MAHARAJA SURAJMAL BRIJ UNIVERSITY
BHARATPUR (Rajasthan)

SYLLABUS

(As Per NEP 2020)

M.Sc. Home Science (Food and Nutrition)

(SEMESTER SCHEME)

I & II SEMESTER EXAMINATION 2024-2025
& onwards

Dr. Farbat Singh
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M.Sc. Home Science (FN)
Food and Nutrition
(As per NEP 2020 guidelines)
Session 2024-25

Year	Semester	Credits							Total
		DSC	DSE	GEC	AEC	SEC	VAC	Seminar/Internship/Dissertation	
I	I	16	4	---	---	---	2	4	26
	II	16	4	---	---	---	2	4	26

Proposed Distribution of Credits for PG Programme		
Course	Semester-I	Semester-II
DSC	DSC1(4)	DSC6(4)
	DSC2(4)	DSC7(4)
	DSC3(2)	DSC8(2)
	DSC4(4)	DSC9(4)
	DSC5(2)	DSC10(2)
DSE	DSE1(4)	DSE2(4)
GEC	---	---
AEC	---	---
SEC	---	---
VAC	VAC1(2)	VAC2(2)
Seminar/Internship/Dissertation	4	4
Semester Total	26	26
Year Total	52	

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I SEMESTER

S.No.	Paper Code	Paper Name	Paper Category	Credit	Teaching hrs/Week	Weightage (%) CW	MTE	ETE	Max Marks
Discipline Specific Core (DSC):									
1.	HFN 401	Research Methodology	DSC	4	4	10	20	70	100
2.	HFN 402	Nutritional Biochemistry-I	DSC	4	4	10	20	70	100
3.	HFN 402A	Nutritional Biochemistry-I (Practical)	DSC	2	2	5	10	35	50
4.	HFN 403	Food Science and Quality Control	DSC	4	4	10	20	70	100
5.	HFN 403A	Food Science and Quality Control (Practical)	DSC	2	2	5	10	35	50
Discipline Specific Elective (DSE):									
1.	HFN 404	Maternal and Child Nutrition	DSE	4	4	10	20	70	100
			OR						
2.	HFN 405	Applied Nutrition-Health and Fitness	DSE	4	4	10	20	70	100
Value Added Course (VAC):									
1.				2	2	5	10	35	50
Seminar/Internship /Dissertation									
1.	----	Seminar	------	2	2	5	10	35	50
2.		Research Project		2	2	5	10	35	50
Total Credit in the Semester				26	26				650

Summary: I Semester		
S.No.	Particulars	Credits
1.	Discipline Specific Core (DSC):	16
2.	Discipline Specific Elective (DSE):	04
3.	Value Added Course (VAC):	02
4.	Seminar/Internship /Dissertation	4
	Total	26

CW(Classwork): It would include attendance, assignment, class test/ quiz test, ppt, play learn by fun activities, etc.

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II SEMESTER

S.No.	Paper Code	Paper Name	Paper Category	Credit	Teaching hrs/Week	Weightage (%) CW	MTE	ETE	Max Marks
Discipline Specific Core (DSC):									
6.	HFN 406	Fundamentals of Statistics	DSC	4	4	10	20	70	100
7.	HFN 407	Nutritional Biochemistry-II	DSC	4	4	10	20	70	100
8.	HFN 407A	Nutritional Biochemistry-II (Practical)	DSC	2	2	5	10	35	50
9.	HFN 408	Advanced Food Science	DSE	4	4	10	20	70	100
10.	HFN 408A	Advanced Food Science (Practical)	DSE	2	2	5	10	35	50
Discipline Specific Elective (DSE):									
3.	HFN 409	Public Health Nutrition	DSE	4	4	10	20	70	100
Value Added Course (VAC):									
2.				2	2	5	10	35	50
Seminar/Internship /Dissertation									
3.	----	Seminar	------	2	2	5	10	35	50
4.	----	Research Project	------	2	2	5	10	35	50
Total Credit in the Semester				26	26				650

Summary: II Semester		
S.No.	Particulars	Credits
1.	Discipline Specific Core (DSC):	16
2.	Discipline Specific Elective (DSE):	04
3.	Value Added Course (VAC):	02
4.	Seminar/Internship /Dissertation	4
Total		26

CW(Classwork): It would include attendance, assignment, class test/ quiz test, ppt, play learn by fun activities, etc.

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FOOD & NUTRITION

I SEMESTER

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I SEMESTER

Paper – HFN 401

Research Methodology (Theory)

Course Type: Theory Major
Credits: 4
Teaching Periods: 4/ week

Objectives:

- To understand the significance of Research Methodology in Food and Nutrition.
- To study the types, tools, and methods of research and develop the ability to construct data appropriate to the research design.
- To develop skills for the preparation of research proposals and writing reports.

CONTENTS

UNIT- I	**Introduction to Research**	**PERIODS**
1.	Meaning, purpose, approaches and scope in various field of Home Science	2
2.	Types of Research	3
3.	Selection of Research problem: need, relevance and feasibility	2
4.	Research Design: meaning, purpose and criteria (Experimental and Observational)	3
5.	Quantitative and Qualitative approaches	2
UNIT- II	**Research Process**	
6.	Planning the Research	2
7.	Defining the Research problem	2
8.	Research Objectives: Definition and formulation of hypothesis/objectives	2
9.	Review of related literature	2
10.	Basics of Sampling: Sampling vs. Complete Enumeration Objectives, Principles and Limitations of sampling, Sampling Techniques, Size and Error	4
UNIT-III	**Data Collection Tools**	
11.	Primary and Secondary Data	1
12.	Methods and Tools in Data Collection (Schedule, Questionnaire, Interview, Case Study Method etc.)	4
13.	Measurement and Scaling Techniques	4
14.	Validity, Reliability, Sensitivity of Data Collection Tools.	3

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UNIT- IV	Report Writing	
15.	Summary, Conclusion and Recommendations	3
16.	Writing References	2
17.	Writing Process of Research Report: Formal Style of writing, Preface, Headings, Tables and Figures, Appendices, Bibliography and Acknowledgement	7

References:

1. C. R. Kothari: Research Methodology- Method and Techniques
2. R. Kumar: Research Methodology: A step by Step Guide for Beginners
3. M. H. Gopal: Introduction to Research Methodology for Social Sciences
4. Good, Carter, Scales and Douglas: Methods of Research

SESSIONAL WORK

- Prepare a research plan in any field of Home Science.
- Prepare a Schedule/Questionnaire of the related topic using scaling techniques.

Paper. HFN - 402
Nutritional Biochemistry - I (Theory)

Course Type: Theory Major
Credits: 4
Teaching Periods: 4/ week
Objectives:

- Augment the biochemistry knowledge acquired and understand the Significance of Biochemistry.
- Understand the mechanisms adopted by the human body for regulation of metabolic Pathways
- Become proficient for specialization in nutrition. Understand integration of cellular level metabolic events to nutritional disorders and imbalances.

CONTENTS

	Unit-I	Periods
1.	Carbohydrates: Classification, isomers, ring structure, proof of ring structure, reaction due to CHO group, sugar derivatives of biological importance, polysaccharides (homoglycans and heteroglycans), detailed Structure of starch.	1

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2.	**Lipids:** Classification, Structure and chemical properties and characterization of :- • Saturated and unsaturated, Fatty acids, essential Fatty acids and their importance • Steroids • Fat • Phospholipids • Rancidity - Definition, Types of Rancidity, Mechanism of Rancidity, Prevention of Rancidity	10
	Unit-II	
3.	**Proteins:** Importance, classification of amino acids (Essential and Non Essential Amino Acids). Reactions of amino acids, structure of proteins, properties, proof of peptides bond, methods of separation and determination of amino acids and peptides, estimation of amino acid sequence.	2
4.	**Nucleic Acids:** Structure, importance and role of • Bases • Nucleotides • Nucleosides • DNA • RNA Synthesis of DNA & RNA (In Brief)	6
	Unit-III	
5.	**Hormones:** mode of action and biochemical role of • Interstitial Cell Stimulation Hormones • Adreno Corticoid Tropic Hormone • Follicle Stimulating Hormone • Growth Hormone • Thyroid Stimulating Hormone • Steroidal Hormone (Adrenal Cortex, Sex Hormones)	3
6.	**Blood Chemistry** Composition, haemoglobin, erythropoiesis, plasma proteins (Types, properties and methods of separation of plasma Proteins), coagulation of blood.	4

Reference books-

- General biochemistry by Frutton and Simmond.
- Text book of Biochemistry by West and Todd.
- Introduction to Modern Biochemistry by Karlson.
- Principles of Biochemistry by White Handler and Smith.
- Biochemistry by Kleiner and Orten.
- Hawk's Physiological Chemistry by Oser.
- Review of Physiological Chemistry by H.A. Harper.
- Essentials of food and Nutrition Vol.-I and II by M. Swaminathan.
- Biochemistry by S.K. Dasgupta. Vol. I, II, III.
- Essentials of Biochemistry by Dr. M.C. Pant.

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- Biochemistry by Virendra Kumar Shukla.
- A Text Book of Biochemistry by S.P. Singh.
- Chemical Analysis- An Instrumental Approach by A.K. Srivastava, P.C. Jain. S. Chand & Company Ltd.
- Principles of Biochemistry by Leneinger, D.L. Nelson, M.M. Cox.
- Instrumental methods of chemical analysis by B.K. Sharma.
- Martin DW, Mayes PA and Rodwell VW. Harper's Review of Biochemistry. 19th Edition. LANGE Medical Publications, MARUZEN Asia, 1983.
- Pike RL and Brown ML. NUTRITION an Integrated approach. 3rd Edition, John Wiley and Sons, New York, 1984.
- Oser BL. Hawk's Physiological Chemistry. 14th Edition. McGraw Hill Book co. New York, 1965.
- Nelson DM and Core MM. Principles of Biochemistry 4th ed. Freeman & Co., 2005.
- Devlin TM. Text Book of Biochemistry with clinical Correction, 5th ed. Wiley & Sons, 2002.
- Chatterjee MN, Shinde R. Textbook of Medical Biochemistry. 4th Edition, Jaypee Brothers Medical Publishers (P) Ltd. New Delhi, 2000.
- West ES, Todd WR, Mason HS and Van Bruggen JT. Textbook of Biochemistry. 4th Edition. MacMillan Co. Collier Ltd. London, 1974.
- Murray RK, Granner DK, Meyer PA and Rodwell VW. Harper's Illustrated Biochemistry. 26th edition. McGraw Hill Asia, 2003.
- Robinson CH and Lawler MR. Normal and Therapeutic Nutrition, Macmillon, New York, 1986.
- Lehninger AR. Biochemistry. 2nd Edition. Kalyani Publishers, 1975.
- White A, Handler P and Smith EL. Principles of Biochemistry. McGraw Hill Book Co., New York.

Sessional Work

1. Seminar presentation on any topic from the syllabus.
2. Academic assessment through short and long questions.
3. Discussions on role of nutrients in biochemistry.

Paper - 402A
Nutritional Biochemistry I (Practical)

Course Type: Practical Major
Credits: 2
Teaching Periods: 2/ week
Objectives:

1. To demonstrate the need for careful planning and organisation of laboratory work and skillful execution of practical/experiments.
2. To develop an understanding of the principles of various biochemical techniques.
3. To develop competence in biochemical estimations.

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4. To apply the knowledge acquired from the biochemical estimation to human nutrition.

Practical: - Interactive periods /week.	
1.	Principles in biochemistry - Introduction to working principles of: • Spectrophotometry • Chromatography • Electrophoresis • Acid base titration, redox titration
2.	Cleaning of glassware with soap, chromic acid and distilled water.
3.	Titrimetric estimations • Determination of strength of acids and bases (single and double titration) • Oxidation reduction titration by KMnO4 • Estimation of vitamin C in lemon juice or any other fresh food stuff.
4.	Preparation of buffers and measurements of their pH with indicators and pH meter.
5.	Estimation of Protein by Kjeldahl's Method.
6.	Calorimetric estimations (in unknown solution) • Glucose • Cholesterol

Paper - HFN 403
Food Science and Quality Control (Theory)

Course Type: Theory Major
Credits: 4
Teaching Periods: 4/ week
Objectives:

- To enable students to understand the physio-chemical properties of foods.
- To make the students aware of the effects of common food processing techniques on food.
- Understand and know various aspects of food product development.

UNIT-1	
1.	Physical, chemical and functional properties of protein, carbohydrates, lipids, water, pigment and flavours.
2.	Physical Properties of Food - Hydrogen ion concentration, oxidation-reduction potentials, surface tension, adsorption, viscosity, plasticity, iso-electric points or proteins, colloidal chemistry of foods sols, gels, foams and emulsions.

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UNIT-II	
3.	Food Processing Technique: freezing, thermal processing, dehydration, irradiation.
4.	Chemical, physical nutritional alteration occurring in food products during food processes: freezing, thermal processing, dehydration, irradiation and environmental control.
5.	Quality control and management.
UNIT-III	
6.	Important food quality attributes • Sensory quality colour, texture, flavour and taste • Microbiological quality nutritional quality evaluation for food products. • Food Adulteration • Shelf-life studies
7.	New Product Development • Market Research • Consumer dynamics • Process of development and standardization • Labelling • Marketing • Quality Evaluation • Entrepreneurship

References:

- Manay NS and Sheela Krishna swamy M. Foods Facts and Principles. 3rd edition, New Age International (P) Limited, publishers, New Delhi, 2008.
- Potter NM. Food Science, the AVI Publishing Co., Inc., Connecticut, 1995.
- Fennema OR. Food Chemistry. Marcell Dekker, Inc., New york, 1996.
- Charley H. Food Science, John Wiley and Sons, Inc., New York, 1982.
- Lowe B. Experimental Cookery. John Wiley and Sons, Inc. New York, 1955.
- Meyer LH. Food Chemistry, CBS Publishers and Distributors, New Delhi, 2004.
- Kramer A and Twig B. Quality Control for the Food Industry. Vol. I and II, AVI Publishing Co., London, 1984.
- Hubbard MR. Statistical quality control for the food industry. Van Nostrand Reinhold, New York, 1990.

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- Fuller GW. New Food Product Development from Concept to Market Place, CRC Press, New York, 1999.
- Winbond W. Techniques of Food Analysis, Allied Scientific Publishers, 1999.
- Chandrashekhar U. Food Science and Applications in Indian Cookery, Phoenix Publishing House, 2000.

Paper – 403A
Food Science and Quality Control (Practical)

Credits: 2
Course Type: Practical Major
Credits: 2
Teaching Periods: 2/ week

Objectives:

1. To develop an understanding of the principles of various nutritional assessment techniques.
2. To develop competence in recording and interpretation of anthropometric measurements.
3. To develop skills in conducting dietary surveys and data interpretation.
4. To develop understanding and skills in clinical observation.

Contents: Practical

- Physical examination of various food grains.
- Detection of adulteration: Milk, Turmeric Powder, Pure Ghee, Wheat Flour, Khoa.
- Determination of the Moisture content in two raw and two processed foods.
- Determination of the acid-insoluble ash in two raw and two processed foods,
- Determination of the Crude fibre content in two raw and two processed foods.
- Determination of the Protein Content in two raw and two processed foods using the method.
- Determination of fat content in two raw and two processed foods.
- Determination of the Taste Threshold for the Different Sensations - Sweet, Salty, Sour.
- Survey of convenience and ready-to-eat foods available in markets food list with nutrition, composition and food label.
- Systematic development of a new food product and its standardization within the BIS stipulated food standards and regulation and evaluation quality parameters for the finished product's acceptability, labelling and cost
- Visit to small-scale food product unit

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Paper - 404
Maternal and Child Nutrition (Theory)

Course Type: Theory Major
Credits: 4
Teaching Periods: 4/ week
Objectives:

- To understand nutritional demands during pregnancy and lactation.
- To acquaint the students with different programs running for controlling undernutrition in infants and mothers.
- To understand nutritional needs during infancy, childhood and adolescence.
- To impart efficient methods of teaching nutrition to children and mothers.

CONTENTS

UNIT-I	PREGNANCY	PERIODS
1.	Pregnancy: The period of physiological stress	2
2.	Physiological changes during pregnancy	1
3.	Nutrition during pregnancy – Nutrient, requirement, diet & dietary pattern	4
4.	Maternal Nutrition & foetal outcome- pre pregnancy weight and foetal outcome, BMI , Weight gain during pregnancy	4
5.	Risk factors during pregnancy	1
UNIT- II	**LACTATION**	
6.	Breast Feeding- Colostrum, composition and importance, initiation of breast feeding and duration, advantages of breastfeeding	3
7.	Nutrition needs of lactation	1
8.	Diet and Dietary pattern for lactating woman	2
9.	Effect of maternal malnutrition on milk output and quality of milk	1
10.	Introduction of complementary foods- initiation and management	2
11.	Infant milk substitute act, BPNI (Breast feeding promotion Network in India)	1
12.	Management of pre-term, low birth weight babies and IUGR	1
UNIT-III	**INFANCY, CHILDHOOD AND ADOLESCENCE**	
13.	Importance of focussing health & nutrition interventions in first 1000 days of life & improving delivery of key nutrition interventions, its evidence, impact, significance for controlling under nutrition & new government initiatives (IYCF- Infant and Young Child Feeding practices, IGMSY- Indira Gandhi Matratv Suraksha Yojana, Janani Suraksha Yojana)	2
14.	Nutritional requirements during infancy, early childhood, childhood and adolescence with special reference to girl child	6

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15.	Diet for preschool child, nutritional deficiency diseases and corrective measures	4
16.	Dietary management of common childhood diseases	2
UNIT-IV	**GOVERNMENT PROGRAMMES AND NUTRITION COMMUNICATION**	
17.	Problems in improving micronutrient deficiencies in children, Pregnant / Lactating women and adolescent girls: issues, weaknesses and newer initiatives of government (Kishori shakti, SABLA), way forward	4
18.	School health programs in India: Current status, bottlenecks	2
19.	School lunch programmes	2
20.	Efficient methods of teaching principles of nutrition to children & mothers	2

References:

1. UNICEF Publications (State of World's Children, tracking maternal & child health, countdown 2015 etc.)
2. Global Strategy for Infant & Young Child Feeding by WHO & UNICEF,2003.
3. National IYCF Recommendations, 2006, Ministry of Women & Child Development, GOI, New Delhi.
4. Mapping India's Children (2004), UNICEF in Action.
5. Nita Dalmia, Ian Darnton Hill, Werner Schultiuld (2009); Multiple micronutrient supplementation during pregnancy in developing country settings. Food & Nutrition Bulletin supplement 30(4).2009
6. Wallace, H.M., Giri, K. (1990). Healthcare of women and children in developing countries,3rd party publishing co. Oakland.
7. Michel Dibble and VpulSenaratu (2010). Special section on IYCF practices in 4 countries in South Asia: S.Asia infant feeding network FN Bulletin 31(2) 291-375, June 2010.
8. Indian Council of Medical Research. Nutrient requirements & recommended dietary allowances for Indians (2009).
9. Indira Gandhi National Open University. School of Continuing Education (2012).Childhood Nutrition: Basic Concepts and Physiological requirements- Course 1.

	SESSIONAL WORK
1.	Plan diet for pregnant and lactating women
2.	Plan and prepare nutrient dense, complementary foods for 6-12 month old infants
3.	Plan and prepare diet for an infant
4	Plan low cost recipe for Balwadi and Anganwadi and school lunch programmes
5	Plan diet for deficiency diseases and common childhood illnesses
6	Plan diet for different age groups of children & adolescents

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Paper - 405
Applied Nutrition - Health and Fitness (Theory)

Course Type: Theory Major
Credits: 4
Teaching Periods: 4/ week

Objectives:

- To promote the students understanding about the functional benefits of Foods for health and fitness.
- To enable the students to understand the role of nutrition in the dietary management of geriatrics
- To enable the students to understand the physiological demands during different sports activities.

CONTENTS

UNIT -I	ANTIOXIDANTS IN HEALTH & DISEASE	PERIODS
1.	Effect of oxidants on Macromolecules- Carbohydrates, proteins, lipids, nucleic acids.	3
2.	Nutrient antioxidants with potent health effects	2
3.	Non - Nutritive food components with potential effects (Flavonoids-polyphenols and tannates, phytoestrogens, cyanogenic compounds)	2
4.	Pre and Probiotics	2
5.	Foetal origin of Non-communicable disease	1
6.	Nutrigenomics- the future of Nutrition care for health management, treatment and prevention of diseases.	2
UNIT-II	**GERIATRIC NUTRITION - MULTIFACETED ASPECT OF AGEING**	
7.	Ageing process - changing demographic trends, theories of ageing	3
8.	The ageing process- physiological, biochemical and body composition changes	3
9.	Health and Nutritional problems of the elderly	2
10.	Nutritional requirements and dietary guidelines	2
11.	Community geriatrics - Dimensions, issues and solutions.	2
UNIT-III	**NUTRITIONAL MANAGEMENT- HEALTH & FITNESS**	
12.	Definitions, components and assessment criteria of- - Specific fitness - Health status	2
13.	Holistic approach to management of fitness and health - energy input and output - diet and exercise - effect of specific nutrients on work performance and physical fitness - nutrition, exercise, physical fitness and health inter-relationships	 1 1 3 3

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14.	Alternative systems for health and fitness like Ayurveda, yoga, meditation, vegetarianism and traditional diets.	2
UNIT- IV	**NUTRITION IN SPORTS**	
15.	Physiological aspects- Metabolic changes during sports activity	2
16.	Energy systems for endurance and power activity	2
17.	Fuels for muscle contraction, Nutritional requirements for sports: Pre game, during and post-game meal (Short-duration, endurance)	4
18.	Water & Electrolyte balance and replenishments	2
19.	Ergogenic aids, sports drink, uses and abuse of dietary supplements	2

References:

1. Shils ME, Olson JA and Shike N (1994). Modern Nutrition in Health & Disease. 8th Edition, Vol I and II, Philadelphia Lea and Febiger.
2. Bagchi K and Puri S (1999). Diet and Ageing: Exploring some facts. Society of Gerontological research and HelpageIndia,New Delhi.
3. Parizkova J (1997). Nutrition, physical activity and health in early life. Ed. Wolinsky, I, CRC press.
4. McArdle W, Katch F, Katch V (1996). Exercise physiology, exercise energy, nutrition and human performance. 4thEditiion. Williams and Wilkins,Philadelphia.
5. Indian Council of Medical Research (2000). Nutrient Requirements and Recommended Dietary Allowances for Indians: A report of the expert group of the ICMR, New Delhi.
6. Hickson JH (2000). Nutrition for exercise & sport. CRC Press. 2nd Edition.
7. Mahan, L.K and Escott Stump .S. (2008). Krause's Food & Nutrition Therapy.12th Ed. Saunders-Elsevier.
8. Ira Wolinsky (Ed.). Nutrition in Exercise & Sports.3rd Edition.

Journals:

1. Medicine and Science in sports in exercise
2. International Journal of Sports Nutrition
3. Journal of Applied Nutrition

	SESSIONAL WORK
1.	Market Survey for commercial nutritional products for physical fitness & sports performance available in India
2.	Ayurveda Cooking
3.	Yoga and Pranayama
4.	Vegetarian , Vegan and traditional Diets
5.	Diet for different sports activities- Endurance & power

Research Project

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Course content:

- Identification of the research problem
- Preparation and finalization of research.

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II SEMESTER

S.No.	Paper Code	Paper Name	Paper Category	Credit	Teaching hrs/Week	Weightage (%) CW	MTE	ETE	Max Marks
Discipline Specific Core (DSC):									
11.	HFN 406	Fundamentals of Statistics	DSC	4	4	10	20	70	100
12.	HFN 407	Nutritional Biochemistry-II	DSC	4	4	10	20	70	100
13.	HFN 407A	Nutritional Biochemistry-II (Practical)	DSC	2	2	5	10	35	50
14.	HFN 408	Advanced Food Science	DSE	4	4	10	20	70	100
15.	HFN 408A	Advanced Food Science (Practical)	DSE	2	2	5	10	35	50
Discipline Specific Elective (DSE):									
4.	HFN 409	Public Health Nutrition	DSE	4	4	10	20	70	100
Value Added Course (VAC):									
3.				2	2	5	10	35	50
Seminar/Internship /Dissertation									
5.	----	Seminar	------	2	2	5	10	35	50
6.	----	Research Project	------	2	2	5	10	35	50
Total Credit in the Semester				26	26				650

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Paper – 406
Statistics (Theory)

Course Type: Theory Major
Credits: 4
Teaching Periods: 4/ week

Objectives:

- To understand the role of Statistics in Research.
- To apply statistical techniques to research data to analyze and interpret data meaningfully.
- To understand the use of Statistical Software in the analysis of data.

Contents:

UNIT- I	**Introduction to Statistics**	**PERIODS**
1.	Meaning and scope of Statistics and its importance in research	2
2.	Classification and tabulation.	3
3.	Measures of central tendency and dispersion (Mean , Median, Mode, Quartiles, Range and Standard Deviation).	2
4.	Graphic and diagrammatic representation of data (Frequency, Histogram, Graphs, Bar- diagram and Pie charts)	3
UNIT- II	**Statistical Measures**	
5.	Elementary ideas on probability (Simple Probability) skewness and kurtosis definition. Elementary ideas of random variable and its density function (Binominal, poison, Normal distribution and its properties, Use of Normal Probability tables.)	6
6.	Elements of testing a statistical hypothesis-formulation of the problem. Definition of type I and II error.	6
7.	Design of experiment: Analysis of variance	
UNIT- III	**Correlation, Regression and Association of Data**	
8.	Correlation and Regression: Correlation and its interpretation. Product moment and rank order.	5
9.	Non- parametric Inference: Sign, Mann - Whitney and Chi - square test.	5
	Computer Applications in data Analysis	
	• Use of computer for statistical analysis using SPSS.	

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References:

1. Hellan M. Walker.: Elementary Statistical Methods
2. Sharma. Choudhary & Gupta.: Descriptive Statistics
3. Elhance. D.N.: Elementary Statistics
4. S. P. Gupta : Statistical Methods
5. Shukla and Sahai: Principles of Statistics

Sessional Work

- Summarization and Presentation of data using tables and graphs.
- Applications of Statistical techniques to data analysis and interpretation of data.
- Applications of Z, T, F and Chi-Square test in hypothesis testing.
- All the above will be done using Statistical Software

Paper - 407
Nutritional Biochemistry II (Theory)

Course Type: Theory Major

Credits: 4

Teaching Periods: 4/ week

Objectives

- To understand the basic nature and role of biomolecules.
- To understand the mechanisms adopted by the human body
- To get an insight into interrelationships between various meta
- To link metabolic events occurring at the cellular level.
- To become proficient in specialization in nutrition.

Contents:

		Periods
	UNIT-I	
1.	**Vitamins**: Biochemical role of • Water soluble vitamins: C and B-Complex(B1, B2, Niacin, Pyridoxin, Pantothenic acid, Biotin, Folic Acid B 12) • Fat soluble vitamins: A, D, E and K	4
2.	**Minerals:** Biochemical role of minerals (Calcium, Phosphorus, Iron, Potassium, Sodium, Chloride, Magnesium, Selenium and Zinc).	3
	UNIT-II	
3.	**Enzymes** - Classification , co-enzymes , methods of isolation , purification and characterization , theories and mechanism of enzyme action, factors affecting reaction of enzyme- effect of time, temperature, pH substrate enzyme activator and inhibitor (type of inhibitors) , Km-its derivation and significance, elements of thermodynamics, active site and specificity of enzymes.	6

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4.	**Intermediary metabolism and it's regulation** • **Carbohydrates** - Glycolysis, TCA cycle, respiratory chain, high energy link, biological redox potential, Gluconeogenesis, hexose monophosphate shunt. • **Lipids** - α and β oxidation of fatty acids , β oxidation of odd and even number fatty acids, synthesis of fatty acids, phosphatidic acid, ketosis, synthesis of cholesterol. • **Proteins** - absorption and conversion of amino acids , nitrogen fixation , degradation of ammonia and removal of amino acids through deamination , transamination decarboxylation and urea cycle.	6
	UNIT-III	
5.	Introduction to causative factors, biochemical and clinical manifestation, treatment and therapeutic measures of following Inborn errors of amino acid metabolism: • Phenylketonuria, • Hypertyrosinaemia, • Hypervalemia, • Hyperhistidinaemia, • Hyper lysinaemia, • Homocystinuria. Carbohydrate metabolism i.e. Pentosuria, galacetosaemia. Lipid metabolism i.e. Hyper chylomicronaemia, pure hyper-cholsterolaemia.	

Sessional work:

1. Estimation of Ascorbic Acid.
2. Estimation of moisture, fat, ash calcium, phosphorous and iron.
3. Buffers - preparation of buffers. Determination of pH of unknown solution.
4. Estimation of protein by Lowry's method.
5. Estimation of blood sugar.
6. Estimating lipid profile (total cholesterol, triglyceride, HDL, LDL, VLDL Cholesterol).

Reference books-

1. General biochemistry by Frutton and Simmond.
2. Text book of Biochemistry by West and Todd.
3. Introduction to Modern Biochemistry by Karlson.
4. Principles of Biochemistry by White Handler and Smith.
5. Biochemistry by Kleiner and Orten.
6. Hawk's Physiological Chemistry by Oser.

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7. Review of Physiological Chemistry by H.A. Harper.
8. Essentials of Food and Nutrition Vol. I and II by M. Swaminathan.
9. Biochemistry by S.K. Dasgupta. Vol. I, II, III.
10. Essentials of Biochemistry by Dr. M.C. Pant.
11. Biochemistry by Virendra Kumar Shukla.
12. A Text Book of Biochemistry by S.P. Singh.
13. Chemical Analysis- An Instrumental Approach by A.K. Srivastava, P.C. Jain. S. Chand & Company Ltd.
14. Principles of Biochemistry by Leneinger, D.L. Nelson, M.M. Cox.
15. Instrumental Methods of Chemical Analysis by B.K. Sharma.
16. Nutrition and diet therapy- Sheel Sharma, Pee,pee, publishers, New Delhi-2013
17. Experimental and techniques in Biochemistry 2007, galgotia Publishers, New Delhi.

Paper - 407A
Nutritional Biochemistry II (Practical)

Course Type: Theory Major

Credits: 2

Teaching Periods: 2/ week

Objectives

1. To demonstrate the need for careful planning and organization of laboratory work and skillful execution of practical/experiments.
2. To develop an understanding of the principles of various biochemical techniques.
3. To develop competence in biochemical estimations.
4. To apply the knowledge acquired from the biochemical estimation to human nutrition.

1	**Titrimetric estimation: Determination of calcium in milk powder , CaC03 solution**
2	• Colorimetric estimation (in unknown solution) • Determination of Iron in Ferrous Ammonium sulphate solution and in blood. • Determination of Haemoglobin in blood by colorimetric method, • Determination of phosphorus in milk and phosphorus solution by F.S. colorimetric method. • Determination of protein by Lowry/ Biuret method.
3	**Enzymes assays** • Determination of Alkaline phosphatase Enzyme • Determination of Transaminase enzyme (GOT & GPT)
4	**Paper Chromatographic separation of Amino Acids by** • Circular method • Ascending and • Descending methods

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Paper - 408
Advanced Food Science (Theory)

Course Type: Theory Major
Credits: 4
Teaching Periods: 4/ week
Objectives :

- Enabling students to comprehend the changes that occur in the Physio - chemical properties of food stuffs during food preparation.
- Enabling the students to understand and apply the various techniques in the quality evaluation of foods.
- Imparting awareness on the concept of 'food product development'

CONTENTS

UNIT-I	Colloids and Carbohydrates in Food	PERIODS
1.	Introduction to food science.	
2.	Physical & Chemical properties of foods-Changes occurring on cooking and storages.	2
3.	Colloids – Properties denaturation of proteins, gelatinisation, gel formation, emulsions, foams, browning reactions enzymatic and non-enzymatic.	4
4.	Sugar Cookery: Stages of cookery and crystallisation of sugar.	2
5.	Starch Cookery: Gelation, factors affecting gelation, starch as thickener, different sources of starch and their properties.	3
UNIT-II	**Proteins and Fats in Food**	
6.	**Protein Cookery** a. **Properties of milk protein, other milk products-** curds, evaporated, spray dried and condensed milk, Cheese, Khoya, Their use in food preparations. 3 b. **Cereals, and grams (dals)** - Effect of soaking, germination & fermentation on cereals and pulses, properties of gluten, gluten formation and factors affecting it. 3 c. **Eggs-** Properties of egg-proteins & uses in egg preparations, egg as binding, foaming and emulsifying agent mayonnaise preparation. 3 d. **Meat-** Postmortem changes, changes on cooking, fish types, changes during heat treatment. 2	
7.	**Fats & Oils:** Properties, smoking points, melting point, hydrogenation, shortening effect. Changes in Storage, rancidity, oxidative and hydrolytic.	3
UNIT-III	**Vegetables & Fruits, Sensory Evaluation**	

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8.	**Vegetables & Fruits:** Structure of vegetable tissues, starch, sugars, pectic substances, celluloses and their effect on texture and palatability. Plant pigments, plant enzymes, enzymatic browning, use of plant enzymes for textural changes in foods e.g. Effect on meat.	4
9.	**Sensory evaluation** a) Selection of panel of judges b) Types of tests c) Judging **Objective methods of measurement of:** a) Colour b) Texture	2 2
UNIT-IV	**New Product Development**	
	a. Food Additives: Definition, importance, classification & uses	2
	b. Leavening agents : Importance, classification, nature & use	2
	c. Food product development: Definition, factors affecting product development and health concerns.	3

References:

1. Charley, H. (1982): Food Science (2nd Edition), John Wiley and Sons, New York.
2. Potter, N. and Hotchkins, J.H. (1996): Food Science, 5th Edition, CBS Publishers and Distributors, New Delhi
3. Belitz, H.D and Geosch , W (1999): Food Chemistry, 2nd Edition, Springer, New York
4. Manay, N.S and ShadarsSharaswamy , M .1987. Food ,Facts and Principles. Wiley Eastern Ltd, New Delhi.
5. Srilakshmi , B.2001. Food Science. New Age International Pvt Ltd. 2nd Edition.
6. Meyer ,L.H.Food Chemistry, Reinhold Book Corporation, New York.

Sessional Work

1. Seminar presentation on any topic from the syllabus.
2. Academic assessment through short and long questions.
3. Discussions on the role of nutrients in food science.

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Paper - 408A
Advanced Food Science (Practical)

Course Type: Practical Major

Credits: 2

Teaching Periods: 2/ week

Objectives :

- Enabling students to comprehend the changes that occur in the physiochemical properties of food stuffs during food preparation.
- Enabling the students to understand and apply the various techniques in the quality evaluation of foods.
- Imparting awareness on the concept of 'Food Product Development'

	PRACTICALS
1.	Experience in training for taste perception & thresh holds, hedonic scale for attributes of foods & developing score cards. Triangular tests, duo & trio tests & others.
2.	Standardisation of recipes & methods or reporting recipes.
3.	Experiments on crystallization of sugar & effects of temperature, concentration, acids and other preparation & evaluation of any three preparations. Laddoo, Halwa & Gulab Jamun.
4.	Experiment on starch gelatinization, viscosity, measurement of starch pastes- comparison of different sources of starch.
5.	Experiment with eggs to study the properties of coagulation foaming, emulsifying, colouring, effect of quality of eggs on these properties. Preparation of cakes, Mayonnaise evaluation.
6.	Milk cookery preparation & evaluation of soup(cream of tomato), cheese, curd, ice-cream.
7.	Meat- Methods of cooking, factors affecting texture of meat.
8.	Pulses- Method of cooking pulses, effect of soaking, alkali, salts, germination.
9	Vegetable & Fruit cooking- Factors affecting colour, texture, flavours, browning reactions & preventive methods.
10.	Fats & Oils – smoking point, absorptions, tests, shortening - effect in food preparations

Paper - 409
Public Health Nutrition (Theory)

Course Type: Theory Major

Credits: 4

Teaching Periods: 4/ week

To understand the concept of public health nutrition.

- To be familiar with the national health care delivery system
- To understand the concept of food and nutrition security
- To gain knowledge regarding national/ public sector policies and programs for improving food and nutrition security.
- To be able to plan, implement and evaluate behaviour change communication for the promotion of nutrition and health among the vulnerable groups.

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- Gain insight into national nutritional problems, and national international contribution towards nutrition improvement in India.
- Development of skills in organizing and evaluating nutrition projects in the community.
- To be familiar with various approaches to public health nutrition programs and policies.

CONTENTS

UNIT - I	**Public Health Nutrition & Health Care System**	**PERIODS**
	• Concept and scope of public health nutrition	2
	• Levels of Health care and Health care system in India	2
	• National Policy: Health, nutrition and population	4
	• Brief note on : Dual burden of malnutrition, National Health Mission, Millennium Development Goals	4
UNIT- II	**Assessing and Intervening the Community's Nutritional Needs**	
	• Community Need Assessment • Reaching out to High Risk population	6
	Promoting the Public's Nutritional Health • Growing a Healthier Nation: Maternal, Infant, Child and Adolescent Nutrition • Importance of Public Health Nutrition Programs in Preventing Disease and Promoting Health • Providing Services in Public Health Primary care	6
UNIT-III	**Public Health Aspects of under nutrition**	
	Etiology, Public Health Implications, preventive/curative strategies for: ▪ Chronic energy deficiency ▪ Protein energy malnutrition ▪ Micronutrient deficiency **Approaches/strategies for improving nutrition and health status of community:** • Health based interventions including immunization, provision of safe drinking water, hygiene, prevention and management of diarrheal diseases • Food based interventions including food fortification, dietary diversification, supplementary feeding and biotechnological approaches.	4
	Education based interventions including growth monitoring and promotion, and nutrition health.	6

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References:

- Vir SC. Public Health Nutrition in Developing Countries P 1 and 2 . Published by Wood head publishing India PVT LTD, New Delhi. Cambridge, Oxford, hiladelphea, 2010.

- Sehgal S and Raghuvanshi Rita S. Textbook of Co unity Nutrition, Indian Council of Agricultural Research, Published by: Directorate of Info tion and Publication of Agricuture, Indian Council of Agriculture Research, Krishi Anusandhan havan, Pusa, New Delhi, 2011.
- Bamji MS, Rao PN and Reddy V. Textbook of Human Nu lion, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1996.
- Sari Edelstein (Editor). Nutrition in Public Health: A han book for developing Programs and Services. Jones Bartlett Learning, 3 1d Edition, 2011.
- Waterlow JC. Protein Energy Malnutrition, Edward Arnold, division of Hodder and Stoughton, 1992.
- Sachdeva MPS and Chaudhary P (Eds). Nutrition in Chi dren: Developing country concerns, Department of Pediatrics, Maulana Azad Medical College, Ne Delhi, 1994.
- Mc Laren IDS. A colored Atlas and Textbook of Diet-Related isorders, 1992.
- Passrnore R and Eastwood MR. Human Nutrition and Di etics, ELBS, Churchill Livingstone, London, Baltimore, 1986.
- Achaya,K.T. (Ed) (1984). Interface between Agriculture, Nutrition and Food Science. The United National University.
- Beaton, G.H and Bengoa, J.M (Eds) (1996) . Nutrition in Preventive Medicine, WHO.
- Gibney M.J., Margetts,B.M., Kearney, J.M. Arab, I., (Eds)(2004). Public health Nutrition, NS Blackwell publishing.
- National consensus workshop on Management of SAM children through Medical Nutrition Therapy (2009)- Compendium of scientific publications Volume I & ii. Jointly organised by AIIMS, SitaramBhartia Institute of Science and Research, IAP (subspeciality chapter on Nutrition, New Delhi. Sponsored by DBT.
- Park, K. (2009). Parks Textbook of Preventive and Social Medicine, 20th Edition, Jabalpur. M/S Banarsidas
- Gopalan,C and Kaur, S. (Eds) (1993). Towards better Nutrition , problems and policies. Nutrition Foundation of india.
- National Nutrition Policy, GOI, 1993.
- National Plan of Action on Nutrition, GOI, 1995.
- Public Health Communication: Evidence for Behaviour change by Robert C.Hornik (2002) by Lawrence Erlbaum Associates, Inc.
- Communication and Health : Systems and Applications. Edited by Eileen Berlin Ray and Lewis Donohew(1990) by Lawrence Erlbaum Associates, Inc.
- Designing health messages: Approaches for communication Theory and Public Health Practice ;Editors : Edward Maibach and Roxanne Louiselle Parrott (1995) by Sage Publications, Inc.

	Sessional work
1.	Planning and preparation of diet/dishes for PEM, VAD and IDA.
2.	Field Visit to ongoing national nutrition programmes
3.	Assessment of Nutritional problem in an identified community and their determinants in different population groups through analysis of secondary data (such as NSSO, NFHS data etc)
4.	Planning of a communication strategy for a nutrition education programme in the community; field testing of messages, materials and methods

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Research Project

Credits: 2

Course Content:

1. **Review of Literature and research methodology of the Study**
2. **Data collection tools for research.**

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