve, batch and continuous culture, factors affecting growth: intrinsic factors, nutrient content, pH, redox potential, antimicrobial barrier and water activity; extrinsic factors: relative humidity, temperature and gaseous atmosphere.

UNIT-II- Microbial and Fermented foods

A. **Microorganisms in Foods and methods for detection**: Fresh meat, Processed meat and poultry, Culture, Microscopic, and Sampling Method for detecting microbes, Physical, Chemical methods, Whole animal assays,

B. Fermented Vegetables (olives, cucumbers), Beverage (cocoa and coffee); Bread, Idli,

C. Microbiology of fermented milk – starter cultures, butter milk, cream, yoghurt, kafir, kumiss, acidophilus milk and cheese.

Unit-III: Food borne Diseases

A. Bacterial food borne diseases (Staphylococcal intoxification, Botulism, Salmonellosis, Shigellosis, Enteropathogenic Escherichia Coli Diarrhoea,Clostridium Perfringens gastroenteritis, Bacillus cereus Gastroenteritics)

B. Food Borne Viral Pathogens (Norwalk virus, Norovirus, Reovirus, Rotavirus, Astrovirus, Adenovirus, Parvovirus, Hepatitis A Virus)

C. Food Borne Animal Parasites Protozoa –Giardiasis, Amebiasis, Toxoplasmosis, Sarcocystosis, Crypotosporiodiosis. Cysticercosis /Taeniasis. Roundworm – Trichinosis, Anisakiasis.

D. Mycotoxins: Aflatoxicosis, Deoxynivalenol Mycotoxicosis, Ergotism. Drug resistance - phenomena and mechanism

UNIT – IV Medical Microbiology:

A. Significance of Microbiology in Medicine, Classification of medically important microbes, Normal microbial flora of the human body: normal flora of skin, eye, throat, gastrointestinal tract and urogenital tract - Infections- Sources, types – opportunistic, nosocomial and community acquired infections - Mode of transmission, carriers and their types – investigation of epidemic diseases.

B. Diagnostic tools, antimicrobial agents diagnostic tests (ELISA, Immunofluorescence, Agglutination based tests, Complement fixation, PCR, DNA probes). Mechanism of action of important chemotherapeutic agents. Principles of drug resistance in bacteria.

UNIT-V- Environmental and Industrial Microbiology:

A. Basic concepts in Soil, air and water Microbiology, Introduction to food, dairy and industrial microbiology, use of various enzymes in industry and environment,GMO’s, GEM’s and use of recombinant DNA technology in Microbiology.Regulatory framework for GMO;s in India.

B. Microbial products of industrial value – raw materials, organism and industrial processes involved in the production of ethanol, vinegar, amylase, protease, glutamic acid. Recycling and disposal of industrial wastes through microbes.

2.B Topics for self study:

- Establishing the Endopeptidase-MS Method as a Screening Method for Botulinum Neurotoxins in Media and Foods - https://www.ifsh.iit.edu/projects/food-microbiology-current-topics-investigation
- https://pubmed.ncbi.nlm.nih.gov/26642690/
- Beneficial Bacteria - https://askabiologist.asu.edu/beneficial-bacteria
- Essential for life - https://www.reactgroup.org/toolbox/understand/bacteria/bacteria-are-essential-for-human-life/

2. C. REFERENCES

1.Microbial Biotechnology: Fundamentals of Applied Microbiology by Glazer &Nikaido , W.H. Freeman and Co., New York, 1995.

2. Modern Food Microbiology, 4th edition by J.M. Jay, Springer, 2006.

3. Fundamental Food Microbiology , 3rd edition by B. Ray., CRC press, 2006.

4.Food Microbiology: Fundamentals and Frontiers, 2nd edition by Michael P. Doyle, Larry R. Beuchat, Thomas J. Montville, ASM press, 2001.

5.Food Microbiology by M.R. Adams & M.O. Moss., Royal Society of Chemistry, 2000.

6.Food Microbiology by M.R. Adams, Royal Society of Chemistry, 2008.

7.Adams MR and Moss MO. (1995). Food Microbiology. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.

8.. Banwart JM. (1987). Basic Food Microbiology. 1st edition. CBS Publishers and Distributors, Delhi, India.

9.. Davidson PM and Brannen AL. (1993). Antimicrobials in Foods. Marcel Dekker, New York.

10. Dillion VM and Board RG. (1996). Natural Antimicrobial Systems and Food Preservation. CAB International, Wallingford, Oxon.

11. Frazier WC and Westhoff DC. (1992). Food Microbiology. 3rd edition. Tata McGrawHill Publishing Company Ltd, New Delhi, India.

12. Gould GW. (1995). New Methods of Food Preservation. Blackie Academic and Professional, London.

13. Jay JM, Loessner MJ and Golden DA. (2005). Modern Food Microbiology. 7th edition, CBS Publishers and Distributors, Delhi, India.

14. Lund BM, Baird Parker AC, and Gould GW. (2000). The Microbiological Safety and Quality of Foods. Vol. 1-2, ASPEN Publication, Gaithersberg, MD.
15. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education.

3. Specific Learning Outcomes (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
I	**Introduction to Microbiology**		
1.1	Introduction to Microbiology Structure, Growth and Multiplication of micro-organisms Definition and History: Microscopy, General Morphology and Types of microorganisms	Illustrate the history of Microscopy and Microbiology	K2
		List about the Types of microorganisms	K4
		Outline the Growth and Multiplication of micro-organisms	K2
1.2	Bacteria, Fungi, Algae, Yeast and Virus - Bacteriophage.	Identify the basic shapes of bacteria	K3
1.3	Growth curve, batch and continuous culture, factors affecting growth curve	Compare Batchand Continuous Culture	K4

		Explain about Growth Curve	K2
		Determine the factors affecting growth curve	K5
1.4	**Intrinsic factors:** nutrient content, pH, redox potential, antimicrobial barrier and water activity; **Extrinsic factors:** relative humidity, temperature and gaseous atmosphere.	List the Intrinsic Factors	K4
		List the Extrinsic Factors	K4
		Evaluate the antimicrobial Barrier	K5
		Evaluate the Relative humidity	K5
II	**Microbial and Fermented foods**		
2.1	Microorganisms in Foods and methods for detection: Fresh meat, Processed meat and poultry, Culture, Microscopic, and Sampling Method for detecting microbes, Physical, Chemical methods, Whole animal assays,	Identify the Microbes in Fresh and Processed meat	K3
		Identify the Microorganisms in Poultry	K3

		Explain the Sampling Method for detecting microbes	K2
		Illustrate the Physical and Chemical methods	K2
2.2	Fermented Vegetables (olives, cucumbers), Beverage (cocoa and coffee); Bread, Idli, Microbiology of fermented milk – starter cultures, butter milk, cream, yoghurt, kafir, kumiss, acidophilus milk and cheese.	Outline the microorganisms in Fermented Vegetables	K2
		Identify the microbes in Bread and Idli	K3
		Explain the Microbiology of fermented milk	K2
		List the Starter cultures used in the production of cultured Dairy products	K4
		Explain about acidophilus milk	K2
		Identify the culture in buttermilk. Explain it.	K3
III	**Food borne Diseases**		
3.1	Bacterial food borne diseases (Staphylococcal intoxification, Botulism, Salmonellosis, Shigellosis, Enteropathogenic Escherichia Coli Diarrhoea,Clostridium Perfringens	Categorize the Bacterial food borne diseases	K4

	gastroenteritis, Bacillus cereus Gastroenteritics)		
		Analyze the Staphylococcal intoxification	K4
3.2	Food Borne Viral Pathogens (Norwalk virus, Norovirus, Reovirus, Rotavirus, Astrovirus, Adenovirus, Parvovirus, Hepatitis A Virus) Food Borne Animal Parasites Protozoa –Giardiasis, Amebiasis, Toxoplasmosis, Sarcocystosis, Crypotosporiodiosis, Cysticercosis /Taeniasis, Roundworm – Trichinosis, Anisakiasis	Identify the Food Borne Viral Pathogens and Food Borne Animal Parasites Protozoa	K3
		Explain Amoebiasis and Crypotosporiodiosis	K2
3.3	Mycotoxins: Aflatoxicosis, Deoxynivalenol Mycotoxicosis, Ergotism. Drug resistance - phenomena and mechanism	Discuss on Deoxynivalenol Mycotoxicosis	K6
		Analyze the Drug resistance - phenomena and mechanism	K4
IV	**Medical Microbiology**		
4.1	Significance of Microbiology in Medicine, Classification of medically important microbes, Normal microbial flora of the human body: normal flora of skin, eye, throat, gastrointestinal tract	Illustrate the Significance of Microbiology in Medicine	K2

	and urogenital tract - Infections- Sources, types – opportunistic, nosocomial and community acquired infections - Mode of transmission, carriers and their types – investigation of epidemic diseases.		
		Evaluate Normal microbial flora of the human body	K5
		List the types of infections	K4
		Determine the Mode of transmission of acquired infections	K5
		Identify the gastrointestinal tract and urogenital tract Infections	K3
		Classify the medically important microbes	K4
		Explain the opportunistic, nosocomial and community acquired infections	K2
		Categorize the Infections, Mode of transmission, carriers and their types	K4
4.2	Diagnostic tools, antimicrobial agents diagnostic tests (ELISA, Immunofluorescence, Agglutination based tests, Complement fixation, PCR, DNA probes). Mechanism of action of important chemotherapeutic agents. Principles of drug resistance in	Identify the Diagnostic tools and the Principles of drug resistance in bacteria.	K3

	bacteria.		
		Demonstrate Mechanism of action of important chemotherapeutic agents	K2
		Demonstrate the antimicrobial agents diagnostic tests (ELISA, Immunofluorescence, Agglutination based tests, Complement fixation, PCR, DNA probes)	K2
V	**Environmental and Industrial Microbiology**		
5.1	Basic concepts in Soil, air and water Microbiology, Introduction to food, dairy and industrial microbiology, use of various enzymes in industry and environment,GMO's, GEM's and use of recombinant DNA technology in Microbiology.Regulatory framework for GMO;s in India.	Illustrate the Basic concepts in Soil, air and water Microbiology	K2
		Explain the use of various enzymes in industry and environment,GMO's	K2
		Identify the use of recombinant DNA technology in Microbiology	K3
		Determine the the Regulatory framework for GMO;s in India	K5
5.2	Microbial products of industrial value – raw materials, organism	Identify the Microbial products of industrial value	K3

	and industrial processes involved in the production of ethanol, vinegar, amylase, protease, glutamic acid.		
		Outline the industrial processes involved in the production of ethanol	K2
5.3	Recycling and disposal of industrial wastes through microbes.	Explain about disposal of industrial wastes through microbes	K2
		List the microbes used in the disposal of industrial wastes	K4

4. Mapping scheme

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	H	-	M	-	L	-	H	L	H	H	-	L
CO2	-	H	-	M	H	-	-	H	L	H	L	-	L
CO3	H	H	-	M	-	-	L	H	L	H	L	-	L
CO4	H	H	-	M	-	L	-	H	L	H	L	-	L
CO5	-	M	M	M	-	-	-	H	L	H	L	-	L
CO6	H	H	-	M	-	-	L	H	L	H	L	-	L

L-Low, M-Medium, H-High

5. COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator: Ms. Preethi S

CORE PRACTICAL -I : ADVANCED FOOD SCIENCE PRACTICAL

Semester : I **Code : P21FS1P1**

Credits : 3 **Total Hours : 45**

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1. Course Outcomes

On completion of this course the students will be able to:

CO.No	Course Outcomes	Level	Unit
CO1	Explain the effect of heat on the consistency of various sweets	K2	I
CO2	Apply the principles of fat cookery and identify the factors affecting absorption of fat in foods	K3	II
CO3	Examine the effect of acid and alkali on the pulse cookery	K4	III
CO4	Assess the role of various parameters such as pH and heat on the pigments present in vegetables	K5	IV
CO5	Determine the factors affecting the tenderness of meat and the role of heat in coagulation of egg and the factors that affect egg cookery	K5	V
CO6	Prepare variety of recipes using different methods of cooking, stages, effect of acid, alkali etc.,	K6	VI

2. A. Syllabus

1. sugar cookery and Starches (12 Hours)

(i) Stages of sugar cookery, preparation of Fondant, Fudge, Caramel, Pulled toffees and brittles.

(ii) Preparation of sugar syrups for various Indian traditional sweets

(iii) Gelatinization of various starches, microscopic examination of starches, fermentation of batter in terms of volume and pH

2. Fat and Oils (7 Hours)

(i) Smoking temperature of fats and oils.

(ii) Factors affecting fat absorption of deep fried foods

3. Pulses & Milk (12 Hours)

(i) Effect of soaking time and types of water on pulses

(ii) Effect of cooking, acid and alkali on pulses

(iii) Effect of germination on pulses

(iv) Principles involved in the preparation of cheese

(v) Setting of curds

4. Meat & Egg (7 Hours)

(i) Changes in cooking of meat, factors affecting the tenderness of meat

(ii) Effect of coo king time on egg protein, coagulation of egg, preparation of Mayonnaise

5. Fruits and vegetables (7 Hours)

(i) Effect of acids, alkali and heat on vegetable pigments

(ii) Determination of the strength of pectin in different fruits and vegetable extracts and Preparation of fruit jam and jelly

(iii)Principles involved in the preparation of tomato soup, ketchup and sauce

2. B.Text Book(s):

1) Srilakshmi, M., Foodscience, New Age International (P) Ltd., Publishers, 2010.
2) Potter NN and Hotchkiss HJ, Food Science, 5 th edition, CBS Publishers, 2007.
3) Paul, P.C., and Palmer, H. H., Food Theory and Applications. John Wiley and Sons, Newyork, 2000.

2. C. Reference:

1) Brown. A. Understanding Food, Wadsworth, Thomson Learning Publications, 2000.
2) Mehas, K.Y., and Rodgers, S. L., Foodscience and You. McmillanMcgraw Hill Company, 2000.
3) Owen R. Fennema, Food Chemistry , Academic Press. 2006.

3. Specific Learning Outcomes (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
I	**Sugar cookery**		
1.1	Stages of sugar cookery, preparation of Fondant, Fudge, Caramel, Pulled toffees and brittles	Analyze the factors affecting stages if stages of sugar cookery	K4
		Determine the appropriate temperature of the stages of sugar cookery	K5
		Develop variety of	K6

		candies, toffees and brittles	
		Prepare fondant, fudge, caramel, toffees and brittles	K6
1.2	Preparation of sugar syrups for various Indian traditional sweets	Categorize the different stages of sugar cookery	K4
		Analyze the factors affecting crystallization	K4
		Prepare Gulab jamun, Rassagulla, Ladoo	K6
II	**Starch cookery**		
2.1	Gelatinization of various starches	Illustrate the factors responsible for gelation	K2
		Determine the gelatinization temperature of in different cereal flours	K5
		Prepare rice starch, ragi starch, tapioca starch and Arrowroot starch	K6
2.2	Microscopic examination of starches	Identify the parts of a compound microscope	K3
		Examine the structure of starch microscopically	K4
		Rule on interference of other microbes under the microscope	K5
2.3	Fermentation of batter in terms of volume and Ph	Categorize fermentation	K4
		Identify the Ph of the fermented food products	K3
III	**Fat and Oils**		
3.1	Factors affecting fat absorption of deep fried foods	Explain factors affecting fat absorption	K2
		Measure the amount of oil added to the preparation	K5

		Prepare deep fried foods	K6
3.2	Smoking temperature of fats and oils	Classify the types of rancidity of fats and oils	K4
		Classify fats and oils based on their smoking temperature	K2
		Identify smoking temperature of different oils	K3
		Assume the factors affecting smoking temperature of fats and oils	K5
IV	**Pulses & Milk**		
4.1	Effect of soaking time and types of water on pulses	Explain the anti-nutrients present in pulses	K2
		Choose the suitable type of water for cooking of pulses	K3
		Assess the effect of soaking and types of water on pulses	K5
4.2	Effect of cooking, acid and alkali on pulses	Explain the factors affecting cooking quality of pulses	K2
		Summarize the effect of cooking on nutritional constituents of pulses	K2
4.3	Effect of germination on pulses	Explain germination and the advantages of germination	K2
		Analyze the nutritional improvement on germinated pulses	K4
4.4	Principles involved in the preparation of cheese Setting of curds	Classify the microbes facilitating fermentation	K4
		Classify cheese based on water content	K2
		Prepare cheese and set curd	K6

V	**Meat & Egg**		
5.1	Changes in cooking of meat, factors affecting the tenderness of meat	Summarize the factors affecting meat tenderness	K2
		Analyze the composition and nutritive value of meat	K4
		Determine the method of cooking of meat for desirable product	K5
5.2	Effect of cooking time on egg protein, coagulation of egg, preparation of Mayonnaise	Identify factors affecting coagulation of egg proteins	K3
		Determine the quality of egg	K5
		Prepare and develop flavoured mayonnaise	K6
VI	**Fruits and vegetables**		
6.1	Effect of acids, alkali and heat on vegetable pigments	Classify pigments based on colour developed during cooking	K2
		Categorize pigments based on the effect of acid, alkali and heat	K4
		Interpret the causes for pigments discoloration	K5
6.2	Determination of the strength of pectin in different fruits and vegetable extracts and Preparation of fruit jam and jelly	Evaluate the strength of pectin to acquire desirable consistency of jam and jelly	K5
		Prepare fruit jam and jelly	K6
6.3	Principles involved in the preparation of tomato soup, ketchup and sauce	Compare soup, sauce and ketchup and explain the principles in the preparation	K2
		Identify the appropriate class of food preservatives	K3
		Develop soup, sauce	K6

		and ketchup using varieties of fruits	

4. Mapping scheme

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	L	L	-	H	M	H	L	H	L
CO2	H	H	H	H	L	L	-	H	M	H	L	H	L
CO3	H	H	H	H	L	L	-	H	M	H	L	H	L
CO4	H	H	H	H	L	L	-	H	M	H	L	H	L
CO5	H	H	H	H	L	L	-	H	M	H	L	H	L
CO6	H	H	H	H	L	L	-	H	M	H	L	H	L

L-Low, M-Medium, H-High

5. COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator: Ms. Meera Muralitharan

Food Microbiology Practical

Course Practical- II
Semester- I **Code – P21FS1P2**
Credit – 3 **Total Hours – 45**

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1. COURSE OUTCOMES

At the end of the course, the students will be able to:

CO. No	Course Outcomes	Level	Unit Covered
CO1	Interpret various staining methods to identify the microbes in foods.	K2	I
CO2	Assess the role of microorganisms in fermentation.	K3	II
CO3	Evaluate the role of microorganisms in food spoilage and their effects.	K3	II, III
CO4	Illustrate the preparation of plating techniques	K4	IV
CO5	Compare various physical and chemical methods used in the control of microorganisms	K5	V
CO6	Cultivate and enumerate microorganisms from various food samples	K6	V

2.A. SYLLABUS

1. Sterilization of glassware and Equipments

1.1 Sterilization by dry heat

1.2 Sterilization by moist heat

1.3 Sterilization by filtration

2. Staining methods

2.1 Preparation of smear

2.2 Simple staining

2.3 Gram's staining method

3. Cultivation of micro-organism

3.1 Types of culture

3.2 Incubation of culture

3.3 Method of inoculation

4. Plate culture

4.1 Preparation of plate for streaking

4.2 Streak plates: Separation of mixed culture

5. Determination of Number of viable organisms in a sample

5.1 Colony Count method

5.2 Dilution Tube count method

5.3 Dye reduction method

6. Microbial examination of food

6.1 Sampling procedure

6.2 Detection of *clostridium welchii* in water

6.3 Microscopic examination of milk

6.4 Microscopic examination of canned foods

6.5 Microscopic examination of fruit juices and squash

6.6 Microscopic examination of bread

2. B. References:

1. Microbial Biotechnology by Glazer AN & Nikaido H., 2nd Ed., Cambridge University Press, 2007

2. Biotechnology: A text Book of Industrial Microbiology by Crueger W, Crueger A, 2nd Ed., Sinauer associates, Inc.1990

3. Biotechnology: Food Fermentation Microbiology, Biochemistry and Technology. Volume 2 by Joshi.

4. Essentials of Food Microbiology. Edited by John Garbult. Arnold International Students Edition.

5. Adams MR and Moss MO. Food microbiology, New Age international (P) Ltd., New Delhi.2006.

6. Chris Bell, Paul Neaves, Anthony P. Williams. Food Microbiology and Laboratory Practicals 2nd edition, Blackwell Scientific Publishers, UK. 2006.

7. Choudhary NL. Food Processing and Biotechnology Applications, Oxford Press, New Delhi.2012.

8. Frazier WC and Westhoff DC. Food Microbiology, Sixth edition, Tata McGraw-Hill Publishing Ltd., New Delhi. 2005.

9. Sinha and Sharma. Food Microbiology, Oxford Book Company, New Delhi. 2012.

10. Varun Mehta. Food Biotechnology, Campus Books International, New Delhi. 2006.

11. Vijaya Ramesh K. Food Microbiology, MJP Publishers. 2007.

12. Lund BM, Baird Parker AC and Gould GW. The Microbiological Safety and Quality of foods. Vol. 1-2, ASPEN Publication, Gaithersberg, MD. 2000.

3. Specific Learning outcomes (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
I	**Sterilization of glassware and Equipments**		
1.1	Sterilization by dry heat	Identify the killing of microorganism by temperature	K3
1.2	Sterilization by moist heat	Examine the killing of microbes by steam	K4
1.3	Sterilization by filtration	Determine the removal of microorganism by using	K5

		solution	
II	**Staining methods**		
2.1	Preparation of smear	Developculturemediaforv ariousmicroorganisms.	K6
2.2	Simple staining	Identifythecategory of bacteriausingstainingtec hnique.	K3
2.3	Gram staining	Estimate the positiveandnegativebact eriausingstainingtechniq ue	K5
III	**Cultivation of micro-organism**		
3.1	Types of culture	Estimation of Pure culturetechniques(Spread plate,Streakplate, pourplatemethods)	K5
3.2	Incubation of culture	Examine the incubation period of various microbes	K4
3.3	Method of inoculation	Analyse the inoculation of loops and needles	K4
IV	**Plate Culture**		
4.1	Preparation of plate for streaking	Develop various streaking methods on the surface of a agar plate	K6
4.2	Streak plates: Separation of mixed culture	Identify the different sizes and shapes from streaked colonies	K3
V	**Determination of Number of viable organisms in a sample**		
5.1	Colony Count method	Estimate the number of viable aerobic bacteria per g or mL of product	K6
5.2	Dilution Tube count method	Analyze the coliforms present in water	K4
5.3	Dye reduction method	Identify the bacterial contamination of food	K3
VI	**Microbial examination of food**		
6.1	Sampling procedure	Demonstrate the sampling procedures in different food commodities	K2
6.2	Detection of *clostridium*	Identify the count of	K3

	welchii in water	bacteria present in water	
6.3	Microscopic examination of milk	Estimate the Direct Microscopic Count(DMC) from given sample	K5
6.4	Microscopic examination of canned foods	Examine the type of bacteria present in canned food sample	K4
6.5	Microscopic examination of fruit juices and squash	Determine the type of microbes present in perishable samples	K5
6.6	Microscopic examination of bread	Estimate the count of bread mold present in the sample	K5

4. Mapping scheme for PO, PSOs and COs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	H	-	M	-	L	-	H	L	H	H	-	L
CO2	-	H	-	M	H	-	-	H	L	H	L	-	L
CO3	H	H	-	M	-	-	L	H	L	H	L	-	L
CO4	H	H	-	M	-	L	-	H	L	H	L	-	L
CO5	-	M	M	M	-	-	-	H	L	H	L	-	L
CO6	H	H	-	M	-	-	L	H	L	H	L	-	L

Low-L Medium-M High-H

5. COURSE ASSESSMENT METHOD

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator: Ms. Preethi S

Core paper V -NUTRITION THROUGH LIFE SPAN

Credit – 4 **Course Code: P21FS205**

Semester – II **Total Hours: 60**

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1. Course Outcomes

On completion of this course the students will be able to:

CO.No	Course Outcomes	Level	Unit
CO1	Identify the correlation between nutrition and health	K3	I
CO2	Explain on the nutritional needs pertaining to different stages of life	K2	II
CO3	Analyze the physiological changes on various stages of life and coping up with their daily dietary requirements	K4	III
CO4	Assess the various stages of a woman's life and her nutritional needs during each stage	K4	IV
CO5	Develop the diet plan for each stage of life according to the guidelines for dietary needs	K3	V
CO6	Plan best nutrition based services for students and ultimately the entire society	K3	**V**

2. A. Syllabus

Unit I: Assessment of Nutritional Status & Meal planning (12 Hours)

A. Assessing the food and nutritional problems in the community methods available for the individual and community- direct methods Indirect methods, assessment of ecological factors techniques of diet and nutritional surveys ***computer assistance for consolidation and documentation of data(SS)***

B. **Meal Planning -** Basic principles of meal planning, balanced diet, RDA, food allowance for different age groups, factors affecting meal planning.

Unit II: Pregnancy & Lactation (12 Hours)

A. **Pregnancy -** Stages of gestation, weight gain, complications of pregnancy physiological adjustments, nutritional problems and dietary management, Importance of nutrition during and prior to pregnancy and dietary allowances.

B. Lactation- Physiology of lactation, hormonal control and reflex action, efficiency of milk production, problems of breast feeding, nutritional composition of breast milk, galactogogues, dietary modification and allowances.

Unit III: Infancy and Pre-school children (12 Hours)

A. **Infancy**- nutritional status of infants, premature infant and their feeding, breast feeding , growth and development, superiority of breast milk, advantages of breast feeding, comparison of human milk with cow's milk, artificial feeding, milestones in development formula feeding, weaning and supplementary foods, problems in weaning, nutrition related health problems- diarrhoea, under nutrition, over nutrition/ obesity, preterm infants.

B. **Nutrition During Early And Late Childhood And Adolescence -** Growth and development of preschool children- nutrition and cognitive development, prevalence of malnutrition in preschool age, eating habits, feeding programmes for preschool children, factors affecting nutritional status and nutritional problems during preschool children.

Unit IV: School age and adolescence (12 Hours)

Food habits and nutritional requirements, packed lunch. Dietary allowances (SS), school lunch programme, nutrition during adolescence - changes in growth and development, hormonal influences, psychological problems, disordered eating behaviour, nutritional problems, changes needed to prevent malnutrition

Unit V: Adult and Geriatric Nutrition (12 Hours)

A. **Nutrition in adulthood** – Physiological changes, Nutrition and work efficiency reference man and reference women, activity classification, body composition, nutritional requirements of an adult man and women.

B. **Geriatrics -** definition of changes in body composition, Physiological changes in aging Clinical, psycho-social and economical factors affecting eating behaviour, social

situation, institutionalization, common health problems (SS), Nutritional requirements, modification in diet, feeding old people.

2. B. Topics for self-study

Current and future healthcare professionals and community health workers, with an overarching goal to promote optimal health utilizing adequate nutrition throughout the human lifespan-Food Composition-Nutrition Assistance program.

2. C. Text book(s):

1. Mahtab, S, Bamji, Kamala Krishnasamy, G.N.V. Brahmam, Text Book of Human Nutrition, Third Edition, Oxford and IBH Publishing Co. P. Ltd., New Delhi, 2012.
2. Srilakshmi, B., Dietetics, New Age International (P) Ltd., New Delhi, 2013.
3. Swaminathan, M., Advanced Textbook on Food and Nutrition, Vol. 1, Second Edition, Bangalore Printing and Publishing Co. Ltd., Bangalore, 2012.

2. D. Reference books:

1. Dietary Guidelines for Indians, ICMR, National Institute of Nutrition, Hyderabad, 2013.
2. Gopalan, C. Rama Sastri B.V. and Balasubramanian, Nutritive Value of Indian Foods, NIN, ICMR, Hyderabad, 2014.
3. Krause, M.V. and Hunscher, M.A., Food, Nutrition and Diet Therapy, 14th Edition, W.B. Saunders

2. E. Reference Link:

4. https://extension.ucsd.edu/courses-and-programs/nutrition-throughout-the-lifecycle
5. https://www.nal.usda.gov/fnic/lifecycle-nutrition

3. Specific Learning Outcomes (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
I	**Assessment of Nutritional Status and Meal planning**		

1.1	Assessing the food and nutritional problems in the community methods available for the individual and community- direct methods Indirect methods,	Classify the various types of methods to assess for individual	K3
1.2	assessment of ecological factors techniques of diet and nutritional surveys	Analyze the of different techniques used in assessments of nutritional survey	K4
1.3	computer assistance for consolidation and documentation of data(SS)	Explain the computer assistance for consolidation and documentation of data(SS	K5
		Compare the anthropometry assessment and clinical assessment for nutritional problems.	K5
1.4	Meal Planning		
	Basic principles of meal planning, balanced diet, RDA, food allowance for different age groups, factors affecting meal planning.	Define and explain balanced diet	K2
		Apply the food exchange list. How are they used in planning a diets?	K3
		Classify the reference women and reference men	K3
		Analyze the different types of method used for deriving RDA	K4
		Distinguish the concepts of food requirements in all age groups.	K5
		Discuss in detail the steps involved in planning a menu	K5
		Determinations of food choice involved in economical, physical and social	K5
II	**Pregnancy and Lactation**		
2.1	A. Pregnancy- Stages of gestation, weight gain, complications of pregnancy	Classify the various stages of gestation periods.	K3

		Combine the complete RDA for a pregnant women who is in first to last trimester of pregnancy	K4
		Discuss the complications of pregnancy.	K5
2.2	Physiological adjustments, nutritional problems and dietary management,	List out the physiological changes during pregnancy	K2
		Analyze the complications including multiples, fetal growth abnormalities and infections in pregnancy.	K4
		Explain the medical disorders in pregnancy including hypertensive disorders, diabetes and epilepsy	K2
		Discuss nutritional anemia in pregnancy period. Measures should taken to prevent it.	K5
2.3	Importance of nutrition during and prior to pregnancy and dietary allowances.	Importance of nutrition during pregnancy periods	K5
		Suggest the dietary modification and dietary requirements during pregnancy periods	K5
		Plan a day's menu for pregnant women.	
2.4	B. Lactation – Physiology of lactation, hormonal control and reflex action, efficiency of milk production	Explain the role of hormones in milk production.	K2
		Describe the process of physiology of lactation.	K3
		Analyze the efficiency of milk production in lactating period.	
		Explain the flow charts for failure to thrive while breast fed.	K2
2.5	Problems of breast feeding, nutritional composition of breast milk, galactogogues,	Describe the nutritional problems of breast feeding	K2
		Discuss ICMR RDA for a lactating mother who delivered the child eight months ago	K5

		Importance of nutritional composition of breast milk	K5
		Explain lactogogues	K2
2.6	Dietary modification and allowances.	Inspite of breast feeding the infant does not thrive. explain	K5
		Formulate the dietary supplements for lactating mother	K6
III	**Infancy and Pre-school children**		
3.1	A. Infancy - Nutritional status of infants, premature infant and their feeding, breast feeding , growth and development	Classify the different stages of infancy	K2
		Make use of the RDA of an infant aged of eight months	K3
		Explain the various growth and development of infancy	K2
3.2	Superiority of breast milk, advantages of breast feeding, comparison of human milk with cow's milk, artificial feeding, milestones in development formula feeding,	Compare the nutritive value of human milk with cow's milk	K5
		Analyze the advantages of artificial feeding.	K4
		Give the nutritional importance of baby and explain problems involved in feeding them	K5
		Discuss the Lactobacillus Bifidus factor	K5
		Importance of milestones in development formula feeding,	K5
3.3	Weaning and supplementary foods, problems in weaning, nutrition related health problems- diarrhoea, under nutrition, over nutrition/ obesity, preterm infants.	Define weaning and give the schedule for it.	
		Apply the need for introducing	K3

		weaning foods to an infant's diet.	
		Develop the method of preparing any one low cost weaning food.	K5
		Explain the problems of weaning and discuss any one in detail.	K2
		Analyze on colostrums. Bring out the difference between fore milk and hindmilk	K4
3.4	B. Nutrition During Early And Late Childhood - Growth and development of preschool children- nutrition and cognitive development,	Explain the nutritional importance during pre-school	K2
		Apply the growth chart on pre-school children	K3
		Categorize the growth and development of preschool children	K4
		Compare the nutrition and cognitive development.	K5
		Discuss the factors affecting the nutritional status of children	K5
3.5	Prevalence of malnutrition in preschool age, eating habits, feeding programmes for preschool children,	Relate in nutritional problems in children	K2
		Describe in detail the three stages of treatment of PEM	K2
		Identify the nutritional requirements of PEM child and explain the sequences of dietary treatment	K4
		Plan a day's diet for a 4 year old child from a low income group	K5
		Suggest five recipes rich in vitamin A suitable for a pre-school child.	K5
		Explain the role of ICDS in alleviating malnutrition	K2
3.6	Factors affecting nutritional status and nutritional problems during preschool children.	Discuss about poverty may not be only the reason for malnutrition during pre school age. What are the other reasons?	K5

		Evaluate the factors affecting the nutritional status of children	K5
IV	**School age and adolescence**		
	Nutrition during school age and adolescence - changes in growth and development, hormonal influences, psychological problems, disordered eating behaviour, nutritional problems, changes needed to prevent malnutrition	Compare the nutritional requirements of 7-9 year old and 10-12 year old school children	K3
		Analyze the points to be considered in planning diet for school children	K4
		Explain the role of MID-DAY meal programme in alleviating malnutrition.	K2
		Compare the different types of feeding programmes of India	K4
		Assess the causes of obesity in school going children	K5
		Plan a packed lunch for a 12 year old boy	K5
		Distinguish the nutritional problems of Indian and Western adolescents.	K5
		Give the nutritional importance of adolescents	K5
		Explain the eating disorder such as anorexia and bulimia nervosa	K2
		Plan a days diet of an adolescent girl suffering from nutritional anemia	K5
		Suggest the points to be consider in planning a menu for adolescents period.	K5
V	**Adult and Geriatric Nutrition**		
5.1	Nutrition in adulthood – Physiological changes, Nutrition and work Efficiency reference man and reference women, activity classification, body composition, nutritional requirements of an adult man	Classify the Indian reference men and women	K3

	and women.		
		Give the RDA suggested by ICMR for a male and female executives	K5
		List out the importance of including millets in the diet	K5
		Compare the cost and nutritive value of low cost balanced diet.	K4
		Classifications of vegetarian diet for adults	K4
		Suggest the dietary guidelines for adult	K5
5.2	definition of changes in body composition, Physiological changes in aging Clinical, psycho-social and economical factors affecting eating behaviour, social situation, institutionalization, common health problems (SS), Nutritional requirements, modification in diet, feeding old people.	Define geriatrics	K2
		Illustrate the reasons for malnutrition during ageing?	K2
		Importance of calcium and fiber during old age	K5
		Analyze the degenerative diseases be prevented during geriatrics	K4
		Explain the importance of antioxidants during ageing.	K2
		Discuss the modifications of calorie requirements during old age	K5
		Plan a day's menu for a 60 year old clerk for your choices.	K3

4. Mapping scheme

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	M	L	H	M	H	H	H	H	L	L	H	H	-
CO2	H	M	H	M	H	H	H	H	L	L	H	H	-
CO3	M	H	H	M	H	H	H	H	L	L	H	H	-
CO4	M	H	H	M	H	H	H	H	L	L	H	H	-
CO5	M	M	H	M	H	H	H	H	L	L	H	H	-
CO6	M	M	H	M	H	H	H	H	L	L	H	H	-

L-Low, M-Medium, H-High

5. COURSE ASSESSMENT METHOD

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator: PREETHI S

COURSE CORE-VI : THERAPEUTIC NUTRITION

Semester : II **Code : P21FS206**

Credits : 4 **Total Hours : 60**

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1. Course Outcomes

On completion of this course the students will be able to:

CO.No	Course Outcomes	Level	Unit
CO1	List the role of dietician and explain various diets based on the therapeutic conditions	K2	I
CO2	Identify principles of diet and recommend therapeutic diets based on the severity of the condition	K3	II
CO3	Analyze the patho-physiological changes in the body during disease conditions	K4	III
CO4	Assess the nutritional requirements of patients individually and recommend diets according to their needs	K5	IV
CO5	Explain the aetiology, symptoms, risk factors and dietary management of different disease conditions	K5	V
CO6	Modify regular diets with therapeutic diets according to different conditions	K6	VI

2. A. Syllabus

UNIT I: Dietitian & Hospital Diet **(12 Hours)**

(i) Role of dietitian in the hospital and community- Types of dietitian, education and personal qualifications- Professional ethics and obligations Feeding the patients – Psychology of feeding the patients, assessment of patient's needs.

(ii) Routine hospital diets- regular diet, soft diet, full fluid diet, clear fluid diet Special feeding methods- Parenteral and enteral nutrition Diet for nutritional deficiency

disorders- etiology, types, symptoms and dietary modifications for PEM, anaemia, Vitamin A deficiency

Unit II: Diet in fevers and gastro intestinal system (12 Hours)

(i) **Fever:** Pathogenesis, aetiology, types, symptoms, treatment and dietary modification for Febrile conditions- acute, chronic and recurrent fevers typhoid, influenza, rheumatic fever, tuberculosis, malaria andpoliomyelitis.

(ii) **Gastro intestinal system:** complications, prevention and recent advances in nutritional management of GIT Disorders

a) Gastritis _ Types, dietary modification

b) Peptic ulcer, etiology, symptoms, dietary modification

c) Ulcerative colitis symptom, dietary treatment

d) Sprue types, dietary consideration

Unit III: Disease of liver, gall bladder & CVD (12 Hours)

(i) **Liver:** Types of liver disease, symptoms, causes, principles of diet and dietary modification-of Fatty liver,Jaundice ,Hepatitis ,Hepatic coma, Cirrhosis, Cholecystitis- Cholelithiases. Pancreatic disorders: etiology, pathogenesis and nutritional care

(ii) **Cardiovascular diseases:** Pathogenesis, aetiology, types, symptoms, treatment and dietary modification for cardio vascular disorders- hypertension, atherosclerosis, hyperlipidemia, hypercholesterolemia,acute and chronic cardiac diseases, congestive cardiac failure

Unit IV: Renal diseases & Allergies (12 Hours)

(i) Renal diseases:

a) Classification of renal disease.

b) Glomerulonephritis- Acute and chronic- symptoms and dietetic treatment

c) Nephrosis symptoms and principles of nutritional care.

d) Renal failure- Acute and chronic renal failure, dialysis.

(ii) **Allergies:** food allergy and intolerance – mechanism, factors influencing, symptoms, tests for allergy, nutritional care and elimination diet.

Unit V: DM, Cancer, HIV & AIDS (12 Hours)

(i) **Diabetes Mellitus:** Symptoms , types and diagnoses , dietary management and meal management, Hypoglycemic agents and insulin, complications of diabetes

(ii) **Pulmonary diseases:** bronco pulmonary disease, asthma, respiratory failure, Nutritional care and requirement for major burns.

(iii) **Cancer:** Cancer -Classification, risk factors, symptoms, general systemic reactions, nutritional problems of cancer therapy, nutritional requirement and diet modifications

(iv) **HIV and AIDS:** aetiology, signs and symptoms, stages, diagnosis and diet modifications

2. B. Topics for Self-study

Integration of nutrition into paediatric care, Reading of nutrition facts label, Haemopoetic diseases and Neurological diseases.

2. C. Text Book(s):

1) Swaminathan M. Essentials of Food and Nutrition, Vol. I & II Ganesh and Company, Madras, 1995.
2) Srilakshmi, B, Dietetics, New Age International, New Delhi, 2002.
3) Gopalan , C. Ramasastri, B.V. and Balasubramaniam, S.C. Nutritive value of Indian Foods National Institute of Nutrition, Hyderbad, 2010.

2. D. Reference:

1) Krause M.V. Horsch M.A. Food Nutrition and Diet Therapy W.B. Saunders Company, Philadelphia, 1993.
2) William's Basic Nutrition and Diet Therapy, Staci Nix, RS, C.V. Muusby Camp. Saint, Lowin, 2012.
3) Cooper Et. al, Nutrition in health and disease 4th edition, Pitman Medical Publishing Co. 1963.

2. E. Reference links:

4. https://books.google.co.in/books?id=4l-k64BD-MIC&printsec=frontcover#v=onepage&q&f=false

5.https://www.google.co.in/books/edition/Therapeutic_Nutrition/IJAkBAAAQBAJ?hl=en&gbpv=1&dq=therapeutic+nutrition+books&printsec=frontcover

3. Specific Learning Outcomes (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
I	**Dietician & Hospital Diet**		

1.1	Role of dietician in the hospital and community- Types of dietician, education and personal qualifications- Professional ethics and obligations	List the responsibilities of a dietician	K1
		Classify the types of dietician	K2
		Demonstrate professionalism and ethical behaviour in all areas of practice	K2
1.2	Feeding the patients – Psychology of feeding the patients, assessment of patient's needs.	Develop practical skills in feeding and management of different age groups	K3
		Asses the needs and modify the diet for patient's	K5
1.3	hospital diets- regular diet, soft diet, full fluid diet, clear fluid diet	Choose appropriate diet for suitable therapeutic condition	K3
		Distinguish types of hospital diet	K4
		Develop diet based on therapeutic condition of the patient	K6
1.4	Special feeding methods- Parenteral and enteral nutrition	Compare the special feeding methods	K2
		Analyze the appropriate feeding method for suitable condition	K4
		Formulate diet for patients under parenteral feeding method	K6
1.5	nutritional deficiency disorders- etiology, types, symptoms and dietary modifications for PEM, anaemia, Vitamin A deficiency	Illustrate nutritional deficiency disorders	K2
		Construct home gardening methods to prevent disease	K3
		Assess pathophysiology, risk factors and clinical manifestation of diseases	K5
		Recommend dietary modification to suit the disease condition	K5
II	**Diet in fevers and gastro intestinal system**		

2.1	FEVER : Pathogenesis, aetiology, types, symptoms, treatment	Outline the etiology, incidence, nature, clinical symptoms and treatment of the condition	K2
		Examine clinical manifestations of the disease condition	K4
2.2	Dietary modification for Febrile conditions- acute, chronic and recurrent fevers typhoid, influenza, rheumatic fever, tuberculosis, malaria and poliomyelitis.	Identify and Categorize the febrile condition based on symptoms	K3, K4
		Analyze the nutrient requirement of the patients	K4
		Evaluate the condition using modified diets	K5
2.3	Gastro intestinal system : complications, prevention	List the complications in Gastro Intestinal system	K1
		Asses the preventive measures to avoid complications	K5
2.4	Recent advances in nutritional management of GIT Disorders a) Gastritis - Types, dietary modification b) Peptic ulcer, etiology, symptoms, dietary modification c) Ulcerative colitis symptom, dietary treatment d) Sprue types, dietary consideration	Interpret the types of therapeutic modifications with respect to consistency, frequency of meals, methods of cooking	K2
		Analyze and Distinguish the types of gastro intestinal disorders	K4
		Asses nutritional status and Recommend suitable therapeutic diets for the disorder	K5
III	**Disease of liver , gall bladder & CVD**		
3.1	LIVER-Types of liver disease, symptoms, causes, principles of diet and dietary modification-of Fatty liver, Jaundice ,Hepatitis	Compare types of liver disease	K2

	,Hepatic coma ,Cirrhosis, Cholecystitis- Cholelithiases.		
		Apply principles of diet and plan suitable modification in dietary pattern	K3
		Catergorize liver disease based on the symptoms	K4
		Influence behavioral change through nutrition counselling to the patients and clients	K5
3.2	Pancreatic disorders: etiology, pathogenesis and nutritional care	Illustrate cause and effect of pancreatic disorders	K2
		Identify suitable nutritional care to combat pancreatic disorders	K3
		Analyze the nutritional status of the patients with pancreatic disorders	K4
3.3	Cardiovascular diseases : Pathogenesis, aetiology, types, symptoms, treatment	List the types and symptoms of cardiovascular disease	K1
		Categorize treatment based on the type of cardiovascular disease	K4
		Determine the causes for cardiovascular disease	K5
3.4	dietary modification for cardio vascular disorders- hypertension, atherosclerosis, hyperlipidemia, hypercholesterolemia, acute and chronic cardiac diseases, congestive cardiac failure	Influence dietary modification using nutrition counselling method	K5
		Evaluate normal and therapeutic nutritional needs of the patient	K5
		Estimate the fat requirement for the types of cardiovascular disease	K5
		Formulate tailor-made diets based on the severity of the condition	K6
IV	**Renal diseases & Allergies**		

4.1	Renal diseases a) Classification of renal disease. b) Glomerulonephritis- Acute and chronic- symptoms and dietetic treatment c) Nephrosis symptoms and principles of nutritional care. d) Renal failure- Acute and chronic renal failure, dialysis.	Classify the types of renal diseases	K2
		Apply principles of diet in modification of dietary pattern	K3
		Identify suitable nutritional care methods to combat the condition	K3
		Discover the recent advancements in treating the condition	K5
		Examine the nutritional status of the patients	K5
4.2	Allergies – food allergy and intolerance – mechanism, factors influencing, symptoms, tests for allergy, nutritional care and elimination diet.	List the foods causing allergic symptoms	K1
		Explain the hormones responsible in inducing the allergic condition	K2
		Select appropriate nutritional care to alleviate the symptoms	K3
		Analyze the food allergy management and prevention plans	K4
		Distinguish food allergy and intolerance	K4
V	**DM, Cancer, HIV & AIDS**		
5.1	Diabetes Mellitus- Symptoms , types and diagnoses , dietary management and meal management, Hypoglycemic agents and insulin , complications of diabetes	Define Diabetes Mellitus and List the types of diabetes mellitus	K1

		Outline the diagnostic methods to screen the condition	K2
		Identify other disorders associated with the metabolic syndrome	K3
		Formulate plans for maximizing wellness and prevention of chronic disease	K6
5.2	Pulmonary diseases- bronco pulmonary disease, asthma, respiratory failure, Nutritional care and requirement for major burns.	Explain the structure of lungs and Contrast the types of pulmonary disease	K2
		Plan tailor-made diets to provide nutritional support	K3
		Asses the needs of the patient with burns and support using therapeutic nutrition	K5
5.3	Cancer - Cancer - Classification, risk factors, symptoms, general systemic reactions, nutritional problems of cancer therapy, nutritional requirement and diet modifications	Classify the types and explain the symptoms of cancer	K2
		Influence health behaviour change using nutrition counseling techniques	K5
		Determine the risk factor and nutritional problems in cancer treatment	K5
5.4	HIV and AIDS - aetiology, signs and symptoms, stages, diagnosis and diet modifications	Explain the relationship between diseases and disorders	K2
		Identify the cause of HIV and AIDS and select suitable dietary modification to support nutritionally	K3
		Assess pathophysiology, risk factors and clinical manifestation of diseases related to nutrition.	K5
		Recommend palliative care to support the infected	K5

		individuals	

4. Mapping scheme

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	-	-	H	H	M	H	M	L	H	H	H	M	-
CO2	-	H	H	H	L	H	H	H	H	H	M	H	-
CO3	-	M	H	M	M	-	H	H	-	H	M	M	-
CO4	-	M	H	H	H	M	H	H	-	H	M	H	-
CO5	-	H	H	M	M	-	L	L	-	L	L	M	-
CO6	-	M	H	H	H	H	H	H	H	H	H	H	-

L-Low, M-Medium, H-High

5. COURSE ASSESSMENT METHOD

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator: ROSELIN C

CORE COURSE-VII : COMMUNITY NUTRITION AND PUBLIC HEALTH

Semester : III **Code : P21FS207**

Credits :4 **Total Hours : 60**

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1. Course outcome

On completion of this course the students will be able to:

CO.N0	Course outcomes	Level	Unit
CO1	Develop ideas to improve health and nutrition in the community.	K5	I
CO2	Predict the reasons for malnutrition and improve the health status of affected individuals	K5	II
CO3	Categorise the role of various agencies like National and International organizations for the welfare of individuals	K5	III
CO4	Assess the epidemiology of communicable disease at community level.	K5	IV
CO5	Evaluate the current programmes of nutrition monitoring and surveillance systems in India	K5	V
CO6	Assess the methods burden of malnutrition in a community, nutritional programmes adopted by various national and international agencies engaged in the battle against malnutrition and related issues	K5	V

2. A. Syllabus

Unit I: Nutrition and National Development, Ecology of Malnutrition, Strategies To Overcome Malnutrition (12 Hours)

A. History of malnutrition in India- factors leading to malnutrition; Measures to overcome malnutrition.Relation of nutrition to national development; Consequences of malnutrition;

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

B. Nutritional Assessment**:** Methods of assessment of Nutritional status –Primary and secondary methods, Direct assessment - Diet survey, anthropometry, clinical and biochemical estimation. Indirect assessment - Food balance sheet,

Unit II: National, International And Voluntary Organizations To Combat Malnutrition

(12 Hours)

A. National organization – ICAR, ICMR, SCWB, SSWB, NNMB, NIN, CFTRI, DFRL, NIPCCID and NFI;

B. International Organizations - WHO, FAO, UNICEF, World Bank, FFHC, WFP; Voluntary organizations – Global Alliance for Improved Nutrition(GAIN),

C. Micronutrient Initiatives, CARE, CRS, AFPRO, IDA; Concepts of Community Health care of the community.

D. Nutrition Intervention programmes - Nutritious Noon Meal Programme. ICDS.

Unit III: Advanced Nutritional Programmein India (12 Hours)

A. Indhradhanush, AnemiaMuktBharat, PoshanAbhiyan, National Oral Health Programme (Nohp), JananiSurakshaYojana, PradhanMantriMatruVandanaYojana (PMMVY), Scheme For Adolescent Girls (SAG) Of MWCD

B. National Health Mission (NHM), Swachh-Bharat Mission, PradhanMantriSwasthyaSurakshaYojana, JananiShishuSurakshaKaryakaram, E-Pds, Eat Right India movement by FSSAI.

Unit III: Nutrition Education (12 Hours)

A. Meaning, nature and importance of Nutrition education to the community and lessons to be taught (SS),Training workers in nutrition education programmes Methods of education when to teach, whom to teach

B. Use of computers to impart nutrition education Organization of Nutrition education programmes.National Nutrition policy

Unit IV: Epidemiology Of Communicable Diseases (12 Hours)

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

B. Types of immunity- active, passive and herd-group protection. Immunization agents- vaccines, immunoglobulins, ***Immunization schedules*** **-** Active- National and WHO Expanded Programme on Immunization- Universal Passive, Combined, Chemoprophylaxis, non-specific measures .

Unit V: Nutrition Monitoring And Nutrition Surveillance System (12 Hours)

A. Nutrition monitoring-objectives of nutrition monitoring, current programmes of nutrition monitoring in India.

B. Nutrition surveillance system– objectives of nutrition surveillance system, use of nutrition surveillance system, infrastructure of nutrition surveillance system, key indicators of successful nutritional surveillance programme.

C. Computerization for monitoring and surveillance.

2. B. Topics for Self study

Community Nutrition in recent research; Nutrition self-efficacy assessment: designing and psychometric evaluation in a community-dwelling elderly population; experiential cooking and Nutrition Education Program.

2. C. References

1. Park A. (2007), Park‟s Textbook of Preventive and Social Medicine XIX Edition M/S Banarasidas, Bharat Publishers, 1167, Prem Nagar, Jabalpur, 428 001(India)

2. Bamji M.S, PrahladRao N, Reddy V (2004). Textbook of Human Nutrition II Edition, Oxford and PBH Publishing Co. Pvt. Ltd , New Delhi

3. Bhatt D.P (2008), Health Education, KhelSahitya Kendra, New Delhi

4. Gibney MJ, Margetts BM, Kearney JM, Arab L (2004) Public Health Nutrition Blackwell Publishing Co. UK

5. Swaminathan M (2007), Essentials of Food and Nutrition. An Advanced Textbook Vol.I, The Bangalore Printing and Publishing Co.
Ltd, Bangalore.

2. DReference Links

6. https://jhpn.biomedcentral.com/articles/10.1186/s41043-019-0203-3

7. https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/5191/IDL-5191.pdf?sequence=1

8. file:///C:/Users/suriya/Downloads/1-s2.0-S1499404616307138-main.pdf

3. Specific Learning outcomes (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
I	**Nutrition and National Development , Ecology of Malnutrition, strategies to overcome Malnutrition**		
	History of malnutrition in India- factors leading to malnutrition; Measures to overcome malnutrition. Relation of nutrition to national development; consequences of malnutrition.	Explain the origin of malnutrition in India.	K2
		Identify the factors affecting malnutrition in India.	K4
		Determine the control measures of malnutrition.	K5
		Identify the consequences of malnutrition.	K4
		Analyse the relationship between nutrition development and consequences of malnutrition.	K4

1.2	A. IMR, NMR, MMR and prevalence of common nutrition problems-PEM, Vitamin A Deficiency diseases, Anaemia, Iodine Deficiency Disorders and Fluorosis.	Define infant mortality rate, Neonate mortality rate and Maternal mortality rate.	K2
		Determine the ratio of IMR, NMR and NMR	K5
		Find out the common nutrition problems.	K3
		Examine the causes and find the preventive measures of protein energy malnutrition.	K3
		Describe the consequences and preventative measures of vitamin A deficiency.	K2
		Explain the specific strategies and control measures of iodine deficiency disorders and fluorosis.	K2
1.3	B. Nutritional Assessment**:** Methods of assessment of Nutritional status –Primary and secondary methods, Direct assessment - Diet survey, anthropometry, clinical and biochemical estimation. Indirect assessment - Food balance sheet.	Determine the various assessment methods of nutritional status.	K5
		Discuss the primary and secondary methods of nutritional status.	K2
		Classify the various methods used for	K3

		assess the nutritional status.	
		Distinguish between A, B, C and D methods of assessment.	K4
		Compare the diet survey and anthropometry assessment	K4
		Discuss the clinical and biochemical method of assessment.	K2
		Analyze the relationship between nutritional status of the individuals and various parameters.	K4
		Discuss the food balance sheet	K2
II	**National, International And Voluntary Organizations To Combat Malnutrition**		
2.1	A. National organization – ICAR, ICMR, SCWB, SSWB, NNMB, NIN, CFTRI, DFRL, NIPCCID and NFI;	Explain about that the national organization.	K2
		List out the role of national organizations	K3
		Categorize the various national programmes in health related.	K4
		Explain the role of following agencies in combating malnutrition SCMB, NNM, SSWB and NFI.	K2
		Apply the knowledge of ICMR , CFTRI , NIN and ICAR	K4
		Discuss the National institute of public cooperation and child development.	K2

		Explain the role and functions of national nutrition monitoring bureau.	K2
		Define NFI and Explain its objectives and projects it has under taken.	K2
		Discuss the Defence food research laboratory, Mysore.	K2
		Explain the contributions of NIN	K2
2.2	B. International Organizations - WHO, FAO, UNICEF, World Bank, FFHC, WFP; Voluntary organizations – Global Alliance for Improved Nutrition(GAIN),	Explain the functions of international organizations.	K2
		Compare the WHO and FAO and their roles and functions.	K4
		Discuss the world Bank.	K2
		Discuss the achievements of UNICEF in relation to nutrition.	K2
		Differentiate the relationship between the FFHC and WEP.	K4
		Describe the role and functions of global of alliance for improved nutrition (GAIN)	K2
2.3	C. Micronutrient Initiatives, CARE, CRS, AFPRO, IDA; Concepts of Community Health care of the community.	Describe the functions of micronutrient initiatives	K2
		Discuss CARE	K2
		Assess the role of AFPRO, CRS and IDA organizations to combat malnutrition.	K5

		Explain the concepts of community health care in community level.	K2
2.4	D. Nutrition Intervention programmes - Nutritious Noon Meal Programme. ICDS.	Assess the nutrition intervention programmes in India.	K5
		Analyze the methods and scope of nutrition interventions.	K4
		Discuss the nutritious noon meal programme	K2
		Explain the role of ICDS.	K2
		Discuss objectives and identify the components of ICDS.	K4
		Identify the beneficiaries of ICDS program.	K4
III	**Advanced Nutritional Programme in India**		
3.1	Indhradhanush, Anemia MuktBharat, Poshan Abhiyan, National Oral Health Programme (Nohp), JananiSurakshaYojana, PradhanMantriMatruVandanaYojana (PMMVY), Scheme For Adolescent Girls (SAG) Of MWCD,	Assess the advanced nutritional programme in India.	K5
		Investigate the goals of the Indhradhanush.	K4
		Identify the main cause of Anemia MuktBharat scheme.	K4
	National Health Mission (NHM), Swachh-Bharat Mission, Pradhan MantriSwasthya Suraksha Yojana, JananiShishuSurakshaKaryakaram, E-Pds, Eat Right India movement by FSSAI.	Explain the major role of Poshan Abhiyan scheme towards a malnutrition free India.	K2

		Discuss about that the National Oral health programme.	K2
		Describe the major impact of Janani Suraksha Yojana scheme.	K2
		Identify the maternal benefits of Pradhan Mantri MatruVandana Yojana (PMMVY).	K4
		Examine the advantage of Adolescent girls under the Ministry of Women and child Development.	K3
		Analysis the main goals of National Health Mission (NHM).	K4
		Assess the impact of Swachh-Bharat Mission	K5
		Evaluate the achievement of swachh Bharat Mission.	K5
		Discuss the schemes of Pradhan MantriSwasthya Suraksha Yojana and Janani Shishu Suraksha Karyakaram.	K2
		Define E-pds.	K2
		Find out the significance of Eat Right India movement by FSSAI.	K2
3.2	**Nutrition Education** A. Meaning, nature and importance of Nutrition education to the community and lessons to be taught (SS),Training workers in nutrition education programmes Methods of education when to teach, whom to teach,	Define Nutrition education.	K2
		Discuss the importance and awareness of nutrition education in our community.	K2

		Assess the guidance and strategies for giving training community health workers about nutrition education programmes.	K5
		Find out the methods of nutrition education in community level.	K3
	B. Use of computers to impart nutrition education Organization of Nutrition education programmes. National Nutrition policy	Explain the utilization of computers to impart nutrition education.	K2
		Discuss the important role of organization of nutrition education programmes.	K2
IV	**Epidemiology of Communicable Diseases**		
4.1	A. Definition of epidemiology - causes, signs and symptoms, epidemic and endemic diseases, treatment and prevention of communicable diseases, respiratory infections, intestinal infections, Other infections- dengue, filariasis.	Define Communicable diseases	K2
		Examine the causes, signs and symptoms of communicable diseases.	K4
		Assess the epidemic and endemic of communicable diseases.	K5
		Discuss about that treatment and preventive measures of communicable diseases.	K2
		List the respiratory and intestinal infections.	K3
		Describe the prevention and control of respiratory infections.	K2

		Describe the epidemiology and control of Dengue and fiariasis infections.	K2
4.2	Types of immunity- active, passive and herd-group protection. Immunization agents- vaccines, immunoglobulins, Immunization schedules - Active-National and WHO Expanded Programme on Immunization-Universal Passive, Combined, Chemoprophylaxis, non-specific measures	Discuss the various types of immunity	K2
		Define immunization and immunization schedule.	K2
		Examine the various immunization agent.	K4
		Explain the important functions of expanded programmes on immunization.	K2
		Define Chemoprophylaxis	K2
		Discuss in detail about the combined chemoprophylaxis vaccines.	K2
V	**Nutrition Monitoring and Nutrition Surveillance System**		
5.1	Nutrition monitoring-objectives of nutrition monitoring, current programmes of nutrition monitoring in India.	Identify the main objectives and components of nutrition monitoring.	K4
		Assess the current programmes of nutrition monitoring in India.	K5
5.2	B. Nutrition surveillance system– objectives of nutrition surveillance system, use of nutrition surveillance system, infrastructure of nutrition surveillance system, key indicators of successful nutritional	Find out the objectives of nutrition surveillance.	K3

	surveillance programme.		
		Uses of nutrition surveillance system.	K3
		Classify the two main infrastructure systems in India that could provide a useful delivery mechanism for NSS.	K3
		Discuss the key indicators that could be critical for successful nutrition surveillance programme.	K2
5.3	C. Computerization for monitoring and surveillance.	Evaluate the computerized monitoring and surveillance of public health information.	K5
		Distinguish between the monitoring and surveillance system.	K4

4. Mapping scheme

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	L	-	M	M	H	-	M	M	L	L	-	L	-
CO2	M	-	H	M	H	-	L	L	-	L	-	-	-
CO3	-	-	H	M	L	-	H	L	-	L	-	L	-
CO4	-	-	L	M	M	-	L	M	-	L	-	-	-
CO5	-	-	M	M	L	-	L	L	-	-	-	-	-
CO6	-	-	M	M	M	-	L	L	-	-	-	L	-

L-Low, M-Medium, H-High

5. COURSE ASSESSMENT METHOD

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed

Book

2. Open Book Test.
3. Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator: MUNEERA NAZEER

ELECTIVE – I : NUTRACEUTICALS AND FUNCTIONAL FOODS

Semester : II **Code : P21FS2:1**
Credits : 4 **Total Hours : 50**

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1. Course outcomes

On completion of this course the students will be able to:

CO.NO	Course outcomes	Level	Unit
CO1	Describe the components of nutraceuticals and functional food	K4	I
CO2	Assess the role of antioxidants and phytochemicals in health and prevention of diseases	K5	II
CO3	Apply the effects of prebiotics and probiotics and formulate some innovative foods	K5	II
CO4	Evaluate the role of commercial nutraceuticals and functional foods in the community	K5	III
CO5	Interpret the related recent trends in the market and to know implications of functional foods with respect to ethical and social issues	K5	IV
CO6	Interpret the potential role of nutraceuticals, functional foods and dietary supplements for their health promotion.	K5	V

2. Syllabus

Unit I: Nutraceuticals and functional Foods (10 Hours)

Definition, concept. Classification of nutraceuticals and functional foods, The importance of nutraceuticals is expanding globally in terms of scientific services, legal aspects, and

marketing strategies for health promotion, reduction of disease geographical position and cultural heritage, sources of nutraceuticals, Regulations regarding the quality and safety of nutraceuticals.

Unit II: Nutraceuticals & phytochemicals (10 Hours)

Natural occurrence of certain phytochemicals- Antioxidants and flavonoids: omega – 3 fatty acids, carotenoids, dietary fiber, phytoestrogens; glucosinates; organosulphur compounds. Standards for health claims, Process of developing -preclinical & clinical studies. Health benefits to reduce the risk of chronic diseases, dietary supplements, fortified dairy products, and citrus fruits, and vitamins, minerals, herbals, milk, and cereals.

Unit III: Innovative and fortified food (10 Hours)

Probiotics, prebiotics- definition, Characteristics, type's role of human body, importance of human nutrition, Health benefits, GMO-definition, types, benefits GM food, list GM foods- Soybeans, corn, rice, tomato, and cotton, Importance of GM food, regulations related GM foods.

Unit IV: Nutraceutical Formulations and Challenges (10 Hours)

Important role in future therapeutic developments-(phytomedicines/nutraceuticals/food supplements/conventional drugs) bioavailability. Nutraceutical formulation's and challenges, stability and safety evaluation, bio accessibility and factors affecting bio accessibility, Bio active of functional foods and Nutraceutical**.**

Unit V: Nutraceuticals in disease (10 Hours)

A. Nutraceuticals in disease prevention-and risk factors for coronary heart diseases, Diet and coronary heart diseases relationship, probiotics, prebiotics and omega 3 fatty acids for prevention of coronary heart diseases; Prevalence and causes of obesity,

B. Foods and cancers: anti-tumour action of phytochemicals, antioxidants and dietary fibres role of nutraceuticals in health and disease management – diabetes mellitus, cancer; non-essential nutrients as dietary supplements, FOSHU foods.

2. B. Topics for Self-study

Current trends and future perspectives on functional foods and nutraceuticals; Microencapsulation of Probiotic Bacteria; Scope and approach of phytonutrients; Bioaccessibility of Phytonutrients

2. C. Text Book(s):

1. Min-Tze Liong , "Beneficial Microorganisms in Food and nutraceuticals, Microbiology Monographs, ISSBN 978-3-319-23177-8 (eBook)

Reference Links:

https://pubmed.ncbi.nlm.nih.gov/12400637/

https://www.sciencedirect.com/science/article/abs/pii/S0924224419307186

2.D. Text Book(s):

1. Wildman, Robert. Nutraceuticals and Functional Foods, second edition. Taylor and Francis Group. 2007.
2. Gibson GR & William CM. Functional Foods - Concept to Product. 2000.
3. Goldberg I. Functional Foods: Designer Foods, Pharma Foods. 1994.
4. Brigelius-Flohé, J &Joost HG. Nutritional Genomics: Impact on Health and Disease. Wiley VCH. 2006.
5. Cupp J & Tracy TS. Dietary Supplements: Toxicology and Clinical Pharmacology. Humana Press. 2003.
6. Galanakis C, Nutraceutical and Functional Food Components: Effects ofInnovativerocessing Techniques. Academic Press (2017).
7. Robert EC, Handbook of Nutraceuticals and Functional Foods. CRC Press (2006).

2.E. Reference Links:

8. **https://pubmed.ncbi.nlm.nih.gov/12400637/**
9. **https://www.sciencedirect.com/science/article/abs/pii/S0924224419307186**

3. Specific Learning outcome (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
I	**Nutraceuticals and functional foods**		
1.1	Definition, concept. Classification of nutraceuticals and functional foods.	Define nutraceuticals and functional food.	K2
		Describe the concept of nutraceuticals and functional food.	K2
		Classify the nutraceuticals based on the natural source, pharmacological condition and chemical constituent.	K3
		Classify the various types functional foods	K2
		Differentiate the similarities between functional foods and nutraceuticals.	K4
1.2	The importance of nutraceuticals is expanding globally in terms of scientific services, legal aspects, and marketing strategies for health promotion, reduction of disease geographical position and cultural heritage	Investigate the importance of global demand of nutraceutical in terms of scientific services and legal aspects.	K4
		Interpret the role of functional food security in global health.	K2
		Analysis the methods of marketing strategies for health promotion.	K4
		Identify the geographical position of	K4

		disease (reduction) and cultural heritage.	
		Analysis the current concept and prospects of herbal nutraceutical.	K4
1.3	Sources of nutraceuticals, Regulations regarding the quality and safety of nutraceuticals.	Discuss the sources of nutraceuticals.	K2
		Explain the regulations regards with quality and safety aspects of nutraceuticals.	K2
II	**Nutraceuticals and phytochemicals**		
2.1	Natural occurrence of certain phytochemicals-Antioxidants and flavonoids, carotenoids, dietary fiber, phytoestrogens; glucosinates'; organosulphur compounds.	Discuss the significance role of phytochemicals.	K2
		Distinguish foods that are rich in phytochemicals.	K4
		Compare and contrast about the natural phytochemicals and phytonutrients.	K4
		Define and discuss about that the antioxidants and flavonoids content.	K2
		Elaborate about that the carotenoids, dietary fibre, phytoestrogens, glucosinates and organosulphur compounds.	K5
		Analysis the relationship between the antioxidant and phytochemicals.	K4
2.2.	Standards for health claims, Processing of developing-preclinical and amp; clinical studies.	Analyze the standards of health claims.	K4

		Discuss about that processing of developing preclinical and amp	K2
		Identify the clinical studies which is applicable to health care	K4
		Differentiate between preclinical , amp and clinical	K4
2.3.	Health benefits to reduce risk of chronic disease, dietary supplements, fortified dairy products and citrus fruits, and vitamins, minerals, herbals, milk and cereals.	Identify the healthy diet to reduce the risk of chronic diseases.	K4
		Describe the relationship between food, food component or dietary supplement and reduced risk or health related condition.	K2
		Describe the significance of health benefits of dietary supplements.	K2
		Analyse the benefits of fortified dairy products and citrus fruits.	K4
		Assess the amount and variety of vitamins and minerals related to health conditions.	K5
		Describe the role of nutraceuticals in health and how they are different from functional foods and dietary supplements.	K2
		Determine the characteristics of nutraceuticals and discuss strategic designs of nutraceutical delivery systems.	K5
		Describe the health benefits of herbals, milk and cereals.	K2
III	**Innovative and fortified food**		
3.1	Probiotics, prebiotics- definition, characteristics, types	Define probiotics and prebiotics with some	K2

	role of human body, importance of human nutrition, health benefits.	examples.	
		Summarize the characteristics of probiotics and prebiotics.	K2
		Analyse the types and important role of probiotics and prebiotics in our human body.	K4
		Discuss about the importance of human nutrition.	K2
		Describe the health benefits of probiotics and prebiotics.	K2
3.2	GMO-definition, types benefits GM food, list GM foods- Soyabeans, corn, rice, tomato and cotton, Importance of GM food, regulations related GM foods.	Define Genetically modified foods (GMO)	K2
		Classify the different types of GMO	K2
		Discuss about the health benefits of GMO	K5
		List out the GMO food list.	K2
		Analyse the importance of GM foods.	K4
		Identify the regulation of GM foods.	K4
IV	**Nutraceutical formulations and challenges**		
4.1	Important role in future therapeutic developments- (phytomedicines/nutaceuticals/food/ supplements/conventional drugs) bioavailability.	Explain about the important role in future therapeutic developments.	K2

		Evaluate the various health care products.	K5
		Examine the impact of nutraceuticals.	K4
		Analyse the current trend and future prospective nutraceuticals in health promotion.	K4
		Discuss about the bioavailability of food supplements /conventional drugs.	K2
4.2	Nutraceutical formulation's and challenges, stability, Bio active of functional foods and Nutraceutical.	Discuss about that the nutraceuticals formulations and challenges.	K2
		Explain the stability aspects of nutraceutical formulations.	K2
		Explain about that the important of bioactive components in specific groups of functional foods and or nutraceuticals that are responsible for the health benefits they offer.	K2
		Describe the different formulations of functional foods and nutraceutical products and identifies the most popular and successful ones.	K2
		Identify the bioactive foods and ingredients for health.	K4
V	**Nutraceuticals in disease**		
5.1	Nutraceuticals in disease prevention and risk factors for coronary heart diseases, Diet and coronary heart diseases relationship, probiotics , prebiotics and omega 3 fatty acids for prevention of coronary heart diseases; Prevalence and causes of obesity.	Analysis the role of nutraceuticals in human health.	K4

		Apply the knowledge of nutraceuticals for improving cardiovascular health disease condition.	K3
		Identify the major causes of CHD.	K4
		Investigate the risk factors associated with CHD.	K4
		Determine the preventive measures of nutraceuticals in diseases condition (CHD).	K5
		Relate with the impact of functional foods for CV health.	K5
		Compare and contrast relationship between the diet and coronary heart disease.	K4
		Determine the prevalence, consequences and causes of obesity in nutraceuticals aspects.	K5
5.2	Foods and cancers: anti-tumour action of phytochemicals, antioxidants and dietary fibres role of nutraceuticals in health and disease management-diabetes mellitus cancer; non-essential nutrients as dietary supplements, FOSHU foods.	Identify at least one condition or disease for which research suggests eating phytochemical rich foods may decrease risk.	K4
		Assess limitations of current research regarding phytochemicals and disease.	K5
		Provide clients and patients with recommendations for consuming phytochemical-rich foods.	K5
		Determine the major role of antitumor action in phytochemicals foods.	K5
		Describe the role of antioxidants and dietary fibres in health and disease	K2

		management.	
		Explain about the non-essential nutrients as dietary supplements and relate with their health issues.	K2
		Define FOSHU foods	K2
		Describe the regulations of functional foods and benefits for Foods for specialized Health Use (FOSHU)	K2
		Discuss about the importance of human nutrition.	K2
		Describe the health benefits of probiotics and prebiotics.	K2
3.2	GMO-definition, types benefits GM food, list GM foods- Soyabeans, corn, rice, tomato and cotton, Importance of GM food, regulations related GM foods.	Define Genetically modified foods (GMO)	K2
		Classify the different types of GMO	K2
		Discuss about the health benefits of GMO	K5
		List out the GMO food list.	K2
		Analyse the importance of GM foods.	K4
		Identify the regulation of GM foods.	K4
IV	**Nutraceutical formulations and challenges**		
4.1	Important role in future therapeutic developments- (phytomedicines/nutraceuticals/ food/ supplements/conventional drugs) bioavailability.	Explain about the important role in future therapeutic developments.	K2

		Evaluate the various health care products.	K5
		Examine the impact of nutraceuticals.	K4
		Analyse the current trend and future prospective nutraceuticals in health promotion.	K4
		Discuss about the bioavailability of food supplements /conventional drugs.	K2
4.2	Nutraceutical formulation's and challenges, stability, Bio active of functional foods and Nutraceutical.	Discuss about that the nutraceuticals formulations and challenges.	K2
		Explain the stability aspects of nutraceutical formulations.	K2
		Explain about that the important of bioactive components in specific groups of functional foods and or nutraceuticals that are responsible for the health benefits they offer.	K2
		Describe the different formulations of functional foods and nutraceutical products and identifies the most popular and successful ones.	K2
		Identify the bioactive foods and ingredients for health.	K4
V	**Nutraceuticals in disease**		
5.1	Nutraceuticals in disease prevention and risk factors for coronary heart diseases, Diet and coronary heart diseases relationship, probiotics , prebiotics and omega 3 fatty acids for prevention of coronary heart diseases; Prevalence and causes of obesity.	Analysis the role of nutraceuticals in human health.	K4

		Apply the knowledge of nutraceuticals for improving cardiovascular health disease condition.	K3
		Identify the major causes of CHD.	K4
		Investigate the risk factors associated with CHD.	K4
		Determine the preventive measures of nutraceuticals in diseases condition (CHD).	K5
		Relate with the impact of functional foods for CV health.	K5
		Compare and contrast relationship between the diet and coronary heart disease.	K4
		Determine the prevalence, consequences and causes of obesity in nutraceuticals aspects.	K5
5.2	Foods and cancers: anti-tumour action of phytochemicals, antioxidants and dietary fibres role of nutraceuticals in health and disease management-diabetes mellitus cancer; non-essential nutrients as dietary supplements, FOSHU foods.	Identify at least one condition or disease for which research suggests eating phytochemical rich foods may decrease risk.	K4
		Assess limitations of current research regarding phytochemicals and disease.	K5
		Provide clients and patients with recommendations for consuming phytochemical-rich foods.	K5
		Determine the major role of antitumor action in phytochemicals foods.	K5
		Describe the role of antioxidants and dietary fibres in health and disease	K2

		management.	
		Explain about the non-essential nutrients as dietary supplements and relate with their health issues.	K2
		Define FOSHU foods	K2
		Describe the regulations of functional foods and benefits for Foods for specialized Health Use (FOSHU)	K2

4.Mapping scheme

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	L	L	L	L	-	L	-	-	-	L	-	-	-
CO2	L	L	-	-	-	H	-	-	-	L	-	-	-
CO3	L	L	L	L	-	L	-	-	-	L	-	-	M
CO4	-	L	-	-	L	M	-	-	-	L	-	-	-
CO5	-	M	-	-	-	M	-	-	-	L	-	-	-
CO6	L	L	L	-	-	H	-	-	-	M	-	-	-

L-Low, M-Medium, H-High

5. COURSE ASSESSMENT METHOD

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).

4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator: BHAGYA R

CORE PRACTICAL-III : NUTRITION THROUGH LIFE SPAN PRACTICAL

Semester : II **Code : P21FS2P3**

Credits : 3 **Total Hours : 45**

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1. Course Outcomes

On completion of this course the students will be able to:

CO.No	Course Outcomes	Level	Unit
CO1	Explain the critical nutritional factors that contribute to healthy growth, development and functional capacity throughout life	K2	I
CO2	Plan a nutritional requirements of women before and during pregnancy and lactation, discuss strategies to overcome nutrition-related problems	K3	II
CO3	Identify the physiological, cultural and behavioural factors that determine nutrition requirements from infancy to adulthood	K3	III
CO4	Apply the knowledge obtained about the various physical changes that take place during adolescence and plan diet to prevent conditions such as anaemia and PCOD	K3	IV
CO5	Explain the conditions associated with ageing and their nutritional implications, discuss successful dietary interventions to stabilize physiological decline and enhance physical and mental resilience	K2	V

2. A. Syllabus

1. **Planning, nutritive value calculation and preparation of meals for**

a) Pregnancy
b) Lactation
c) Infancy- weaning foods, Infant Formula, Lactose free diet
d) Pre-school children
e) School going children- packed lunch
f) Adolescence – Anemia , PCOD
g) Geriatric nutrition

2. B. **Topic for the Self-study**

Essential Nutrition Actions And Key Contact Points For Improving Women's Nutrition-Micronutrient Needs At Different Stages In Life-Indicators Of Adequate Women's Nutrition-Interventions To Break The Malnutrition Cycle: Infancy Through Adolescence

2. C. Reference books:

1. M. Swaminathan "Principles of Nutrition and Dietetics",New age international, 1993
2. Srilakshmi.B., "Dietetics", 6th Edition, New Age Publication, New Delhi, 2013

2. E. **Reference Link:**

3. https://motherchildnutrition.org/nutrition-protection-promotion/pdf/mcn-womens-nutrition-training-of-trainers-module.pdf

3. Specific Learning Outcomes (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
I	**1. Planning, nutritive value calculation and preparation of meals for Pregnancy and Lactation**		
1.1	**a) Pregnancy**	Outline the ICMR allowance for protein, energy and calcium for a pregnant women	K2
		Identify the complete RDA for a pregnant women	K3

		Plan and prepare the balanced diet for pregnant women	K6
1.2	**b) Lactation**	Identify the reasons for the increased energy and protein requirements for a lactating woman	K3
		Explain about the lactogogues	K2
		Plan and prepare the menu for lactating mother	K6
1.3	**c) Infancy** - weaning foods, Infant Formula, Lactose free diet	List the RDA of an infant aged 8months	K4
		Compare the nutritive value of human milk with cow's milk	K4
		Explain the nutritional importance during infancy	K2
1.4	**d) Pre-school children**	Plan and prepare a menu for a 5year old child	K6
		Plan a day's diet for a 4year old child from a low income group	K6
		List the factors to be considered in planning a diet for a preschooler	K4
1.5	**e) School going children-packed lunch**	Identify the RDA for 11year old girl	K3

		Compare the nutritional requirements of 7-9 year old and 10-12year old	K4
		Explain the points to be considered in planning diets for school children	K2
1.6	**f) Adolescence –** Anemia , PCOD	Plan a day's diet for an adolescent girl suffering from nutritional anaemia	K6
		Identify the RDA of a 16-year old boy	K3
		Explain the common nutrient deficiencies in adolescents	K2
1.7	**g) Geriatric nutrition**	Plan a modified diet for geriatrics and special needs	K6
		Outline the modifications of calorie requirement during old age	K2
		List out the importance of calcium and fibre in the diet of geriatrics	K4

4. Mapping scheme

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	M	L	H	M	H	H	H	H	L	L	H	H	-
CO2	H	M	H	M	H	H	H	H	L	L	H	H	-
CO3	M	H	H	M	H	H	H	H	L	L	H	H	-
CO4	M	H	H	M	H	H	H	H	L	L	H	H	-
CO5	M	M	H	M	H	H	H	H	L	L	H	H	-

CO6	M	M	H	M	H	H	H	H	L	L	H	H	-

L-Low, M-Medium, H-High

5. COURSE ASSESSMENT METHOD

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator: PREETHI S

CORE PRACTICAL IV : THERAPEUTIC NUTRITION PRACTICAL

Semester : II **Code : P21FS2P4**

Credits : 3 **Total Hours : 45**

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1. Course Outcomes

On completion of this course the students will be able to:

CO.No	Course Outcomes	Level	Unit
CO1	Compare nutritive value of various foods and prepare diets	K4	I, II
CO2	Analyze the epidemiology of various diseases and plan therapeutic diets based on the condition	K4	II
CO3	Assess the needs of the patient and plan tailor-made diet	K5	II
CO4	Distinguish normal diet and therapeutic diets	K4	II
CO5	Plan and execute diet for various conditions of the patients	K6	II
CO6	Compare deviations in the requirement of nutrients for various disorders and diseases	K4	II

2. A. Syllabus

1) Preparation of clear and full liquid diets and soft diet
2) Planning and preparing diets for:
   a) Diabetes mellitus
   b) Cardio Vascular disorders- atherosclerosis and hypertension

c) Diet for liver disease- jaundice, cirrhosis

d) Diet for nephritis, renal failure, acute and chronic

e) Diet for cancer and HIV patient

f) Allergic condition

g) Ketogenic diet

h) Paleo diet

2. B.Text Book(s):

1) Swaminathan M. Essentials of Food and Nutrition, Vol. I & II Ganesh and Company, Madras, 1995.
2) Srilakshmi, B, Dietetics, New Age International, New Delhi, 2002.
3) Gopalan , C. Ramasastri, B.V. and Balasubramaniam, S.C. Nutritive value of Indian Foods National Institute of Nutrition, Hyderbad, 2010.

2. C. Reference:

1) Krause M.V. Horsch M.A. Food Nutrition and Diet Therapy W.B. Saunders Company, Philadelphia, 1993.
2) William's Basic Nutrition and Diet Therapy, Staci Nix, RS, C.V. Muusby Camp. Saint, Lowin, 2012.
3) Cooper Et. al, Nutrition in health and disease 4th edition, Pitman Medical Publishing Co. 1963.

3. Specific Learning Outcomes (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
I	Preparation of clear and full liquid diets and soft diet	Measure the quantity of the diet	K5
		Asses the condition to support nutritionally	K5
		Test the consistency of the diet	K6
II	Planning and preparing diets for: Diabetes mellitus	Plan the suitable diet and select the method of preparation	K3
		Contrast on blood glucose level in fasting and Post Prandial (PP)	K2
		Apply principles of diet and identify the suitable foods using food	K3

		exchange table	
III	Planning and preparing diets for: Cardio Vascular disorders – atherosclerosis and hypertension	Analyze the biochemical parameters for Cardiovascular disease and associated predisposing factors	K4
		Plan and prepare a low-fat and low-sodium diet	K6
IV	Planning and preparing diets for: Diet for liver disease- jaundice, cirrhosis	Compare the clinical and biochemical effects liver disease	K5
		Plan and prepare Low-fat diet for Jaundice and Liver Cirrhosis	K6
V	Planning and preparing diets for: Diet for nephritis, renal failure, acute and chronic	Analyze the routine hospital diet for renal diseases	K4
		Plan and prepare Low-protein diet	K6
VI	Planning and preparing diets for: Diet for cancer and HIV patient	Contrast the aetiology of cancer and HIV	K2
		Combine nutritional and palliative support	K6
		Plan and prepare High-protein and High-energy diets for cancer and HIV	K6
VII	Planning and preparing diets for: Allergic condition Ketogenic diet Paleo diet	Explain the factors inducing allergic reactions	K2
		Analyze the role of histamine in developing allergic reactions	K4
		Assess the types of diet in alleviating symptoms of metabolic syndrome	K5
		Plan and prepare High-fat and Low-carbohydrate diets	K6

4. Mapping scheme

L-Low, M-Medium, H-High

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	-	-	H	H	M	H	M	L	H	H	H	M	-
CO2	-	H	H	H	L	H	H	H	H	H	M	H	-
CO3	-	M	H	M	M	-	H	H	-	H	M	M	-
CO4	-	M	H	H	H	M	H	H	-	H	M	H	-
CO5	-	H	H	M	M	-	L	L	-	L	L	M	-
CO6	-	M	H	H	H	H	H	H	H	H	H	H	-

SUBJECT COORDINATOR ROSELIN C

CORE COURSE- VIII : ANALYTICAL INSTRUMENTATION

Semester : III **Code : P21FS308**
Credits : 4 **Total Hours : 60**

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1. Course outcomes

On completion of this course the students will be able to:

CO.No	Course outcomes	Level	Unit
CO1	Apply the knowledge obtained to choose the appropriate instrument and technique for food analysis	K5	I
CO2	Assess the role of chromatography and spectrometry in food analysis	K5	II
CO3	Study the importance of advanced chromatography and electrophoresis techniques	K4	III
CO4	Elaborate the principle behind the functioning of fluorimetry and flame photometry	K5	IV
CO5	Analyze the methods and types of radioactive isotopes and their functions.	K5	V
CO6	Assess the usage of various analytical techniques for quality of food analysis.	K5	V

2. Syllabus

Unit I: Analytical Instrumentation and Spectroscopic Techniques (16 Hours)

Need for analysis and instrumentation, Selecting an appropriate instrumental technique, criteria for selecting a technique, Limit of Detection (LOD) and Limit of Quantification (LOQ) Colorimetry, Spectrophotometry-definition and derivation of Lambert-Beer‟s Law, Atomic-Absorption Spectroscopy (AAS),Inductively Coupled Plasma – Optical Emission Spectrophotometry (ICP- OES/MS), ***Nuclear Magnetic Resonance Spectroscopy (NM)*****(SS*),*** Fourier Transform Infrared Spectroscopy (FT-IR) - Principle, Instrumentation and Applications

Unit II: Chromatographic Techniques (14 Hours)

Basics and Classification of Chromatography- Adsorption, partition, size exclusion, ion-exchange, affinity Gas Chromatography, Liquid Chromatography - Instrumentation, Sampling Techniques and Applications, Applications of HPLC, Comparison of HPLC and GC

Unit III: Advanced Chromatographic Techniques and Electrophoresis (16 Hours)

Thin Layer Chromatography, High Performance Thin Layer Chromatography (HPTLC), Hyphenated Techniques - Gas Chromatography-Mass Spectrometry (GC-MS), Liquid Chromatography-Mass Spectrometry (LC-MS), Principles and procedure of electrophoresis – ***Paper and Agar Electrophoresis***(SS) Moving boundary electrophoresis, PAGE

Unit IV: Fluorimetry and Flame Photometry (12 Hours)

Theory of fluorescence (SS) and instrumentation, Instrumentation in Flame Photometry-oxidant, fuel, filter, detector, amplifier, applications

Unit V: Measurement of Radioactivity (12 Hours)

Radio active isotopes (SS) Methods and Types Radioactive Counters- gas and liquid Scintillation- uses, applications and safety

2. B. Topics for Self-studies

Diverse food based applications of NMR, UV spectroscopy –Principle, Instrumentation, Applications, Ultra-sonication, Application and Processes of ultra-sonication.

2. C. Reference Books

1. A. Frank, Settle, Editor, "Handbook of Instrumental Techniques for Analytical chemistry", ISBN 0-13-177338-0.
2. S.M Knopkar, Basic concepts of Analytical Chemistry," Basic concepts of Analytical Chemistry. New Age International (P) Ltd., Publishers
3. R S Khandpur, Handbook of Analytical Instruments, 3rd editions.

Skoog, Holler, Crouch. "Principles of Instrumental Analysis ", Seventh Editions.

2. D. Reference Links

4.https://www.foodandnutritionjournal.org/vol04nospl-issue-conf-october-2016/nuclear-magnetic-resonance-spectroscopy-applications-in-foods/

5. https://microbenotes.com/uv-spectroscopy-principle-instrumentation-applications/

6. https://www.hielscher.com/technolo.htm

3. Specific Learning outcomes (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
I	**Analytical Instrumentation and Spectroscopic Techniques**		
1.1	Need for analysis and instrumentation, selecting an appropriate instrumental technique, criteria for selecting a technique, Limit of Detection (LOD) and Limit of Quantification (LOQ)	Identify the importance of analytical instruments.	K4
		Analyse the instrumental methods of analysis.	K4
		Select the appropriate analytical method for a particular food analysis.	K3

		Describe and explain the function and method of operation of a range of analytical instruments.	K2
		Explain the criteria used in selecting appropriate techniques.	K2
		Determine the Limit of detection (LOD) and Limit of quantification (LOQ)	K5
1.2	Colorimetry, Spectrophotometry-definition and derivation of Lambert-Beer's Law, Atomic Absorption Spectroscopy (AAS), Inductively Coupled Plasma- Optical Emission Spectrophotometry (ICP-OES/MS).	Define colorimetry and spectrophotometry	K2
		Find out the general principle of colorimetry and spectrophotometry	K3
		Determine the derivation of Beer Lambert Law.	K5
		Explain the principle of Atomic absorption spectroscopy (AAS)	K2
		Describe the inductively coupled plasma optical emission spectroscopy	K2
		Difference between ICP MS and ICP-OES.	K4
1.3	Nuclear Magnetic Resonance Spectroscopy (NM)(SS), Fourier Transform Infrared Spectroscopy (FT-IR)-Principle, Instrumentation and Applications	Discuss the principle of NMR spectroscopy.	K2
		Describe instrumentation working process of NMR spectroscopy.	K2
		Identify the applications of NMR	K4

		spectroscopy.	
		Explain the basic principle of FT-IR spectroscopy	K2
		Discuss the instrumentation and applications of FTIR spectroscopy.	K2
II	**Chromatographic Techniques**		
2.1	Basics and classification of chromatography-Adsorption, partition, size exclusion, ion-exchange, affinity, Gas chromatography, liquid chromatography, - Instrumentation, sampling techniques and applications. Applications of HPLC, Comparison of HPLC and GC.	Define basic information on chromatography and separation science and the relationship between these important fields.	K2
		Classify the chromatography techniques.	K3
		Identify the principles involved in various modes of chromatography.	K4
		Describe the role of chromatography and separation science in various fields.	K2
		Distinguish between adsorption and partition chromatography.	K4
		Elaborate the instrumentation process of size exclusion chromatography.	K5
		Describe the set up and process of gas and liquid chromatography.	K2
		Make use of different applications of gas and liquid chromatography.	K3
		Explain the HPLC instrumentation techniques and its applications.	K2

		Compare and contrast between HPLC and GC chromatography	K4
III	**Advanced Chromatographic Techniques and Electrophoresis**		
3.1	Thin layer Chromatography, High Performance Thin Layer Chromatography(HPTLC), Hyphenated Techniques-Gas Chromatography-Mass spectrometry (GC-MS), Liquid chromatography-Mass Spectrometry (LC-MS), Principles and procedure of electrophoresis-Paper and Agar Electrophoresis (SS) Moving boundary electrophoresis, PAGE	Describe the importance of advanced chromatographic techniques.	K2
		Differentiate between TLC and HPTLC	K4
		Compare the advantages and limitations of TLC and HPTLC.	K4
		List the different hyphenated techniques.	K2
		Analyse the role of gas and liquid chromatography	K4
		Distinguish between LCMS and GCMS	K4
		Define and types of electrophoresis	K2
		Apply the principle and techniques for paper and agar electrophoresis of particular food sample analysis.	K3
		Investigate the electrophoresis method of instrument Procedure.	K4
		Explain the basic principle and procedure for moving boundary electrophoresis.	K2

		Identify the principles and method of Polyacrlamide gel electrophoresis techniques.	K4
IV	**Fluorimetry and Flame Photometry**		
4.1	Theory of fluorescence (SS) and instrumentation. Instrumentation in Flame Photometry-oxidant, fuel, filter, detector, amplifier and applications.	Discuss the fundamental theory of fluorescence and instrumentation.	K2
		Describe the working principle of Flame Photometry.	K2
		Explain the process of instrumentation in flame photometry-oxidant.	K2
		Categorize the components of flame photometry.	K4
		Elaborate the important applications of flame photometry.	K5
V	**Measurement of Radioactivity**		
5.1	Radioactive isotopes (SS) Methods and types. Radioactive Counters –gas and liquid scintillation-uses, applications and safety.	Define Radioactive isotopes.	K2
		Classify types of radioactive isotopes.	K3
		List the different methods of radioactive isotopes.	K4
		Discuss the radioactive counters.	K2
		Determine the Measurement of radiation and isotope quantitation.	K5
		Describe about that the gas and Liquid scintillation.	K2

		Differentiate between the scintillation and Geiger counter.	K4
		Analyse the uses, applications and safety measures of radioactive counters.	K4

4. **Mapping scheme**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	L	L	-	-	-	-	-	-	L	H	M	-	-
CO2	L	-	-	M	-	-	-	-	L	H	M	-	-
CO3	L	-	-	L	-	-	-	-	L	H	L	-	-
CO4	L	-	-	H	-	-	-	-	L	M	M	-	-
CO5	L	-	-	M	-	-	-	-	-	L	L	-	-
CO6	L	-	-	L	-	-	-	-	-	L	H	-	-

L-Low, M-Medium, H-High

5. COURSE ASSESSMENT METHOD

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator: Ms. Maheswari K

CORE COURSE- IX- Food Toxicology

Semester : III **Code : P21FS309**

Credits :4 **Total Hours : 60**

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1. Course Outcome

On completion of the course the students will be able to:

CO.No	Course Outcomes	Level	Unit
CO1	Classify toxins based on its source and explain mechanism of toxicity	K4	I
CO2	Analyze how the food additives are acting as toxicants	K4	II
CO3	Determine the types of toxicants and its effect	K5	III
CO4	Evaluate the safety and risk of toxicants	K5	IV
CO5	Discuss the metabolism of xenobiotics	K6	V
CO6	Compile the types of toxicants, safety and evaluation aspects and its metabolism in the human body	K6	VI

2. A. Syllabus:

Unit I – Introduction to Food Toxicology

1.1 Principles of toxicology – Definition, Classification, Characteristics and Dosage

1.2 Determination of Food toxicants

1.3 Naturally occurring toxins – Plant and Animal origin, Microbial origin (Endotoxin and Exotoxin) and Sea food origin

1.4 Microbial Toxins in contamination of food products

1.5 Mechanism of Toxicity

Unit II –Food additives as Toxicants

2.1 Traditional Food toxicants – General principles, colorants, artificial sweetener, preservatives, antioxidants and glutamate

2.2 Functional additives – General principles, drug interaction

2.3 Toxicants formed during food processing – nitrosamine, acrylamide, benzene and heterocyclic amine and aromatic hydrocarbon

Unit III – Environmental toxins and drug residues in food

3.1 Environmental toxins - Fungicide and pesticide residues in foods

3.2 Drug residues - Heavy metal and their health impact, Use of veterinary drugs (malachite green in fish and beta agonists in pork) and Dioxins and related compounds in food

3.3 Radioactive contamination of food, Food adulteration and potential toxicity of food adulterants

Unit IV – Toxicological safety and Risk analysis

4.1 General principles and Epidemological studies

4.2 Toxicity tests for hazard characterization in foods

4.3 Evaluation of toxicity – Risk and benefit

4.4 Evaluation based on dietary and health condition

4.5 Biomarker research on toxins

Unit V – Xenobiotics

5.1 Entry and absorption of foreign compounds – Digestive tract, lungs and skin

5.2 Bioaccumulation of Xenobiotics

5.3 Metabolism – Influence of diet on metabolism, Induction and Exhibition of metabolic enzymes

5.4 Elimination of xenobiotics – Kidneys, Liver, Intestine and Lungs

2. B. Topics for Self-study

1 Food allergies and sensitivity

2 Non-nutrient antioxidants in food

3 Potential benefits of Transgenic plants

4 Antioxidants and chemical carcinogens

3. **Specific Learning Outcomes (SLO)**

Unit / Section	**Course Content**	**Learning Outcomes**	**Highest Bloom's Taxonomic Levels of Transaction**
I	**Introduction to Food Toxicology**		
1.1	Principles of toxicology – Definition, Classification, Characteristics and Dosage	Illustrate the principles of toxicology	K2
		List about the characteristics and dosage of toxicology	K4
		Outline the classification of toxicology	K2

1.2	Determination of Food toxicants	Analyze the food toxicants	K4
1.3	Naturally occurring toxins – Plant and Animal origin, Microbial origin (Endotoxin and Exotoxin) and Sea food origin	Outline the different types of naturally occurring toxins	K2
		Compare the endotoxin and exotoxin of microbial origin toxin	K4
		Determine the natural toxins present in food of plant and animal origin	K5
		Discuss the toxins present in sea food origin	K6
1.4	Microbial Toxins in contamination of food products	Explain about the microbial toxins	K2
		Analyze the microbial toxins that contaminate the food products	K4
1.5	Mechanism of Toxicity	Explain the mechanism of toxicity	K4
II	**Food additives as Toxicants**		
2.1	Traditional Food toxicants – General principles, colorants, artificial sweetener, preservatives, antioxidants and glutamate	Outline the traditional food toxicants	K3
		Illustrate the general consideration on the toxicity of antioxidants	K2

		Explain the effects of artificial sweetener and colorants in food	K4
		Analyze the food additives and preservatives are toxic to food	K4
2.2	Functional additives – General principles, drug interaction	Outline the general principles of functional additives	K2
		Explain the additive drug interaction	K3
2.3	Toxicants formed during food processing – nitrosamine, acrylamide, benzene and heterocyclic amine and aromatic hydrocarbon	Determine the toxicants formed during food processing	K5
		List the points to be considered during food processing to prevent from toxicants	K4
		Explain the carcinogenic effects of heterocyclic amine	K2
		Identify the negative effects of toxicity formed during food processing	K3
III	**Environmental toxins and drug residues in food**		
3.1	Environmental toxins - Fungicide and pesticide residues in foods	Categorize the Fungicide and pesticide residues in foods	K4
		Analyze theEnvironmental toxins	K4
3.2	Drug residues - Heavy metal and their health impact, Use of veterinary drugs (malachite	Identify the malachite green in fish and beta agonists in pork	K3

	green in fish and beta agonists in pork) and Dioxins and related compounds in food		
		Explain the Heavy metal and their health impact	K2
3.3	Radioactive contamination of food, Food adulteration and potential toxicity of food adulterants	Discuss on Radioactive contamination of food	K6
		Analyze the Food adulteration and potential toxicity of food adulterants	K4
IV	**Toxicological safety and Risk analysis**		
4.1	General principles and Epidemological studies	Illustrate the general principles of toxicology	K2
		Determine the epidemiological study of toxicology	K5
4.2	Toxicity tests for hazard characterization in foods	Identify the toxicity tests for hazards in foods	K3
		Illustrate the hazard characterization in foods	K2
4.3	Evaluation of toxicity – Risk and benefit	Evaluate the risk of toxicity	K5
		Determine the risk-benefit consideration in toxicology	K5
4.4	Evaluation based on dietary and health condition	Explain the evaluation based on dietary and health condition	K2

		Identify the toxicity assessment in health condition	K3
4.5	Biomarker research on toxins	Discuss the biomarker research on toxins	K6
V	**Xenobiotics**		
5.1	Entry and absorption of foreign compounds – Digestive tract, lungs and skin	Discuss about the term xenobiotics	K6
		Illustrate the Entry and absorption of foreign compounds in Digestive tract	K2
		Explain theEntry and absorption of foreign compounds in lungs and skin	K3
5.2	Bioaccumulation of Xenobiotics	Outline the Bioaccumulation of Xenobiotics	K3
5.3	Metabolism – Influence of diet on metabolism, Induction and Exhibition of metabolic enzymes	Determine the Influence of diet on metabolism	K5
		Identify the Induction and Exhibition of metabolic enzymes	K3
5.4	Elimination of xenobiotics – Kidneys, Liver, Intestine and Lungs	Outline the elimination of xenobiotics in Kidneys	K2
		Explain about theexclusion of xenobiotics in Liver	K2

		Discuss about the removal of xenobiotics in intestine	K6
		Explain the elimination of xenobiotics in lungs	K2

4. Mapping scheme

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	-	L	M	-	L	-	M	L	L	-	L	-
CO2	H	-	L	-	-	H	L	M	-	H	L	M	-
CO3	H	-	L	M	M	H	M	M	M	L	-	M	-
CO4	H	-	-	-	-	M	-	-	L	M	L	M	H
CO5	L	-	M	-	-	M	-	L	-	-	-	-	-
CO6	H	L	L	M	-	H	-	M	-	L	-	L	-

Low-L Medium-M High-H

5. COURSE ASSESSMENT METHOD

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Assignment, Group Presentation, Group Discussion, project

   Report, Field Visit Report, Poster Presentation, Seminar, Quiz

(written).

4. Pre-Semester & End Semester Theory Examination

CORE COURSE- X : RESEARCH METHODOLOGY and STATISTICS

Semester : III **Code : P21FS310**

Credits : 4 **Total Hours : 60**

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator:

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1. Course Outcomes

On completion of this course the students will be able to:

CO.No	Course Outcomes	Level	Unit
CO1	Classify and explain the types of Research, research design and sampling techniques	K4	I
CO2	Identify suitable method of data collection and select data for processing, editing and coding	K3	II
CO3	Simplify data in terms of tabulation, diagrammatic representations etc.,	K4	III

CO4	Determine mean, median, and mode values to interpret the results	K5	IV
CO5	Test hypothesis using appropriate statistical tools	K6	V
CO6	Rule on the types of research, methods of data collection, organization and representation of data, research design and statistical inferences in research studies	K6	VI

2. A. Syllabus

Unit I: Introduction to Research, Types of Research and Research Design (12 Hours)

Definition ,objectives and characteristic of research , Types of Research and research design- Basic , applied , action , evaluation and experimental Surveys- Descriptive , diagnostic and exploratory ,Basic components of research design, Sampling design- Probability and non probability sampling methods

Unit II: Data and Tools of Data Collection (12 Hours)

Methods of data collection- Primary and secondary data and data sources , data processing and analysis strategies and tools ,Interview schedules and questionnaires ,Interviews and type of Interviews ,Pre-testing and pilot study, Editing and coding of data

Unit III: Organization and Representation of Data, Report writing (12 Hours)

Classification- qualitative, Quantitative- frequency distribution, discrete and continuous Tabulation of data- parts of a table, preparation of blank tables, Diagrammatic – One dimensional diagrams, two dimensional diagrams, pictogram and cartographs, Graphical- Frequency graphs- line , polygon, curve, histogram Cumulative frequency graphs - ogives General structure of scientific reports includes-Different types of scientific documents- journal articles, books, thesis, conference and project reports**.**

Unit IV: Mean, median, mode and their applications (12 Hours)

Measures of dispersion- standard deviation, coefficient of variation, percentiles and percentile ranks Correlation coefficient and its interpretation, Rank correlation. Association of attributes , contingency table, basic software application like Ms- Excel, SPSS in doing basic statistical evaluation, Management Tools for PLAGIARISM – Pro Writing Aid, Quetext, EduBirdie and PDS(plagiarism detection system)

Unit V: Probability and Tests of Significance (12 Hours)

Rules of probability and its applications, Normal, binomial, their properties, importance of these distributions in research studies, Large and small sample tests – "t", F and chi square tests ANOVA and applications

2.B. Topics for Self-study

Construction of hypothesis, The role of statistics in research, Ethics in evaluation process, Concepts of validity and reliability.

2.C. Text Book(s):

2) Kothari.G.R. Research Methodology, Methods and Techniques, Wiley Eastern Limited, New Delhi, 2004
3) Gupta.S.P. Statistical Methods, Sultan Chand & Sons, New Delhi, 2002
4) Gosh.B.N. Scientific Methods and Social Research Sterling Publishers Pvt.Ltd. New Delhi, 2015
5) Devadas.R.P. A Handbook on methodology of Research, Sri Ramakrishna Vidyalaya, Coimbatore, 2000

2.D. Reference:

1) Gurumani N, Scientific thesis writing and paper presentation, MJP Publishers, 2010.
2) Vijayalakshmi G, Research methods. MJP Publishers, 2009.
3) Kulbir Singh Sidhu, Methodology of Research in Education Sterling Publishers Pvt. Ltd., New Delhi, 2006.

2.E. Reference Link:

4. http://www.sociology.kpi.ua/wp-content/uploads/2014/06/Ranjit_Kumar Research_Methodology_A_Step-by-Step_G.pdf

3. Specific Learning Outcomes (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
I	**Introduction to Research , Types of Research and Research Design**		

1.1	Definition ,objectives and characteristic of research	Define, recognize and identify the qualities of research	K1
1.2	Types of Research and research design- Basic, applied, action, evaluation and experimental Surveys- Descriptive, diagnostic and exploratory	Outline the types of research	K2
		Classify and compare the types of research	K4
		Apply experimental survey in community nutrition	K3
1.3	Basic components of research design	List the components of research design	K1
		Analyze the components of research design	K4
		Criticize the components of research design	K5
1.4	Sampling design- Probability and non probability sampling methods	Describe the types of sampling design	K1
		Classify and Compare the sampling methods	K4
		Identify an appropriate sampling technique	K3
II	**Data and Tools of Data Collection**		
2.1	Methods of data collection- Primary and secondary data and data sources	Identify the source of data	K3
		Classify method of data collection	K4

		Select suitable method of data collection	K3
2.2	Data processing and analysis strategies and tools	Identify the methods of data processing	K3
		Design the tool for data collection	K6
2.3	Interview schedules and questionnaires	Identify the tool for data collection	K3
		Distinguish schedules and questionnaire	K4
		Develop a model schedule or questionnaire	K6
2.4	Interviews and type of Interviews	Explain the types of interviews	K2
		Analyze the suitable type of interview for the study	K4
2.5	Pre-testing and pilot study	Categorize the sample	K4
		Recommend for further study	K5
		Justify the conclusion of the existing studies	K5
2.6	Editing and coding of data	Select the technique for editing and coding of data	K3
III	**Organization and Representation of Data , Report writing**		
3.1	Classification- qualitative, Quantitative- frequency distribution, discrete and continuous	Classify the methods of data collection	K4
3.2	Tabulation of data- parts of a table, preparation of blank tables	Determine the parts of tables	K4
		Categorize data under appropriate components of the table	K4

		Construct a blank table	K6
3.3	Diagrammatic – One dimensional diagrams, two dimensional diagrams, pictogram and cartographs	Analyze the pictorial presentation of data	K4
		Construct a sample diagrammatic representation of data	K6
3.4	Graphical- Frequency graphs- line, polygon, curve, histogram Cumulative frequency graphs- ogives	List the type of graphical presentation	K1
		Identify suitable graphical presentation	K3
		Construct graphical representation of data	K6
3.5	General structure of scientific reports includes-Different types of scientific documents-journal articles, books, thesis, conference and project reports	Explain the importance of report writing	K2
		Classify the types of reports	K4
		Compare the reports based on the type of study	K4
I V	**Mean, median, mode and their applications**		
4.1	Measures of dispersion- standard deviation, coefficient of variation, percentiles and percentile ranks.	Analyze the data using statistical techniques	K4
4.2	Correlation coefficient and its interpretation, Rank correlation	Analyze the variation in the collected data	K4

4.3	Association of attributes , contingency table, basic software application like Ms- Excel, SPSS in doing basic statistical evaluation	Select appropriate application for statistical evaluation	K3
		Examine suitable application for statistical inferences	K5
4.4	Management Tools for PLAGIARISM –ProWritingAid, Quetext, EduBirdieand PDS(plagiarism detection system)	Paraphrase the truthfulness of research work	K2
		Justify uniqueness of research using different tools for plagiarism	K5
V	**Probability and Tests of Significance**		
5.1	Rules of probability and its applications	Apply rules of probability in research work	K3
5.2	Normal, binomial, their properties, importance of these distributions in research studies	Analyze different distribution of probabilities in research studies	K4
		Explain the importance of distributions in research studies	K2
5.3	Large and small sample tests -t‟, F and chi square tests ANOVA and applications	List the types of tests to interpret result using statistical techniques	K1
		Apply suitable tests to interpret the result	K3

4. Mapping scheme

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	L	-	H	-	M	-	-	-	L	M	M	L	L
CO2	-	-	M	-	H	-	-	-	-	-	-	-	L
CO3	-	-	M	-	H	M	L	-	-	-	-	-	H
CO4	-	-	H	-	H	H	H	M	-	M	M	-	M
CO5	-	-	H	-	H	H	H	H	-	-	-	-	M
CO6	L	-	H	-	H	H	L	L	-	-	-	L	M

L-Low, M-Medium, H-High

5. COURSE ASSESSMENT METHOD

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator:

ELECTIVE COURSE-II : FOOD PRODUCT DEVELOPMENT AND FOOD PROCESSING

Semester : III **Code : P21FS3:2**
Credits : 4 **Total Hours : 50**

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1. Course Outcomes

On completion of this course the students will be able to:

CO.No	Course Outcomes	Level	Unit
CO1	List the sequence of actions involved in the development a food product	K4	I
CO2	Identify the various methods of development of a new food product	K3	II
CO3	Evaluate the safety measures which should be followed by developing a new product	K5	III
CO4	Analyse the importance of processing of foods and the steps involved in food processing	K4	IV
CO5	Assess the effect of food additives and preservatives on foods	K5	V
CO6	Determine about the various food process and developing new products in order to stay healthy and satisfy consumer demand.	K5	V

2. A. Syllabus

Unit I: Introduction of Food product development (10 Hours)

Basic principles of food product development, Sensory properties of food and their role in product development, Concept of product development Formulation and evaluation of recipes at laboratory level, Product life cycle, Creating brand value for the Product.

Unit II: Methods of food product (10 Hours)

A. Bulk food preparation for food institutions and enterprises: servings, nutritive value and costing. Evaluation of food: objective and subjective method, selection and training of judges, development of score card and analysis of data.

B. Consumer evaluation: development of schedule and data analysis. Packaging material, types for different products. Food labelling.

Unit III: Safety and regulations (10 Hours)

Food safety issues in food product development, food quality regulations and standards, quality control in HACCP. Product formation and development for general and therapeutic use.

Unit IV: (10 Hours)

Food Processing- Definition, principles of food processing, Effect of processing on physicochemical characteristics, Classification of food processing- Primary, secondary and tertiary food processing, importance of food processing including thermal, radiation, refrigeration, freezing and dehydration. Principles of using electromagnetic radiation in food processing-ionizing radiations and non ionizing radiations, advantages and disadvantages, nutrient losses of food processing,

Unit V: (10 Hours)

Technologies underlying in mutual supplementation, enrichment and fortification, fermentation, malting and germination Quality control in food industry: raw material, finished products. Processing technologies for convenience and processed foods Food additives; Definition, types and functions, permissible limits and safety aspects. Chemical Preservatives- type I and type II.

2.C. Topics for the self-study

Product Development: Scale of new product development in market place, concept generation, consumer testing, quality function deployment. Research and Development process. Trends and new techniques in processing, for example extrusion, sous vide, high pressure, electrical and magnetic fields, light pulses, minimal processing, home meal replacements, hurdle technology. Food ingredients and their functions.

2. D. Reference:

1. Jacqueline H. Beckley, M. Michele Foley Elizabeth J. Topp&_J. C. Huang WitoonPrinyawiwatkul (2007). Accelerating New Food Product Design and Development. Blackwell Publishing Company. IFT Press. USA
2. Howard R. Moskowitz, I. Sam Saguy& Tim Straus (2009). An Integrated Approach to New Food Product Development. Taylor and Francis Group, LLC.USA
3. Mary Earle and Richard Earle (2008). Case studies in food product development Wood head Publishing Limited and CRC Press LLC.USA
4. Creating New Foods. The Product Developer's Guide: Marie D. Earle and Richard L. Earle (2001). Chadwick House Group Ltd. New Zeeland.
5. David H. Lyon, Mariko A. Francombe, Terry A. Hasdell and Ken Lawson (1992).Guidelines for sensory analysis in food product development and quality control.Chapman& Hall, 2-6 Boundary Row, London.
6. Rao, Chandra Gopala (2006). Essentials of food process engineering. B.S. Publications.
7. Khatkar, Bhupendra Singh ed (2007). Food science and technology.Daya Publishing House.
8. Singh, N.P (2007). Fruit and vegetable preservation. Oxford Book Company.
9. Ahlluwalia, Vikas (2007). Food processing.Paragon International Publishers.
10. Sivasankar,B (2005). Food processing and preservation. Prentice - Hall of India

2. E. Reference Link:

11. https://www.adelaide.edu.au/course-outlines/004631/1/sem-2/

3. Specific Learning Outcomes (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
I	**Introduction of Food product development**		
1.1	Basic principles of food product development, Sensory properties of food and their role in product development, Concept of product development	List the steps in food product development	K4

		Explain the importance of research, sensory evaluation and consumer testing.	K2
		Explain the stages of food product developmet	K2
1.2	Formulation and evaluation of recipes at laboratory level	Determine about bulk food preparation for food institutions and enterprises: servings, nutritive value and costing.	K5
1.3	Product life cycle, Creating brand value for the Product.	Develop the Life cycle of a product	K3
		Outline the essentials of a food brand	K2
		List the steps to create a new specialty food brand	K4
II	**Methods of food product**		
2.1	Bulk food preparation for food institutions and enterprises: servings, nutritive value and costing.	Explain bulk food production	K2
		Categorize the bulk food production	K4
		List the salient features of bulk food production	K4
		Outline the equipments required for bulk food production and service	K2
		Explain the factors to be kept in mind while compiling a menu.	K2

		Illustrate the importance of Food cost control	K2
		List the elements of costing	K4
		Identify the essentials of food cost control	K3
		Explain the measures to control food cost	K2
2.2	Evaluation of food: objective and subjective method,	Discuss the advantages and disadvantages of sensory and objective evaluation.	K6
		Outline the points to be considered in conducting objective evaluation of food	K2
2.3	Selection and training of judges, development of score card and analysis of data.	Outline the process by which select and train a taste panel	K2
		Explain the importance of score card in sensory evaluation	K2
		Develop a score card for an experiment might conduct in the laboratory	K3
2.4	Consumer evaluation: development of schedule and data analysis.	Develop an evaluation card for consumer to evaluate newly introduced food product	K3
		Demonstrate tests for acceptability of a new product	K2

2.5	Packaging material, types for different products. Food labelling.	List the purposes of packaging	K4
		Outline the Objectives of packaging label	K2
		Explain the types of packaging	K2
		Identify the labels and symbols used on packages	K3
		Explain about the package development considerations	K2
III	**Safety and regulations**		
3.1	Food safety issues in food product development, food quality regulations and standards,.	Identify the causes of accidents	K3
		Organize the safety procedure	K3
		Organize the safety training	K3
		Explain the enforcement of safety	K2
		List the legal responsibilities of a food service manager	K4
		Outline the Labour laws	K2
		Discuss on the role of consumers in maintaining standards	K6

3.2	Quality control in HACCP.	Explain the Importance of HACCP	K2
3.3	Product formation and development for general and therapeutic use	Explain the product development process	K2
		List the therapeutic products	K4
IV	**Food Processing**		
4.1	Definition, principles of food processing, Effect of processing on physicochemical characteristics	Identify the purpose of food processing	K3
		Outline the types of food processing	K2
		Evaluate the effect of food processing method on food quality	K5
		Evaluate the effect of food processing method on nutritional properties of food	K5
4.2	Classification of food processing- Primary, secondary and tertiary food processing	Categorize the classification of food processing industries	K4
		Outline the food classification systems based on the food processing	K2
4.3	Importance of food processing including thermal, radiation, refrigeration, freezing and dehydration.	List the Importance of food processing industries in India	K4
		Discuss the Importance of food processing and preservation	K6

4.4	Principles of using electromagnetic radiation in food processing- ionizing radiations and non ionizing radiations, advantages and disadvantages, nutrient losses of food processing,	Elaborate on Food preservation by irradiation	K6
		Evaluate the effect of irradiation technology on nutritional quality	K5
V			
5.1	Technologies underlying in mutual supplementation, enrichment and fortification, fermentation, malting and germination	Explain the Conventional food processing technologies	K2
		Explain the Advanced food processing technologies	K2
5.2	Quality control in food industry: raw material, finished products. Processing technologies for convenience and processed foods	Discuss on the Importance of quality control in food processing industry	K6
		Evaluate the quality control process in food processing	K5
5.3	Food additives; Definition, types and functions, permissible limits and safety aspects. Chemical Preservatives- type I and type II.	Explain the role of food additives	K2
		Explain on Nutritive additives	K2

4. **Mapping scheme**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	-	-	L	M	H	-	M	L	H	H	-	H
CO2	H	-	-	L	M	H	-	M	L	H	H	-	H
CO3	H	-	-	L	M	H	-	M	L	H	H	-	H
CO4	H	-	-	L	M	H	-	M	L	H	H	-	H
CO5	H	-	-	L	M	H	-	M	L	H	H	-	H
CO6	H	-	-	L	M	H	-	M	L	H	H	-	H

L-Low, M-Medium, H-High

5. COURSE ASSESSMENT METHOD

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator: Ms. Bavithra

ELECTIVE-III : FOOD SAFETY AND QUALITY CONTROL

Semester : III **Code : P21FS3:3**
Credits : 4 **Total Hours : 50**

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1. Course Outcomes

On completion of this course the students will be able to:

CO.No	Course Outcomes	Level	Unit
CO1	Explain the importance of food safety in the processing industry	K2	I
CO2	Identify the concepts of food labeling	K3	II
CO3	Compare the effects of various contaminations on different food commodities	K2	III
CO4	List the various food safety programs	K4	IV
CO5	Analyze various hazard analysis techniques and differentiate biological and chemical hazards	K4	V
CO6	Determine an overall idea about quality control and food safety regulations in India	K5	
CO7	Explain the importance of food safety in the processing industry	K2	I

2. Syllabus

Unit I: Food safety concept **(10 Hours)**

A. Importance of food safety in the food processing industry Risk classification, National and international food regulatory agencies

B. Food contaminates and adulterants:.Food toxins – Mycotoxins – aflatoxins, aspergillus and pencillium species, Mushroom poisoning sea food toxins.Other toxins- Naturally occurring in foods lathyrogens, haemagglutinins, goitrogens.

C. Food adulterations and food standards : adulterations- Definition, common food adulterants : Test for detecting food adulterants ,contamination with toxic minerals, pesticides and insecticides : Effects of food adulterants and contamination, measures to control food adulterants .Prevention of food adulterants act.

Unit II: Food Safety Programs (10 Hours)

A. Definitions and importance, Good Manufacturing Practices (GMPs), Pest Control Program, Facility Maintenance, Personal Hygiene, Supplier Control, Sanitary Design of Equipment and Infrastructure, Procedures for Raw Material Reception, Storage and Finished Product Loading.

B. Sanitation Program. (Sanitation Standard Operating Procedures (SSOPs).,B. Product Identification, Tracking and Recalling Program, Preventive Equipment Maintenance Program, Education and Training Program.

Unit III: Hazard Analysis and Risk Assessment (10 Hours)

A. Physical hazards (metals, glass, etc), Chemical hazards (food additive toxicology, natural toxins, pesticides, antibiotics, hormones, heavy metals and packaging components), Biological hazards (epidemiology of biological pathogens: virus, bacteria and fungi)

B. Evaluation of the severity of a hazard Controlling Food Hazards .Hazard Analysis Critical Control Point (HACCP) system.

Unit IV: Food Hygiene Programs (10 Hours)

A. Training programs, Infrastructure, Personal habits, Hygiene verification, Water in the food industry, Water sources, Water uses, Water quality, Treatments, Cleaning and sanitation, Cleaning agents, Sanitizing agents, Equipment and systems.

B. Waste management in food industry – food recovery hierarchy, source reduction and reuse, animal feeding, recycling, composting, fermentation, landfills, incineration and land application

Unit V: Food safety regulation in India (10 Hours)

A. An overview of Food Regulation in India; Food Laws and Regulations; Structure, organization and duties of regulatory system; Duties and responsibilities of food business operator; Registration and Licensing process and requirements;

B. Labelling of Food Products; Traceability; Import and Export of Foods; Liability for Defective Products; Food safety management systems and certifications; Regulation of special category Foods: Regulation of Irradiated foods;

C. General food laws and food safety regulations, (i) international food standard and Codex Alimentarous, (ii) AGMARK & BIS (iii) FSSAI (iv) HACCP.

2.B. Topics for the self-study

Sensometrics for Food Quality control-Food and Nutrition Services Quality Control Management Program-Quality assurance and halal control points for the food industry-Radiation Dosimetry for Quality Control of Food Preservation and Disinfestation

Reference Link: https://worldwidescience.org/topicpages/f/food+quality+control.html

2.C. Text books:

1. Food Safety and standards Act 2006, Rules 2011, Regulations, 2011, 10th Edition, ILBCO India, Indian Law Book Company, 2013
2. Early, R. (1995): Guide to Quality Management Systems for the Food Industry, Blackie, Academic and professional, London.
3. Gould, W.A and Gould, R.W. (1998). Total Quality Assurance for the Food Industries, CTI Publications Inc. Baltimore.
4. Pomeraz, Y. and MeLoari, C.E. (1996): Food Analyasis: Theory and Practice, CBS publishers and Distributor, New Delhi.

5. 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 Organisation, Geneva.
6. Kirk, R.S and Sawyer, R. (1991): Pearson's Composition and Analysis of Foods, Longman Scientific and Technical. 9th Edition, England.
7. FAO (1980): Manuals of Food Quality Control. 2-Additives Contaminants Techniques, Rome.
8. FSSAI, FSIS, EU and FAO website for updates

3. Specific Learning Outcome (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
I	**Food safety concept**		
1.1	Importance of food safety in the food processing industry Risk classification, National and international food regulatory agencies.	Outline the responsibilities of Food Safety system	K2
		Explain the Development of National Food Safety System	K2

		List the objectives of Food Safety Studies	K4
		Illustrate Safe Food Production with Minimum and Judicious Use of Pesticides	K2
1.2	Food contaminants Food toxins –Mycotoxins – aflatoxins, aspergillus and pencillium species, Mushroom poisoning sea food toxins.	List the Regulations for Food Toxins	K4
	Other toxins- Naturally occurring in foods lathyrogens,haemagglutinins, goitrogens.	Analyze the Risk assessments of toxins in food	K4
		Identify the Sources, Signs and symptoms, Treatment and prevention	K3
1.3	Food adulterants- Food adulterations and food standards : adulterations- Definition, common food adulterants	Classify the Types of food adulterants and harmful effects	K4
		Categorize the Different food items and their adulterants	K4
	Test for detecting food adulterants, contamination with toxic minerals, pesticides and insecticides : Effects of food adulterants and contamination, measures to control food	Analyze the Different food articles and adulterant detection techniques for them	K4

	adulterants Prevention of food adulterants act.		
		Identify the Effects of Food adulterants on Humans	K3
		Explain the Impacts of adulteration, Safety measures and prevention of adulteration	K2
II	**Food Safety Programs**		
2.1	Definitions and importance, Good Manufacturing Practices (GMPs), Pest Control Program, Facility Maintenance	Evaluate the Implementation of GMPs	K5
		Determine the Common Prerequisite Programs	K5
		Explain the Pest Control, Facility and Building Design, Equipment and Preventive Maintenance	K2
2.2	Personal Hygiene, Supplier Control, Sanitary Design of Equipment and Infrastructure,	Summarize the Individual chemical hygiene responsibilities	K2
		Outline the Purpose, scope and applications, Roles and Responsibilities	K2
		Illustrate the Lab safety equipments, Personal protective equipments	K2
2.3	Procedures for Raw Material Reception, Storage and Finished Product Loading.	Demonstrate the Hygiene and quality of raw materials and ingredients	K2

		Categorize the Procurement of raw materials and ingredients	K4
		Identify the Requisite conditions for the transport, storage and preservation of raw materials and ingredients	K3
2.4	SanitationProgram. (Sanitation Standard Operating Procedures (SSOPs).	Demonstrate the Sanitation Principles and Food Handling Practices	K2
		Apply the Manufacturing Controls and Essential Operations, Personal Cleanliness and Conduct	K3
		Evaluate the General Protection from Contamination, Sanitary Facilities, General Sanitary Design	K5
2.5	Product Identification, Tracking and Recalling Program, Preventive Equipment Maintenance Program, Education and Training Program.	Explain FAO's work on traceability and recalls	K2
		Illustrate the Product Recalls/Market Withdrawals; Regulatory Compliance	K2
		Identify the Market Access; Public Health Trace-backs; Food Safety and Quality Assurance; and Process and Order Management	K3
		Demonstrate the Effective Sanitation Programs for Food Safety Success	K2
III	**Hazard Analysis and Risk Assessment**		

3.1	Physical hazards (metals, glass, etc), Chemical hazards (food additive toxicology, natural toxins, pesticides, antibiotics, hormones, heavy metals and packaging components),	Categorize the Physical hazards differ from chemical and biological hazards	K4
		Summarize the Naturally occurring physical hazards and dangerous	K2
		Explain the Prevention of harms from naturally occurring physical hazards	K2
3.2	Biological hazards (epidemiology of biological pathogens: virus, bacteria and fungi)	Illustrate Risk factors, Major biological hazards	K2
		List the Sources, Control and Prevention	K4
		Identify the microbial toxins as Public Health Hazards	K3
3.3	Evaluation of the severity of a hazard Controlling Food Hazards .Hazard Analysis Critical Control Point (HACCP) system.	Demonstrate the Importance of conducting a thorough hazard analysis	K2
		Identify the Food safety hazards , Hazard analysis process	K3
		Explain about Hazard identification, Determination of acceptable levels, Hazard evaluation, Control measures	K2

IV	Food Hygiene Programs		
4.1	Training programs, Infrastructure, Personal habits, Hygiene verification	Demonstrate the Hygiene programs, procedures, training ,records, monitoring and follow-up	K2
		Outline Introduction to the Principles and Concepts of Hygiene	K2
		Categorize the Components of hygiene and environmental health.	K4
4.2	Water in the food industry, Water sources, Water uses, Water quality, Treatments	List the primary sources of fresh water, Knowledge of the water source and how it was obtained	K4
		Explain about Impurity of water identification and measured in three basic categories -qualitative, general quantitative and specific	K2
		Analyze the Tests used for general quantitative analysis of water	K4
		Demonstrate the Common water treatment techniques and their purpose	K2
4.3	Cleaning and sanitation, Cleaning agents, Sanitizing agents, Equipment and systems.	Classify the Types Of Cleaning Compounds, Properties Of A Cleaner	K4
		Illustrate the Factors That Affect Cleaning Efficiency, Cleaning Operation	K2

		Summarize about Heat, Chemical Sanitizers, Factors Affecting Sanitizing	K2
		Explain the Machine Ware washing, Dishwashing Machines, Hot Water Sanitizing, Chemical Sanitizing, Requirements For A Successful Dishwashing Operation	K2
4.4	Waste management in food industry – food recovery hierarchy, source reduction and reuse	Outline the Waste management hierarchy-waste prevention	K2
		Explain the reuse, recycling, recovery, safe disposal, sustainable, effective and profitable waste management options	K2
4.5	animal feeding, recycling, composting, fermentation, landfills, incineration and land application	List the Methods of Processing Organic Waste	K4
		Classify the Disadvantages of using of organic waste as an animal feed. Incineration, Advantages and Disadvantages of waste incineration method	K4

4. **Mapping scheme**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	H	-	M	-	L	-	H	L	H	H	-	L
CO2	-	H	-	M	H	-	-	H	L	H	L	-	L

CO3	H	H	-	M	-	-	-	H	L	H	L	-	L
CO4	H	H	-	M	-	-	-	H	L	H	L	-	L
CO5	-	M	M	M	-	-	-	H	L	H	L	-	L
CO6	H	H	-	M	-	-	-	H	L	H	L	-	L

L-Low, M-Medium, H-High

5. COURSE ASSESSMENT METHOD

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator: Ms. Meera Muralidharan

CORE PRACTICAL- V- FOOD ANALYSIS

Semester : III **Code : P21FS3P5**
Credits :3 **Total Hours : 45**

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1. Course Outcomes

On completion of this course the students will be able to:

CO.No	Course Outcomes	Level	Unit
CO1	Illustrate the relationship between body composition and fitness	K2	I
CO2	Compare and contrast the metabolisms with reference to fitness	K4	II
CO3	Determine the relationship between exercise and prevention of disease and disorder	K5	III
CO4	Assess the role of energy balance and electrolyte balance with reference to physical activity	K5	IV
CO5	Interpret the nutritional requirements for male and female sports persons	K5	V
CO6	Determine the nutritional requirement for fitness and physical performance	K5	**V**

2. A. Syllabus:

1. Estimation of **moisture** in dehydrated powders
2. Estimation of **carbohydrate** by Anthrone method
3. Estimation of **minerals** in flour – Calcium, Iron and Phosphorus
4. Estimation of **beta carotene** in carrot, Sweet potato and pumpkin
5. Estimation of **ascorbic acid** in Green Leafy Vegetables
6. Estimation of **fibre** in vegetables – Crude and Dietary
7. Estimation of **protein** in pulses by Kjeldhal Apparatus
8. Estimation of **cholesterol** by Zak's method
9. Estimation of **fat** in dehydrated powders using Soxhlet apparatus
10. Determination of **Peroxide value, Iodine and Saponification number** in fats and oils

3. Specific Learning outcomes (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
1.	Estimation of **moisture** in dehydrated powders	Identify the moisture content in dehydrated powder	K3
2.	Estimation of **carbohydrate** by Anthrone method	Analyze the carbohydrate content in the given food sampleby Anthrone method	K4
3.	Estimation of **minerals** in flour – Calcium, Iron and Phosphorus	Identify the mineral content in the given flour	K3
4.	Estimation of **beta carotene** in carrot, Sweet potato and pumpkin	Analyze the beta carotene content in carrot, sweet potato and pumpkin	K4
5.	Estimation of **ascorbic acid** in Green Leafy Vegetables	Identify the ascorbic acid content in green leafy vegetable	K3
6.	Estimation of **fibre**in vegetables – Crude and Dietary	Identify the crude and dietary fibrecontent in vegetables	K3
7.	Estimation of **protein** in pulses by Kjeldahl Apparatus	Estimate the protein content by nitrogen	K5

		concentration of the pulses	
8.	Estimation of **cholesterol** by Zak's method	Identify the cholesterol content by using zak's method	K3
9.	Estimation of **fat** in dehydrated powders using Soxhlet apparatus	Analyze the fat content in dehydrated powders	K4
10.	Determination of **Peroxide value, Iodine and Saponification number** in fats and oils	Estimate the degree of oxidation in fats and oils	K5

4. Mapping scheme for PO, PSOs and COs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	M	L	H	M	-	-	-	-	L	M	M	H	L
CO2	L	L	H	L	-	-	-	-	L	M	M	H	L
CO3	M	L	H	M	-	M	-	-	L	M	M	H	L
CO4	M	L	H	M		-			L	L	M	H	L
CO5	M	L	H	M		H			L	M	M	H	L
CO6	L	-	M	M	-	L	-	L	L	H	M	H	M

L-Low, M-Medium, H-High

5. COURSE ASSESSMENT METHOD

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz

(written).

4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator: Ms. Preethi S

CORE COURSE-XI : NUTRITION IN FITNESS

Semester : IV **Code : P21FS411**

Credits : 4 **Total Hours : 60**

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2. Course Outcomes

On completion of this course the students will be able to:

CO.No	Course Outcomes	Level	Unit
CO1	Illustrate the relationship between body composition and fitness	K2	I
CO2	Compare and contrast the metabolisms with reference to fitness	K4	II
CO3	Determine the relationship between exercise and prevention of disease and disorder	K5	III
CO4	Assess the role of energy balance and electrolyte balance with reference to physical activity	K5	IV
CO5	Interpret the nutritional requirements for male and female sports persons	K5	V
CO6	Determine the nutritional requirement for fitness and physical performance	K5	**V**

3. A. Syllabus

Unit I: Body composition and fitness **(12 Hours)**

(i) Body composition- classification (Fat mass and fat free Mass) and its components, actors influencing body mass composition. Techniques for measuring body composition.

(ii) Fitness-definition, parameters of fitness- cardiovascular endurance, muscular strength, muscular endurance, flexibility and body composition

Unit II: Role of macronutrients (12 Hours)

(i) Carbohydrate- Carbohydrate reserves, Carbohydrate as energy source for sports and exercise. Glycogen synthesis and carbohydrate loading. Carbohydrate requirements.

(ii) Consumption of carbohydrate –Consumption of carbohydrate in pre exercise, duration and recovery period. Carbohydrate supplementation during exercise, Factors affecting utilization of carbohydrates during exercise

Unit III: Role of lipids as an energy source for sports (12 Hours)

Fat stores, oxidation of fats, factors affecting fat oxidation (intensity, duration, training status and carbohydrate feeding).Consumption of fats – Fat requirements and utilization. Influence of dietary factors on fat utilization – total fat intake, high carbohydrate diets, dietary fibre and alcohol.

Unit IV: Protein and amino acid requirements (12 Hours)

Importance of protein and amino acid requirements during sports, Factors affecting protein turnover during endurance exercise, resistance exercise and recovery process. Protein supplementation. Importance of micronutrients in sports – Role of vitamins, minerals and antioxidants. Dietary supplements and ergogenic aids (Mechanical, nutritional, pharmacological, physiological and psychological) – concept.

Unit V: Water balance (12 Hours)

Fluid balance in sports and exercise, dehydration. Water recommendation for athletic performance, Sports anaemia, Performance – influencing factors – Chronic dieting and eating disorder, Female athlete triad, stress, type of exercise, gender influence, lipid metabolism and weight loss, caffeine and athletic performance.

2.B.Topics for Self-study –

Safety of nutritional ergogenics, Legal issues of nutritional ergogenics, Nutritional quackery – health and sports.

2.C. Text Book(s):

1) Mahan, L.K. & Ecott-Stump, S.,Krause's Food, Nutrition and Diet therapy, 10th edition,W.B.Sunders ltd, 2000.
2) Sizer, F. &Whitney,E. , Nutrition- Concepts & Controversies,8th edition, Wadsworth Thomson learning, 2000.
3) Shills, M.E., Olson, J.A., Shike,N. and Ross, A.C.(Ed) Modern Nutrition in Health & disease, 9th edition, Williams & Wilkins, 1999.

2.D. Reference:

1) Parizkova. J. Nutrition, physical activity and health in early life, Ed.Wolinsky. I., CRC press, 2001.
2) Whitney, E.N. & Rolfes. S.R., Understanding Nutrition, 8th edition, West/Wadsworth, an International Thomson publishing Co. 2002.

2.E. Reference Link:

3.http://ir.torrent.tarafdari.com/complete/Nutrition%20for%20Health%2C%20Fitness%20and%20Sport%2C%2011th%20Edition/Nutrition%20for%20Health%2C%20Fitness%20and%20Sport%2C%2011th%20Edition.pdf

4. Specific Learning Outcome (SLO)

Unit / Section	Course Content	Learning Outcomes	Bloom's Taxonomic Levels of Transaction
I	**Body composition and fitness**		
1.1	Body composition- classification (Fat mass and fat free Mass) and its components	Define Reference man and Reference Woman	K1
		Distinguish fat muscle mass and fat free muscle mass	K4
		Measure the Body Mass Index of an individual	K5
1.2	Factors influencing body mass composition	Identify the factors influencing body mass composition	K3
		Assess body composition by anthropometric method	K5
1.3	Techniques for measuring body composition	Define Broka's Index	K1
		Explain the techniques	K2

		to measure body composition	
		Classify the techniques for the assessment of body composition	K4
		Distinguish BMI and body composition	K4
		Recommend the suitable method to assess body composition	K5
1.4	Fitness-definition, parameters of fitness- cardiovascular endurance, muscular strength, muscular endurance, flexibility and body composition	Define and list the parameters of fitness	K1
		Explain the components of physical fitness	K2
		Contrast and Test for cardiovascular endurance over physical fitness	K4
		Examine the muscular strength to ensure physical fitness	K4
		Analyze and compare the body composition	K4
		Estimate the duration of muscular endurance in physical fitness	K5
II	**Role of macronutrients**		
2.1	Carbohydrate - Carbohydrate reserves, Carbohydrate as energy source for sports and exercise	Label the sources of carbohydrates	K1
		Classify and explain the types of carbohydrates	K2
		Identify the reserves of carbohydrate	K4
		Categorize hormones for energy production during exercise	K4
2.2	Glycogen synthesis and carbohydrate loading, Carbohydrate requirements	Explain the requirements of carbohydrate	K2
		Summarize glycogenesis pathway	K2
		Outline the role of ATP	K2

		in energy transfer in exercise	
		Identify the alternative method to replace glycogen	K3
2.3	Consumption of carbohydrate – Consumption of carbohydrate in pre exercise, duration and recovery period	Choose the type of carbohydrate required during exercise	K3
		Distinguish the effect of meal in pre- and post exercise period	K4
		Determine overall carbohydrate intake for individuals	K4
2.4	Carbohydrate supplementation during exercise. Factors affecting utilization of carbohydrates during exercise	Illustrate the factors affecting utilization of carbohydrates	K2
		Analyze the glycemic index in pre, during and post exercise periods	K4
		Interpret dietary guidelines for carbohydrate feeding in pre, during and post exercise periods	K5
		Formulate energy bars to provide adequate supply of carbohydrates	K6
III	**Role of lipids as an energy source for sports**		
3.1	Fat stores, oxidation of fats, factors affecting fat oxidation (intensity, duration, training status and carbohydrate feeding).	Define rancidity and Classify the types of rancidity	K1,K2
		Explain the functions, classification and dietary sources of fat	K2
		Identify the factors affecting oxidation of fat	K4
		Assess the highest fat containing dietary source	K5
3.2	Consumption of fats – Fat requirements and utilization.	Explain the requirements of fat for physical fitness	K2

		Analyze the relationship between body fat and physical fitness	K4
		Analyze fat stores utilization during exercise	K4
		Identify Essential Fatty acids for physical fitness	K5
3.3	Influence of dietary factors on fat utilization – total fat intake, high carbohydrate diets, dietary fibre and alcohol	Summarize oxidation of fat during physical exercise	K2
		Explain the effect of alcohol in physical fitness	K2
		Select foods with high fat, carbohydrates and dietary fibre content	K3
		Develop fat-rich food for athletes	K6
IV	**Protein and amino acid requirements**		
4.1	Importance of protein and amino acid requirements during sports	Explain the impact of amino acids on physical performance	K2
		Classify proteins and amino acids	K4
		Compare the protein requirements for normal individuals and athletes	K4
4.2	Factors affecting protein turnover during endurance exercise, resistance exercise and recovery process	Summarize protein breakdown for physical endurance	K2
		Relationship between protein synthesis and degradation	K4
		Analyze the impact of protein intake on exercise performance	K4
4.3	Protein supplementation	Select the suitable protein supplements to compensate protein loss	K3
		Analyze the ergogenic properties of protein	K4
4.4	Importance of micronutrients in sports – Role of vitamins, minerals	Explain the biological functions of	K2

	and antioxidants	micronutrients for sports individuals	
		Classify vitamins based on its requirements	K4
		Compare the requirement of antioxidants for sports and normal individuals	K4
		Assess clinical manifestations of micronutrients deficit sports individuals	K5
4.5	Dietary supplements and ergogenic aids (Mechanical, nutritional, pharmacological, physiological and psychological) – concept	Relate the impact of high doses of supplements with natural fat rich foods	K2
		Illustrate the ergogenic aids and dietary supplements	K2
		Identify the harmful effects of ergogenic aids and other supplements	K4
		Categorize ergogenic aids based on its effect imposed on sports individuals	K4
		Recommend natural foods for high physical performances	K5
V	**Water balance**		
5.1	Fluid balance in sports and exercise, dehydration. Water recommendation for athletic performance.	Illustrate the effect of fluid imbalance on body functions and performance	K2
		Relate body fluid balance and rehydration in sports and physical exercise	K2
		Compare the fluid requirement for sports, exercise and dehydrated individuals	K4
		Recommend guidelines to prevent thermal injury during endurance	K5

	Sports anaemia, Performance – influencing factors – Chronic dieting and eating disorder, female athlete triad, stress, type of exercise, gender influence, lipid metabolism and weight loss, caffeine and athletic performance	Define and classify the types of anaemia	K1, K4
		Explain the performance influencing factors of sports individuals	K2
		Compare basal loss of iron	K4
		Compare iron requirement of normal individuals with sports individuals	K4
		Analyze the ergogenic aids influencing the performance	K4
		Analyze the iron requirements for sports and athletics	K4
		Recommend iron supplements to the anaemic sports individuals	K5
		Estimate the haemoglobin concentration in blood	K5

4. **Mapping scheme**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	-	H	-	M	-	-	-	L	-	L	L	-	-
CO2	M	H	-	M	-	-	-	H	-	L	L	-	-
CO3	L	H	-	H	-	L	M	-	-	H	-	-	-
CO4	L	H	H	H	-	-	-	H	-	L	L	-	-
CO5	-	H	H	H	-	M	M	H	-	M	-	-	-

CO6	-	H	H	H	-	M	M	H	-	M	-	-	-

L-Low, M-Medium, H-High

5. COURSE ASSESSMENT METHOD

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator:

ELECTIV –IV : FOOD PACKAGING

Semester : IV **Code : P21FS4:4**
Credits : 4 **Total Hours : 50**

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1. Course Outcomes

On completion of this course the students will be able to:

CO.No	Course Outcomes	Level	Unit
CO1	Explain the role of packaging in the food industry	K2	I
CO2	Compare the advantages and disadvantages of various packaging material	K2	II
CO3	Identify the types of packaging and their usage in packing various foods	K3	III
CO4	Analyse the differences in packing fresh and processed foods	K4	IV
CO5	Interpret the packaging designs and environmental issues in various packing techniques	K5	V
CO6	Determine the various laws relating to packaging industries and the importance of labels in the food packaging	K5	**V**

2. Syllabus

Unit I: Introduction to food packaging (10 Hours)

A. History, functions of Packaging –Types, Concepts, Significance, Testing & evaluation of packing media - retail packs (including shelf life evaluation) and transport packages. Packaging of food(s)- Fresh and processed, general characteristics

B. Food products - General classification and packing types, varieties and trends. Storage, handling and distribution of packages (foods) - including palletisation & Containerization

Unit II: Packaging Materials (10 Hours)

A. An introduction to packaging materials,**Basic Packaging Materials – Paper, Wood, Plastics, Glass, Metal Containers (SS)** Packaging Films – Polyethylene, Cellophane, Aluminium foil, Laminates, New Polymeric Packaging Films, Shrink Film, Cling and Wrap Film, Edible Film.

B. Packaging Methods and Systems-Traditional Food Packaging, Retortable, Lined Cartons, Bag in Box Aseptic, Modified Atmosphere Packaging, Vacuum, Gas Packaging, Bio Based Packaging, Eco-friendly and Safe Packaging for Exports Ovenable Packages, Transport Packages, Packaging Equipments.

Unit III: Storage, Handling and Distribution of Packages (10 Hours)

Shelf-Life Testing of Packaged Foods, Evaluation of Packaged Foods **Labeling – Definition, Purpose, Types, Materials, Adhesives (SS)** Food and Nutritional Labeling as per FSSAI specifications Packaging Laws and Regulations – National and International Specifications

Unit IV: Packaging of fresh and processed foods (10 Hours)

Packaging of Fruits and vegetables, Fats and Oils, Spices, meat, Poultry and sea foods, Dairy Products, Bakery, beverages, Dehydrated and frozen foods. Liquid and powder filling machines – like aseptic system, form and fill (volumetric and gravimetric), bottling machines. Form Fill Seal (FFS) and multilayer aseptic packaging machines.

Unit V: Packaging Design & Environmental Issues in Packaging (10 Hours)

A. Food marketing and role of packaging- bar coding, Migration in food packaging. FSSAI regulations for packaging and food labelling.

B. **Packaging -** Laws & Regulations - FDA, PFA, Packaging Commodity Rules, Weight & Measures Act etc, Coding & marking including bar coding, Environmental & amp; Eco issues and waste disposal.

Unit VI: Topics for Self-Study

Consumer awareness about packaging- influence of existing and new FMCG food products packaging on consumer buying behavior- consumer experience of purchasing packaged food products- how packaging can influence them to purchase their decision powers.

Reference Link:

https://www.ukessays.com/essays/marketing/research-views-food-packaging-5714.php

Text Books and Reference materials:

1. Miquel Angelo P R C, Ricardo Nuno C P, Oscar Leandro D S R, Jose Antonio C T, Antonio Augusto V , 2016, Edible Food Packaging: Materials and Processing Technologies, CRC Press. Taylor & Francis, Boca Raton , FL

2. Luciano P, Sara L,2016, Food Packaging Materials, Springer chamHeildelberg, New York, Department of Food Science and Technology 39

3. Robertson, G.L. 2006 Food Packaging: Principles and Practice (2nd ed.), Taylor & Francis

4. NIIR. (2003). Food Packaging Technology Handbook, National Institute of Industrial Research Board, Asia Pacific Business Press Inc.

5. Ahvenainen, R. (Ed.) 2003 Novel Food Packaging Techniques, CRC Press,

3. **Specific Learning Outcomes (SLO)**

Unit / Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
I	**Introduction to food packaging**		
1.1	History , functions of Packaging –Types, Concepts, Significance, Testing &	Illustrate the history of packaging- Modern era and ancient era	K2

		List about the major functions of packaging	K4
		Outline the classification of packaging	K2
1.2	Evaluation of packing media - retail packs (including shelf life evaluation) and transport packages.	Identify the quality control testing of packaging materials	K3
1.3	Packaging of food(s)- Fresh and processed, general characteristics	Compare the packaging and Logistics of Fresh and Processed Foods	K4
		Explain about packaging helps to ensure the safety of food and retain the quality of the product	K2
		Determine the packaging for organic foods	K5
1.4	Food products - General classification and packing types, varieties and trends.	List the different types of food packaging	K4
		List the different packaging materials used in food products	K4
	Storage, handling and distribution of packages (foods) - including palletisation & Containerization	Evaluate the storage conditions and distribution systems at various stages of food manufacturer	K5

		Evaluate the storage and distribution after food manufacture	K5
II	**Packaging Materials**		
2.1	An introduction to packaging materials,Basic Packaging Materials – Paper, Wood, Plastics, Glass, Metal Containers (SS)	Identify the materials used for packing	K3
		Identify the food stuffs and desirable packing material	K3
	Packaging Films – Polyethylene, Cellophane, Aluminium foil, Laminates, New Polymeric Packaging Films, Shrink Film, Cling and Wrap Film, Edible Film.	Explain the Active food packaging	K2
		Illustrate the points to be considered before designing a packaging systems	K2
2.2	Packaging Methods and Systems-Traditional Food Packaging, Retortable, Lined Cartons, Bag in Box Aseptic, Modified Atmosphere Packaging, Vacuum, Gas Packaging	Outline the Advances in packaging methods	K2
		Identify the processes and systems in food packaging	K3
	Bio Based Packaging, Eco-friendly and Safe Packaging for Exports Ovenable Packages, Transport Packages, Packaging Equipments.	Explain the Biobased packaging materials for the food industry	K2

		List the Packaging requirements for microwavable foods	K4
		Explain about Transport Packaging	K2
		Identify the Packaging equipment and machines	K3
III	**Storage, Handling and Distribution of Packages**		
3.1	Shelf Life Testing of Packaged Foods, Evaluation of Packaged Foods	Categorize the commonly used methods for determining the shelf life of packaged foods	K4
		Analyze the quality *evaluation of Packaging* Materials.	K4
3.2	Labeling – Definition, Purpose, Types, Materials, Adhesives (SS), Food and Nutritional Labeling as per FSSAI specifications	Identify the Guiding principles of nutrition labeling	K3
		Explain the Importance of 'Nutrition Labelling'	K2
3.3	Packaging Laws and Regulations – National and International Specifications	Discuss on Laws related to packaging	K6
		Analyze the Recent development on the food labelling front in india	K4
IV	**Packaging of fresh and processed foods**		

4.1	Packaging of Fruits and vegetables, Fats and Oils, Spices, meat, Poultry and sea foods, Dairy Products, Bakery, beverages, Dehydrated and frozen foods.	Illustrate the Packaging requirements for fresh fruits and vegetables	K2
		Evaluate the Packaging and Distribution of Fresh Fruits & Vegetables	K5
		List the Factors required for the packaging of fats and oils	K4
		Determine the Packaging strategies of meat, Poultry and sea foods	K5
		Identify the Packaging Materials for milk and dairy products	K3
		Classify the Packaging of different types of beverages	K4
		Explain the Vacuum packaging of dehydrated foods	K2
		Categorize the Types of frozen food packaging	K4
4.2	Liquid and powder filling machines – like aseptic system, form and fill (volumetric and gravimetric), bottling machines. Form Fill Seal (FFS) and multilayer aseptic packaging machines.	Identify the Liquid fillers or liquid filling machines	K3
		Demonstrate liquid filling machine work	K2

		Demonstrate the aseptic filling machine	K2
V	**Packaging Design & Environmental Issues in Packaging**		
5.1	Food marketing and role of packaging- bar coding, Migration in food packaging. FSSAI regulations for packaging and food labelling.	Illustrate the Role of packaging in market development	K2
		Explain the purpose of food package labeling	K2
		Identify the Labels and symbols used on packages	K3
		Identify the barcode for food products in India	K3
		Determine the Importance of bar coding on food packaging	K5
5.2	B. Packaging - Laws & Regulations - FDA, PFA, Packaging Commodity Rules, Weight & Measures Act etc, Coding & marking including bar coding	Identify the Food packaging laws and regulations in India	K3
		Outline the Important role of coding and marking printer in food safety	K2
5.3	Environmental& Eco issues and waste disposal.	Explain about the environmental issues of packaging	K2

		List the problems with plastic packaging	K4
		Explain the disposal of packaging	K2
		Evaluate the waste disposal bad for the most environmentally friendly packaging	K5

4. Mapping scheme

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	M	H	-	M	M	L	-	L	L	H	H	-	M
CO2	M	H	-	M	M	L	-	L	L	M	M	-	M
CO3	H	H		M	M	L	-	L	L	M	M	-	M
CO4	H	H	-	M	M	L	-	L	L	H	M	-	M
CO5	M	H	-	M	M	L	-	L	L	M	M	-	M
CO6	M	H	-	M	M	L	-	L	L	M	M	-	M

L-Low, M-Medium, H-High

5. COURSE ASSESSMENT METHOD

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Assignment, Group Presentation, Group Discussion, project

Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).

4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator:

ELECTIVE–V : NUTRITION DURING EMERGENCY

Semester : IV **Code : P21FS4 : 5**
Credits : 4 **Total Hours : 50**

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1. Course Outcomes

On completion of this course the students will be able to:

CO.No	Course Outcomes	Level	Unit
CO1	Apply Millennium Goals Development in prevention of loss of lives in disaster	K3	I
CO2	Recommend special nutritional requirements for epidemic, endemic and pandemic conditions	K5	II
CO3	Prioritize the demand for food in the State and manage distribution to the diverse population based on the nutritional requirement	K5	III
CO4	Assess malnutrition in the affected population and recommend suitable mitigation programs	K5	IV
CO5	Analyze various laws and policies on disaster management	K4	V
CO6	Discuss the mitigation programmes and preventive measures required during emergency situations	K6	VI

2. A. Syllabus

UNIT I: Categorization of disasters leading to emergency situations (10 Hours)

(i) Definition of emergency situation /disaster — classification of emergencies – natural, man- made - Famine, drought, flood, earthquake, cyclone, war, civil and political emergencies.

(ii) Factors leading to emergency conditions during disaster.

(iii) History of emergency situations and disasters in Indian subcontinent – Gujarat earthquake, Surat plague, Chennai-Psunami etc.

Unit II: Health-related emergencies (10 Hours)

(i) Epidemic diseases - Dengue, chikenguniya and other epidemic conditions.

(ii) Endemic diseases - Hypothyroidism and hyperthyroidism.

(iii) Pandemic diseases – SARS, COVID-19.

Unit III: Nutritional management during emergencies (10 Hours)

(i) Nutritional relief and rehabilitation- Assessment of food needs, food distribution strategy, targeting food aid, mass and supplementary feeding, special foods/ rations for nutritional relief.

(ii) Organizations for mass feeding/ food distribution, transportation and storage, feeding centers.

(iii) Sanitation and hygiene and public nutrition approach to tackle nutritional and health problems in emergencies, ethical considerations.

Unit IV: Assessment and surveillance of nutritional status (10 Hours)

(i) Malnutrition in emergency affected populations- Indicators of malnutrition during emergencies classification of malnutrition Body measurement indicators, clinical and other impacts

(ii) Scope for malnutrition assessment, indicators and simple screening methods.

(iii) Organization for nutritional surveillance.

Unit V: Food and Nutrition Security and disaster management programmes (10 Hours)

(i) Food production, Access, Distribution, Availability, Losses, Consumption.

(ii) Food Security, Socio-cultural aspects and Dietary Patterns: Their implications for Nutrition and health.

(iii) Disaster/emergency Management programmes in India & International - Disaster management acts & policies - Disaster Management Authority DMA (national, state, district, executive committees (national, state), National & state disaster response force. United nation disaster management team- assessment and humanitarian affairs

2.B. Topics for self study –

Monitoring tools, Monitoring mechanisms to assess the adequacy of the ration, Access to other food sources in post-emergency phase, Self-reliance and exit strategies.

2. C. Text Book(s):

1) Sharma S, Wadhwa A., "Nutrition in the Community- A textbook", Elite Publishing House Pvt. Ltd, 2003.
2) Srilakshmi B. "Dietetics" Seventh Edition, New Age International (P) Ltd, 2016

2.D. References:

1) Gibney, "Public Health Nutrition", Blackwell Publishing, 2004.
2) Khanna., "Textbook of Nutrition and Dietetics", Phoenix Publisher,2013.

2.E. Reference Link:

3. https://www.unhcr.org/45fa745b2.pdf

3. Specific Learning Outcomes (SLO)

Unit / Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
I	**Categorization of disasters leading to emergency situations**		
1.1	Definition of emergency situation /disaster — classification of emergencies – natural, man- made - Famine, drought, flood, earthquake, cyclone, war, civil and political emergencies	Define hazard, risk and vulnerability	K1
		Illustrate the impact of disaster	K2
		Classify and explain the types of disaster	K3
		Recommend measures to prevent man-made disasters	K5
1.2	Factors leading to emergency conditions during disaster	Summarise the objectives and principles of disaster management	K2

		systems	
		Choose the constant factors leading to emergency conditions	K3
		Identify factors influencing emergency conditions in disaster	K3
1.3	History of emergency situations and disasters in Indian subcontinent – Gujarat earthquake, Surat plague, Chennai-Tsunami	Explain the occurrence of earthquake, Tsunami and plague	K2
		Select the mitigation program and preventive actions	K3
		Analyze and identify the rehabilitation measures in post-emergency situations	K4
II	**Health-related emergencies**		
2.1	Epidemic diseases - Dengue, chikenguniya and other epidemic conditions	Define epidemic	K1
		Select the suitable preventive measures	K3
		Classify the types of epidemic diseases	K4
		Distinguish pandemic and epidemic	K4
2.2	Endemic diseases - Hypothyroidism and hyperthyroidism	Illustrate the role of thyroid hormones	K2
		Select the suitable preventive measures	K3
		Classify the different grades of thyroid	K4
		Distinguish Hypo and Hyperthyroidism	K4
2.3	Pandemic diseases – SARS, COVID-19	Explain SARS and COVID-19	K2
		Select the preventive measures based on the age	K3
		Analyze the rate of mortality during COVID-19	K4
		Relate the symptoms of	K5

		pandemic diseases with endemic and epidemic diseases	
III	**Nutritional management during emergencies**		
3.1	Nutritional relief and rehabilitation- Assessment of food needs, food distribution strategy, targeting food aid, mass and supplementary feeding, special foods/ rations for nutritional relief	Illustrate the types of feeding in nutritional relief	K2
		Choose the vulnerable population and support with nutritional reliefs	K3
		Analyze the role of GO's and NGO's in emergency situations	K4
		Discuss the types of risk	K6
3.2	Organizations for mass feeding/ food distribution, transportation and storage, feeding centers	Choose the suitable transport for mass feeding	K3
		Analyze the importance of food distribution in emergency situation	K4
		Enumerate and discuss the role of feeding centers during emergency situation	K5
		Assess the nutritional demands during emergency situations	K5
3.3	Sanitation and hygiene and public nutrition approach to tackle nutritional and health problems in emergencies, ethical considerations	Explain global WASH situation	K2
		Analyze the preventive measures to combat WASH-related diseases	K4
		Choose methods for safer foods	K3
		Distinguish Hygeine and Sanitation	K4
		Recommend nutrition interventions to combat health problems in emergency	K5

IV	**Assessment and surveillance of nutritional status**		
4.1	Malnutrition in emergency affected populations- Indicators of malnutrition during emergencies classification of malnutrition Body measurement indicators, clinical and other impacts	Define and list the types of malnutrition	K1
		Explain the Millennium Developmental Goals	K2
		Identify the symptoms of malnutrition during emergency	K3
		Assess the nutritional status using types of indices	K5
		Classify malnutrition	K4
4.2	Scope of normal nutrition assessment, indicators and simple screening methods	Classify the methods of screening	K4
		Explain the scope of assessment methods	K2
		Identify the suitable nutritional assessment method	K3
4.3	Organization for nutritional surveillance	List the organizations for nutritional surveillance	K1
		Assess the role of the organizations in nutritional surveillance	K5
		Classify organizations	K4
		Examine the nutritional surveillance systems	K5
V	**Food and Nutrition Security and disaster management programmes**		
5.1	Food production, Access, Distribution, Availability, Losses, Consumption	Identify governmental strategies to improve food production	K3
		Recommend measures to prevent food loss by means of spoilage	K5
		Distinguish food and nutrition security	K4
		Assess the disaster management programmes	K5
5.2	Food Security, Socio-cultural	Assess population	K5

	aspects and Dietary Patterns: Their implications for Nutrition and health	growth and food security	
		Assess dietary patterns using dietary survey method	K5
		Take survey to on the socio-cultural background	K5
5.3	Disaster/emergency Management programmes in India & International - Disaster management acts & policies - Disaster Management Authority DMA (national, state, district, executive committees (national, state)	Define disaster risk management	K1
		Identify the threats to food and nutrition security	K3
		Explain emergency management programmes	K2
		Classify Disaster Management Authority	K4
5.4	National & state disaster response force. United nation disaster management team- assessment and humanitarian affairs	List Humanitarian principles	K1
		Analyze the steps in disaster preparedness	K4
		Explain National and State disaster response force	K2

4. Mapping scheme

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	-	-	-	-	-	-	-	L	-	L	-	-	-
CO2	-	H	H	H	H	M	H	M	-	M	M	H	-
CO3	-	H	H	L	H	H	M	H	-	M	-	M	-

CO4	-	M	H	M	H	H	L	H	-	H	M	-	-
CO5	-	-	-	-	-	-	H	H	-	-	-	-	-
CO6	-	-	-	-	H	H	-	H	-	H	-	-	-

L-Low, M-Medium, H-High

5. COURSE ASSESSMENT METHOD

DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
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3. Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator:

xxxxx- Revised Content