

**RAJA NARENDRA LAL KHAN WOMEN'S COLLEGE
(AUTONOMOUS)**



Post Graduate Syllabus
in
FOOD SCIENCE & NUTRITION
under Choice Based Credit System
(CBCS)

COURSE STRUCTURE

FIRST SEMESTER

SL NO	PAPER CODE	COURSE TITLE	CONDUCT HOURS PER WEAK				MARKS		
			L	T	P	CREDITS	Int Asst.	End Sem	Total
THEORITICAL									
1	MFSN 101	Research methodology	3	1		4	10	40	50
2	MFSN 102	Food Science - I	3	1		4	10	40	50
3	MFSN 103	Nutritional biochemistry	3	1		4	10	40	50
4.	MFSN 104	Nutritional physiology and pathophysiology	3	1		4	10	40	50
Total in Theory						16			200
PRACTICAL									
5	MFSN 105 P1	Review Report			2	2		25	25
	MFSN 105 P2	Report on industrial visit			2	2		25	25
6	MFSN 107 P1	Experiments on Nutritional Biochemistry			2	2		25	25
	MFSN 108 P2	Experiments on Physiology			2	2		25	25
Total in Practical						8			100
Total of Semester						24			300

Second Semester

SL NO	PAPER CODE	COURSE TITLE	CONDUCT HOURS PER WEAK				MARKS		
			L	T	P	CREDITS	Int Asst.	End Sem	Total
THEORITICAL									
1	MFSN 201	Health & Nutritional Statistics and Computer Applications	3	1		4	10	40	50
2	MFSN 202	Food Science-II (Advance analytical techniques and food packaging)	3	1		4	10	40	50
3	MFSN 203	Advanced Microbial Technology and Industrial Microbiology	3	1		4	10	40	50
4.	MFSN 204	Food Safety and Quality Control (CBCS)	3	1		4	10	40	50
Total in Theory						16			200
PRACTICAL									
5	MFSN 205 P1:	Health and Nutritional Statistics			2	2		25	25

	MFSN 205 P2:	Computer applications			2	2		25	25
6	MFSN 206 P1:	Food Science-II (Advance analytical techniques and food packaging)			2	2		25	25
	MFSN 206 P2:	Advanced and Industrial Microbiology			2	2		25	25

THIRD SEMESTER

SL NO	PAPER CODE	COURSE TITLE	CONDUCT HOURS PER WEEK				MARKS		
			L	T	P	CREDITS	Int Asst.	End Sem	Total
THEORITICAL									
1	MFSN 301	Public health, Diseases and Nutritional Therapy	3	1		4	10	40	50
2	MFSN 302	Nutrient, Drug and Gene Interaction	3	1		4	10	40	50
3	MFSN 303	Food Resource Management and Entrepreneurial Development	3	1		4	10	40	50
4.	MFSN 304	Food as Medicine (CBCS)	3	1		4	10	40	50
Total in Theory						16			200
PRACTICAL									
5	MFSN 305 P1	Nutritional Therapy			2	2		25	25
	MFSN 305 P2	Nutritional Proteomics, Genomics and Metalabolomics			2	2		25	25
6	MFSN 306 P1	Public health and nutritional status assessment			2	2		25	25
	MFSN 306 P2	Survey Report on Food Resources and Marketing			2	2		25	25
Total in Practical						8			100
Total of Semester						24			300

FOURTH SEMESTER

SL NO	PAPER CODE	COURSE TITLE	CONDUCT HOURS PER WEEK				MARKS		
			L	T	P	CREDITS	Int Asst.	End Sem	Total
THEORITICAL									
1	MFSN 401	Basic Food Production Operations	3	1		4	10	40	50
2	MFSN 402	Basics of Bakery and Confectionary	3	1		4	10	40	50
3	MFSN 403	Basics of Indian Cooking	3	1		4	10	40	50
4.	MFSN 404	Evaluation of Food Quality	3	1		4	10	40	50

Total in Theory					16	200			
PRACTICAL									
5	MFSN 405 P1	Food Production Operations and Bakery and Confectionary			2	2		25	25
	MFSN 405 P2	Preparation of Recipes and Quality Evaluation			2	2		25	25
6	MFSN 406 P1	Internship			2	2		25	25
	MFSN 406 P2	Project work			2	2		25	25
Total in Practical						8			100
Total of Semester						24	300		

SYLLABUS IN DETAILS

FIRST SEMESTER

SL NO	PAPER CODE	COURSE TITLE	CONDUCT HOURS PER WEEK				MARKS		
			L	T	P	CREDITS	Int Asst.	End Sem	Total
THEORY									
1	MFSN 101	Research methodology	3	1		4	10	40	50
2	MFSN 102	Food Science - I	3	1		4	10	40	50
3	MFSN 103	Nutritional biochemistry	3	1		4	10	40	50
4.	MFSN 104	Nutritional physiology and pathophysiology	3	1		4	10	40	50
Total in Theory						16	200		
PRACTICAL									
5	MFSN 105 P1	Review Report			2	2		25	25
	MFSN 105 P2	Report on industrial visit			2	2		25	25
6	MFSN 107 P1	Experiments on Nutritional Biochemistry			2	2		25	25

	MFSN 108 P2	Experiments on Physiology			2	2		25	25
Total in Practical						8			100
Total of Semester						24			300

FIRST SEMESTER

Code: MFSN 101 Research Methodology Full Marks -50 Credit-4

THEORY

Research Methodology

A. Purpose of research

Definition, objectives and significance of research, criteria of a good researcher, criteria for a good research project. Types of research, Positivism and Post-positivistic approach to research.

Research Methods: induction and deduction, quantitative, qualitative and mixed, Experimental, Descriptive, Historical, Qualitative and Quantitative methods, Quasi experiments.

B. Principles of Research in quantitative and qualitative approaches

Research design: Meaning and need of research design, Components and types of research design, Issues in design construction

Research Sampling: Concept of sampling, key differences in the two approaches, sampling methods, sample size and sampling error, selecting participants and contexts to examine social phenomenon

Data collection and analyses: Methods and measurement: Measurement in research, scales and errors in measurement, reliability and validity of measurement tools, Methods of data collection and types of data.

International norms of project formulation/project writing.

Errors in inference: Bias and confounding, reliability and validity issues, Ensuring reliability and validity in qualitative research.

Application of ICT in research: Information and Communication Technology (ICT), ICT: General abbreviations and terminology, Basics of Internet, Intranet, E-mail, Audio and Video-conferencing, Digital initiatives in higher education, ICT and Governance.

C. The Research Cycle

Systematic literature review and referencing:Formulating a research problem –Developing research questions and objectives, exploring research context/phenomenon, Identifying variables, constructing hypotheses, Deciding research approach and design, Selection of sample/participants, choice of methods and analysis.Writing a research report-Styles and format.

D.Values, Social Responsibility and Ethics in Research

Ethical principles guiding research: from inception to completion and publication of research, ethical issues relating to research participants and the researcher

- Rights, dignity, privacy and safety of participants
- Informed consent, confidentiality anonymity of respondents, voluntary participation, harm avoidance.
- Conflicts of interest or bias, Use of inappropriate research methodology, Incorrect reporting, misuse of information.

E. Governmental strategies on Research and Higher education

Institutions of higher learning and education in ancient India. Evolution of higher learning and research in Post Independence India. Oriental, Conventional and Non-conventional learning programmes in India. Professional, Technical and Skill Based education for research development. Policies, Governance, and Administration related with research funding.

Code: MFSN 102 Food Science-I Full Marks – 50 Credit-4

A. Food Chemistry

Water: Definition of water in foods, structure, water activity, phase diagram of water, phase transition of food containing water, interaction of water solute and food compounds, water activity and its influence on quality and stability of foods, methods for stabilization of food systems by control of water activity, sorption isotherm, colloidal properties of foods.

pH: Hydrogen ion concentration in food, oxidation reduction potential of foods and their applications in food systems.

Protein: Physical, chemical, nutritional and functional properties and interactions with other food constituents.

Sugars: Composition and properties of different types of sugars, their application in food systems, crystallization, caramelization, Maillard reaction and its industrial application.

Lipids: Properties of fats, functional properties of fats and oils, fat stabilizers, fat deterioration and antioxidants, Emulsions such as mayonnaise, interesterification of fats, auto-oxidation of lipids and rancidity.

B. Basic concepts of new product development

Stages of product development and standardization, sensory evaluation of foods, packaging, labelling and marketing of new food products.

C. Food Ingredients and additives

Food additives- definitions, classification and functions, Preservatives, antioxidants, colours and flavours (synthetic and natural), emulsifiers, sequestrants, humectants, hydrocolloids, sweeteners, acidulants, buffering salts, anticaking agents, etc. - chemistry, food uses and functions in formulations; indirect food additives; toxicological evaluation of food additives.

Code: MFSN 103 Nutritional biochemistry Full Marks – 50 Credit-4

A. Enzymes

Classification of enzymes, Cofactor & Prosthetic groups, Concept of active site. Effect of pH, temperature, substrate concentration (K_m and V_{max} , Michaelis-Menten equation) & metal ions on enzyme activity, Isozyme and Ribozyme, Application of enzymes in diagnostics (SGPT, SGOT, Creatine kinase & Alkaline phosphatase) used in food industry/food processing units. Application of enzymes in food industry and immobilized enzymes.

B. Carbohydrates

Metabolic regulation of glycolysis, gluconeogenesis, citric acid cycle and glycogen metabolism. Pentose phosphate pathway and its significance. Disorders of carbohydrate metabolism: galactosemia, hereditary fructose intolerance, fructosuria and Glycogen storage disease (Von Gierke, Pompe, Cori and McArdle diseases)

C. Lipids

Fatty acids – Classifications, Synthesis of saturated and unsaturated fatty acids

Triacylglycerols – Synthesis

Phospholipids – Synthesis

Lipoproteins – Types, synthesis, degradation and clinical significance

Cholesterol – Synthesis and regulation

Micelle, Bilayer and Liposome

Glycolipid and Sterols

D. Three dimensional structures of proteins: primary, secondary, tertiary and quaternary structures of proteins, bonds and interactions stabilizing the structure, Ramachandran plot, common fibrous and globular proteins, protein aggregation and protein folding, role of molecular chaperones in protein folding; misfolding of proteins, protein ligand binding.

E. Hormones and integration in metabolism

Concept of Hormones

Types of signaling mechanisms

Role of insulin, glucagon & epinephrine in intracellular signaling

Steroid hormones

Code: MFSN 104 Nutritional physiology and pathophysiology Full Marks – 50 Credit-4

A. Blood and Cardio-Thoracic Physiology

Blood and Plasma Protein -Composition and Function

Blood formation and factors controlling Erythropoiesis.

Patho-physiology of Anaemia and Jaundice

Cardiac cycle, Cardiac output ,Heart sounds

E.C.G. & its interpretation, Heart rate & regulation

Blood pressure, Hypertension

Coronary Artery Disease

Hemorrhage; Compensatory changes after hemorrhage

Transport and exchange of gases

Control of Respiration and Respiratory function tests

Lung volume & Capacities and COPD

B. Excretory Physiology and Exercise Physiology

Urine formation

Renal function tests

Acid Base balance

Pathophysiology of Renal Stones, Urinary Tract Infection, Glomerulonephritis

Concept of Fitness, Adaptations to exercise

Energy Metabolism in Sports

Overview of Diet and Physical Performance

C. Gastrointestinal Physiology

Functions of Stomach, Liver, Pancreas and Gall Bladder

Composition, function and regulation of:

Salivary juice

Gastric juice

Pancreatic juice

Bile juice

Intestinal juice

GI hormones

Pathophysiological overview of some common diseases in relation to Gastrointestinal Tract (Peptic ulcer/GERD, Cholelithiasis, Portal Hypertension, Fatty liver and Liver Cirrhosis

D. Neuro-Endocrine and Reproductive Physiology

Overview of organization of nervous system, Glial cells, Synapse and neuromuscular junction, Anatomy of brain-structure and function relationship. Migraine, Parkinson's disease, Alzheimer's disease, and Huntington's disease.

Pituitary, Thyroid, Parathyroid, Adrenal and Pancreatic hormones and their regulations.

Pathophysiology of Diabetes Mellitus, Metabolic Syndrome, Hashimoto's disease. Tetany and Cushing Syndrome

Physiology of Menstruation and Menopause and related pathological disorders

Physiology of Ageing – metabolic changes, nutrients as modulators to delay ageing

Physiology of Pregnancy, Lactation and the impact of nutrients

Pathophysiology of PCOD and Infertility – corrective effects of nutrients

E. Immunology:

Basic concept of immunity, Types of immunity-innate, acquired, active and passive immunity and immune-modulatory role of nutrients.

Humoral immune system:

Mechanisms of humoral immunity, Immunoglobulin isotypes- IgG, IgM, IgA, IgD, and IgE. – impact of nutrients

Cell mediated immune system:

Types of effector T cells, mechanisms of cell mediated immunity- impact of nutrients.

Autoimmune diseases, Immunology of AIDS. Contribution of nutrients for rectification.

PRACTICAL

CODE: MFSN 105 P1 Review Report Marks: 25 Credit-2

A report preparation on Review and Literature with the help of research publications and power point presentations.

CODE: MFSN 105 P1 Report on industrial visit Marks: 25 Credit-2

Report preparation on industrial visit and power point presentations.

CODE: MFSN 106 P1 Nutritional biochemistry Marks:25 Credit-2

Solutions

Preparations of buffers, physiological solutions, molecular solutions, determination of pH, preparation of tissue homogenate.

Spectrophotometry

Estimation of Proteins.

Estimation of Cholesterol.

Estimation of glucose.

Enzyme Assays

Assay of SGOT, SGPT, Catalase, SOD, MDA, GSH, GSSG.

Estimation of triglyceride content of blood.

Enzyme activity: effect of pH and temperature on enzyme activity

Code: MFSN 106 P2 Experiments on Physiology Marks: 25 Credit-2

Human Experiments:

Study of pulse rate and breathing rate with the change of postures.

Determination of diurnal variations of pulse rate, blood pressure, respiratory rate.

Study of blood pressure with the change of postures.

Haematology:

Hb estimation.

Estimation of TC,DC& RBC indices.

Detection of sickle cell anemia by sodium meta-sulphite test.

Histology:

Preparation and staining of histological slides of different organs in rats.

Second Semester

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2	MFSN 202	Food Science-II (Advance analytical techniques and food packaging)	3	1		4	10	40	50
3	MFSN 203	Advanced Microbial Technology and Industrial Microbiology	3	1		4	10	40	50
4.	MFSN 204	Food Safety and Quality Control (CBCS)	3	1		4	10	40	50
Total in Theory						16	200		
PRACTICAL									
5	MFSN 205 P1:	Health and Nutritional Statistics			2	2		25	25
	MFSN 205 P2:	Computer applications			2	2		25	25
6	MFSN 206 P1:	Food Science-II (Advance analytical techniques and food packaging)			2	2		25	25
	MFSN 206 P2:	Advanced and Industrial Microbiology			2	2		25	25

THEORY

Paper: MFSN 201: Health & Nutritional Statistics and Computer Applications Full Marks: 50 Credit: 4

- A. Conceptual understanding of statistical measures, Classification and tabulation.
- B. Measurement of central tendency, Frequency distribution, Histogram, Frequency polygon, Binomial distribution, Normal distribution, Parametric and nonparametric tests.
- C. Sampling Statistics: standard errors, sampling distributions, degrees of freedom, probability distribution: normal, binomial, and Poisson distributions.
- D. Testing of hypothesis, Chi-square test, Goodness of fit, student 't' test, Correlation, Regression and prediction ANOVA, posthoc analysis.
- E. Correlation - product moment correlation, partial correlation, multiple correlations, Regression - simple and multiple linear regressions.
- F. Basic computer architecture, Software's-use of MS word, MS EXCEL-Bar diagram, Pie diagram and line diagram, MS power point, Application of SPSS, Use of software for food analysis.
- G. Basic concept of email, Internet- components of Internet, www, searching biological information from Internet, library-searching technique, LAN, INFLIBNET.
- H. Bioinformatics - study of structure of biomolecules – primary and secondary structure, tools for sequence analysis

Paper: MFSN 202 Food Science-II (Advance analytical techniques and food packaging) Full Marks: 50 Credit: 4

- A. Techniques – Paper chromatography, TLC, Gel filtration, ion exchange, affinity, HPLC and GLC. Spectroscopy - UV-visible, fluorescent spectroscopy, CD spectroscopy, NMR. Radiotechniques – nature of radiation sources, radioactive decay, units of radiation, detection and measurements of radioactivity, autoradiography, GM counter, Scintillation counter.
- B. Optimisation of PCR reactions and application in food technology, immunological techniques. Extraction, isolation and purification of soluble and membrane bound enzymes. Isolation of enzymes, extraction of soluble and membrane bound enzymes purification of enzyme- criteria for purification.

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

D.Food packaging: Definitions, objectives and functions of packaging and packaging materials. Packaging requirements and selection of packaging materials; Types of packaging materials. Sanitation and hygiene, GMP, GLP,

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

F.Packaging equipment and machinery: Vacuum, CA and MA packaging machine; gas packaging machine; seal and shrink packaging machine; form and fill sealing machine; aseptic packaging systems; bottling machines: carton making machines.

Paper: MFSN 203 Advanced and Industrial Microbiology Full Marks: 50 Credit: 4

A.Morphology and characteristics of industrial microorganisms (Bacteria, yeasts, molds and actinomycetes). Fermentation processes: Historical development, important media and different types (i.e. submerged, surface and solid state fermentation); Criteria for selection of industrially important microorganisms.

B.Growth and cell division: Measurement of growth (direct and indirect) and factors affecting microbial growth, Pure and Axenic microbial culture, growth physiology, cell division, growth yields, and continuous growth. Isolation: identification and quantitative estimation of microorganisms. Pure culture isolation techniques. Cultivation of microbes: aerobic, anaerobic and facultative.

C.Microbial nutrition and some microbiologically important media. Genetics of some industrial microorganisms, Microbiology of industrially important products, Selection, development and maintenance of cultures. Biosynthesis of microbial products e.g. vitamins, amino acids, enzymes, steroids, antibiotics and polymers. SCP and its applications in health. Primary and Secondary metabolites and their productions.

D. Microbial food production. Spoilage microorganisms in foods and their control. Applied microbiology in animal nutrition. Microbial insecticides. Different types of fermentative approaches, economics of fermentation, Fermentation in batch culture:

E. Specialty food based on genetics; Genetically modified foods, Transgenic foods, Proprietary foods. Supplementary foods, High-altitude foods, functional foods, Yeast probiotics foods. New trends in food science and nutrition.

F. Food Fermentations; Traditional fermented foods of India and other Asian countries; Probiotics and prebiotics; Synbiotics, beneficial effects of probiotic bacteria. Fermented foods based on milk, meat and vegetables and cereals; Fermented alcoholic beverages.

Paper: MFSN 204 Food Safety and Quality Control (CBCS) Full Marks – 50 Credit-4

A. Hazard Analysis Critical Control Point (HACCP): History, structure, pre-requisites and principles, HACCP applications, HACCP based SOPs.

B. Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP), Good Agricultural Practice (GAP), Good Veterinary Practice (GVP), Storage and distribution of food, sanitation and safety in food services.

C. Food adulteration: common, adulterants, and health hazards. Food standards and food laws. National and International; PFA, FSSAI, HACCP, ISO Certification.

D. Consumer guidance society, Consumer rights, Consumer court, Central facilities for assessing food adulteration, Role of food inspectors.

E. Food handling and Public Health: Preventing food borne illness and the spread of communicable disease; Sanitation of food serving institution; environmental sanitation, hygienic in food handling and personal hygiene of food handler.

PRACTICAL

Paper: MFSN 205 P1 Health and Nutritional Statistics Marks: 25 Credit-2

1. Computation and significance of partial correlation coefficient between two variables.
2. Computation and significance of multiple correlation coefficient between a continuous measurement variable and two others continuous measurement variables.
3. Computation and significance of point biserial r between a continuous measurement variable and a genuinely dichotomous qualitative variable.
4. Computation and significance of biserial r between a continuous measurement variable and an artificially dichotomized variables.
5. Computation of percentile values from grouped data.
6. Testing the goodness of fit of a continuous frequency distribution with best –fitting normal distribution by Chi square test and G test.
7. Computation and significance of one- way model I analysis of variance and multiple comparison t- test and Scheffe,s F test.

Paper: MFSN 205 P2 Computer Applications Marks: 25 Credit-2

Mean, SD and SE computation using statistical software, Bar diagram, Pie diagram, Line diagram construction using MS Excel, Test of significance of the data using SPSS statistical software, Origin statistical software, Co relation of co efficient and ANOVA using SPSS software, Food analysis and calorific value using the software. Bioinformatics - study of structure of biomolecules – primary and secondary structure, tools for sequence analysis

**Paper: MFSN 206 P1 Advanced and Industrial Microbiology Techniques
Marks: 25 Credit-2**

1. Production of lactic acid from whey.
2. Production and estimation alcohol from molasses and whey by yeasts.
3. Production of fermented whey beverages.
4. Analysis of canned food products for microbiological spoilage.
5. Determine the amylolytic activity of industrially important yeasts and moulds.
6. 6. Production of rice beer by using various types of industrially important yeasts.

7. 7.Educational tour to food processing/ fermentation industries.

Paper:MFSN 206 P2 Food Science-II (Advance analytical techniques and food packaging)
Marks: 25 Credit-2

Food Packaging

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

Food Safety and Quality Control

- 1) Determination of moisture in a given food sample
- 2) Determination of ash in a given food sample.
- 3) Estimation of acidity of given food sample/beverage
- 4) Determination of water vapour transmission rate for different materials.
- 5) Detection of adulteration in foods.
- 6) Estimation of total microbial count of (a) milk products (b) fruits and vegetable products (c) meat, fish and poultry products (d) canned foods.
- 7) Assessment of air using Surface Impingement method.

Advanced Analytical Techniques

1. Identification of various types of amino acids by Paper Chromatography.
2. Isolation and identification of various types of phytochemicals by Thin Layer Chromatography.
3. Extraction, isolation and purification of food proteins (one animal and one plant proteins) by any standard lysis buffer.
4. Gel Electrophoresis of isolated food proteins.
5. Estimation total Nitrogen from foods by Kjeldal Techniques.

THIRD SEMESTER

SL NO	PAPER CODE	COURSE TITLE	CONDUCT HOURS PER WEAK				MARKS		
			L	T	P	CREDITS	Int Asst.	End Sem	Total
THEORY									
1	MFSN 301	Public health, Diseases and Nutritional Therapy	3	1		4	10	40	50
2	MFSN 302	Nutrient, Drug and Gene Interaction	3	1		4	10	40	50
3	MFSN 303	Food Resource Management and Entrepreneurial Development	3	1		4	10	40	50
4.	MFSN 304	Food as Medicine (CBCS)	3	1		4	10	40	50
Total in Theory						16			200
PRACTICAL									
5	MFSN 305 P1	Nutritional Therapy			2	2		25	25
	MFSN 305 P2	Nutritional Proteomics, Genomics and Metalabolomics			2	2		25	25
6	MFSN 306 P1	Public health and nutritional status assessment			2	2		25	25
	MFSN 306 P2	Survey Report on Food Resources and Marketing			2	2		25	25
Total in Practical						8			100
Total of Semester						24			300

THEORY

Paper: MFSN 301: Public health, Diseases and Nutritional Therapy

Full Marks: 50 Credit: 4

1. Nutritional Assessment of Patient: The Nutrition Care Process, Documentation in the nutrition care record, Influence on nutrition and health care, Nutrition intervention, Nutrition for the terminally ill or hospice patient.

2. Complementary and integrative medicine: Use of complementary and integrative therapies, Dietary supplementation, Dietary supplement regulation, Assessment of dietary supplement use in patients.

3. Food and Nutrient Delivery: Rationale and criteria for appropriate nutrition support, Enteral nutrition access, Parenteral nutrition access, Complications, Re-feeding syndrome and Transitional Feeding, Nutrition support in long term and home care.

4. Education and counselling: Models for behaviour change and counselling strategies, Skills and attributes of the nutrition educator or counsellor, Counselling approaches after the assessment, Ready to change counselling sessions.

5. Medical Nutrition Therapy for various diseases (including pathophysiology and risk factors): Rheumatic diseases, Osteoarthritis, Lupusarthritis, Renal disorders, Nephrolithiasis, Asthma, Chronic obstructive pulmonary disease, Respiratory failure, Tuberculosis, Inborn error of metabolism (Phenyl Ketouria, Galactosemia, Glycogen storage disease, Maple syrup urine disease), HIV and AIDS, Cancer, Sepsis, Trauma, Burns, Graves disease, Alzheimer's disease, Huntington Corea disease.

6. Medical Nutrition Therapy in Viral infections: Role of various foods and functional foods with nutrients and non nutrients for prevention of viral infections.

7. Medical Nutrition Therapy in Critical Care: Metabolic response to stress, Hormonal and cell mediated response, starvation versus stress, Systemic inflammatory response syndrome (SIRS) and multiple organ dysfunction syndrome (MODS), Trauma and open abdomen, Major burns.

8. Medical Nutrition Therapy and Cognitive Disorders: The enteric nervous system, Blood glucose regulation, Food allergies and sensitivities, The role of nutrients in mental function, Addiction and substances abuse, Anxiety, Bipolar disorder, Dementia and Alzheimer's Disease, Depression, Schizophrenia.

9. Medical Nutrition Therapy for Intellectual and Developmental Disabilities: Chromosomal Aberrations including Down's syndrome and Pander-Willi syndrome.

10. **Integrate Medical Nutrition Therapy:** Dietary management for comorbid diseases (Dietary management for diabetes mellitus patient with hypertension).

**Paper: MFSN 302: Nutrient, Drug and Gene Interaction Full Marks: 50
Credit: 4**

1. **Bioavailability of drug:** Influence of nutrients, biotransformation, stability of the drug, gastric emptying.

2. **Pharmacokinetic of drugs:** Influence of nutrients, competition of absorption of drug and nutrients, nutrients and nutritional status on drug efficacy.

3. **Pharmacologic aspect of food-drug interaction:** Effects of food on drug therapy. Effects of drugs on food and nutrition. Modification of drug action by food and nutrients. Effects of drugs on nutritional status. Excipients and food-drug interaction.

4. **Concept and metabolism of Nutraceuticals:** Nutraceuticals with its potential health benefit definition, Perspective for food applications for Polyphenols, Phytoestrogens, phytosterols, pigments like lycopene, carcummin. Phytatics, Protease inhibitors, amalyse inhibitors, Saponins.

5. **Idea about nutrigenomics:** Nutrient and gene expression with special reference to vitamin and other macronutrients. Influence of cholesterol and triglycerides levels of regulation of LDL receptors gene and apolipoprotein gene expression in liver and G.I tract. Nutrient control of lipoprotein lipase gene expression.

6. **Idea about Epigenomics:** Introduction to epigenetics, epigenetic effect of nutritional supplement. Genetics and nutrition therapy. Ethical, legal, and social implications.

7. **Basic idea and field of metabolomics:** Metabolome represent the ingredient of life, Techniques adopted in the study of metabolomics. The human genome project and the “Omic” disciplines.

8. **Vitamin like compounds and Pseudo vitamins:** Choline, carotene, inositol, taurine, flavanoid, pangamate, Vitamin drug interaction.

9. **Ultra trace minerals:** Cobalt, Nickel, Cadmium. Manganese, molybdenum, chlorine, selenium, fluorine- metabolism, role in human nutrition, deficiency, toxicity, sources, minerals and drug interaction.

10. **Plant microbiome and Human Microbiome:** Microbiome in fruits and vegetables. Analysing microbiome for enhancing nutrient use efficiency, interaction of plant microbiome with human microbiome-role of drug, reshaping human microbiome with antibiotic intake.

**Paper: MFSN 303: Food Resource Management and Entrepreneurial
Development Full Marks: 50 Credit: 4**

- 1. History and Development of food service establishment:** Factors affecting development, recent trends, Types of food service establishment.
- 2. Approaches to management:** Theories of management principles and aspects of management and management tools.
- 3. Entrepreneurship and Food service Management:** Conceptual perspective of entrepreneurship, creativity and innovation, Business requirements for food products, Entrepreneurship Development and training.
- 4. Definition, Characteristic, Importance of entrepreneurship in economic development:** Steps, Quality of successful entrepreneur, Contents of training programme, Women entrepreneur, Problems measures, taken for the development of women entrepreneur in India.
- 5. Concepts of small food sectors:** Objectives, Problems, Measures taken for the promotion of SSI, Procedures to start SSI market survey, raw material collection, food production, Packing, labelling and marketing.
- 6. Personnel Management:** Staff planning and Management, Employment process, staff recruitment and selection, placement and training, employee laws, trade unions and negotiations, leadership, formal relationships and duties, work design, work measurement in food service operations.
- 7. Food Management:** Menu planning, purchase and storage, Quality food production, planning and control, kitchen production, records and control, delivery and service styles, types of food service systems.
- 8. Kitchen layout and equipment:** Steps in planning and layouts. Determining equipment selection and placement, maintenance of equipment.
- 9. Sanitation and safety:** Plant sanitation and safety, considerations necessary for an efficient cleaning programme, Post cleaning care and cleaning premises and surroundings. The 3 E's of safety, standards, Policies and schedules,
- 10. Microbiology and food safety:** food borne illness, Modes of Disease transmission, Food spoilage, importance of pest control, Hygienic food handling.

Paper: MFSN 304: Food as Medicine (CBCS) Full Marks: 50 Credit: 4

Concept of disease- communicable and non-communicable disease, life style disorder. Very basic concept of medicine. Culture of health and wellness and healthy food. Supplementary and fortified food. Fast food and junk food culture and its related hazards. Practice of healthy food habit from infancy, Food for common disorders-fever, gastritis, diarrhea, IBS, colitis. Food for lifestyle disorder-stress and anxiety, obesity, diabetes, hypertension and cardiovascular disorders, renal disorders, asthma, COPD.

PRACTICAL

Paper: MFSN 305 P1 Nutritional Therapy Marks: 25 Credit-2

Therapeutic diet chart preparation for Nephritis, case specific.

Therapeutic diet chart preparation for Glomerulitis, case specific.

Therapeutic diet chart preparation for Renal failure, case specific.

Therapeutic diet chart preparation for Kidnystone , case specific.

Therapeutic diet chart preparation for Nephrolithiasis, case specific
Therapeutic diet chart preparation for Asthama, case specific.

Therapeutic diet chart preparation for Chronic obstructive pulmonary disease, case Specific.

Therapeutic diet chart preparation for Respiratory failure, case specific.

Therapeutic diet chart preparation for Tuberculosis, case specific.

Therapeutic diet chart preparation for Inborn error of metabolism, case specific.

Therapeutic diet chart preparation for HIV, case specific.

Therapeutic diet chart preparation for Sepsis, case specific.

Therapeutic diet chart preparation for Trauma, case specific.

Therapeutic diet chart preparation for Bums, case specific.

Therapeutic diet chart preparation for Phenyl ketonuria, case specific.

Therapeutic diet chart preparation for Galactosemia, case specific.

Therapeutic diet chart preparation for Glycogen storage disease, case specific.

Therapeutic diet chart preparation for Maple syrup urine disease, case specific.

Therapeutic diet chart preparation for Arthritis, case specific.

Therapeutic diet chart preparation for Osteoarthritis, case specific
Therapeutic diet chart preparation for Lupus arthritomatosis, case specific.

Paper: MFSN 305 P2 Nutritional Proteomics, Genomics and Metalabolomics

Marks: 25 Credit-2

Isolation of genomic DNA from organism, amplify fragments of gene of interest using PCR, analyze PCR results by gel electrophoresis.

Identification of specific protein using antibody by Gel Electrophoresis and Western blot analysis.

Analysis of cell apoptosis by FACS using specific antibody.

Antioxidant measurement by DPPH method of any food extracts.

Program on Nutrient-Drug interaction by chronic delivery of antibiotics in animal model through oral route and bio-availability/pharmacodynamics of micronutrients like Ca⁺⁺, Fe, I, Vit-E, Vit-A, Vit-D, etc.

Fat enriched diet supplied to animal & assessment of glycolytic metabolic pathway by quantification of pyruvate, fumarate, α -ketoglutarate, lactic acid.

Carbohydrate enriched diet supplied to animal and assessment of LDL, HDL, VLDL, Triglyceride, Cholesterol, Ketone bodies, HbA1c.

Protein enriched diet supplied to animal and assessment of Uric acid, Urea, Ammonia, Purine & Creatinine.

Paper: MFSN 306 P1 Public health and nutritional status assessment

Marks: 25 Credit-2

Assignment work on community nutrition awareness and public health.

Paper: MFSN 306 P2 Survey Report on Food Resources and Marketing

Marks: 25 Credit-2

Survey on food resources, traditional and modern food processing practices and marketing in the rural and urban communities.

FOURTH SEMESTER

SL NO	PAPER CODE	COURSE TITLE	CONDUCT HOURS PER WEAK				MARKS		
			L	T	P	CREDITS	Int Asst.	End Sem	Total
THEORY									
1	MFSN 401	Basic Food Production Operations	3	1		4	10	40	50
2	MFSN 402	Basics of Bakery and Confectionary	3	1		4	10	40	50
3	MFSN 403	Basics of Indian Cooking	3	1		4	10	40	50
4.	MFSN 404	Evaluation of Food Quality	3	1		4	10	40	50
Total in Theory						16			200
PRACTICAL									
5	MFSN 405 P1	Food Production Operations and Bakery and Confectionary			2	2		25	25
	MFSN 405 P2	Preparation of Recipes and Quality Evaluation			2	2		25	25
6	MFSN 406 P1	Internship			2	2		25	25
	MFSN 406 P2	Project work			2	2		25	25
Total in Practical						8			100
Total of Semester						24			300

THEORY

Paper: MFSN 401 Basic Food Production Operations

Full Marks: 50

Credit: 4

- 1. Basic Principle of Vegetable Cookery:** Classification of Vegetables. Pigments and colour changes. Effect of heat on vegetables. Controlling the changes in texture and flavour. Cuts of vegetables. Indian cuts of vegetable including okra, baby brinjal, bitter gourd, jackfruit, drumstick, banana flower, bamboo shoot, chilli, lotus root, broccoli, cabbage, carrot, zucchini, garlic, onion, spinach, avocado, colocasia, aubergine, snake gourd, bell pepper/ capsicum, round gourd, asparagus, artichokes, radish, tomato, potato, beet root, French beans, mushroom, turnip, ginger, drumstick and okra/lady's finger.
- 2. Classification of Fruits and their uses in Cooking:** Classification of fruits. Description, selection and storage of following fruits-apple, banana, cherry, fig, grape, gooseberry, orange, peach, watermelon, apricot, cranberry, date, grapefruit, guava, mango, pineapple, papaya, melon, pomegranate, sapodilla/ mad apple, dragon fruit, kiwifruit.
- 3. Stocks:** Broth, court bouillon, neutral stock, fumet and remouillage. Classification of stocks. Uses of stocks.
- 4. Soups:** Classification of soups-broth, consommé, puree, veloute, cream, bisque, chowder and cold soups. Making a good soup. Modern trends of presenting soups.
- 5. Sauces:** Uses of sauces-flavour, moisture, visual appeal, texture and nutritional factor. Thickening agents- roux, slurry, beurremanie, liaison, blood, butter and vegetables or fruit purees. Component of sauce. Mother sauces-Bechamel/ white sauce, veloute, espagnole/ brown sauce, tomato sauce, hollandaise sauce/ dutch sauce and mayonnaise sauce. Proprietary sauces-soya sauce, worcestershrine sauce, HP sauce, barbecue sauce, ketchup, Tabasco sauce and chilli sauce. Contemporary sauces- pestro sauce, chimichurri, harissa, salsa di noci, almolndtarator, beurre blanc. Making a good sauce. Modern trends of making sauces.
- 6. Salads:** Composition of salad. Types of salad. Compound salads. Various types of lettuce used in salads. Salad dressing. Emerging trends in salad making.
- 7. Meats:** Physical and chemical characteristics of meats. Selecting and grading meat. Processing of whole animal. Classification of meats. Category meat.
- 8. Fish and Shell Fish:** Classification of Fish. Classification of shellfish. Some classical preparation of fish. Selection of storage of seafood. Common cooking method used for seafood.

9. **Eggs:** Classification- Farm and Feed, Grade and size, Types of eggs. Eggs coagulation, leavening and emulsification. Cooking of eggs for breakfast.
10. **Seeds, nuts and Spices:** Classification of seeds- spices and nuts.
11. **Rice, cereals and pulses:** Common beans and cereals. Classification of rice.

Paper: MFSN 402: Basics of Bakery and Confectionary Full Marks: 50

Credit: 4

1. **Commodities used in bakery and pastry:** Types of flours from wheat and various grains. Types of gluten free flours. Types of raising agents. Usage of fats and oils in cooking and baking. Types of milk and dairy products. Types of creams in cooking. Types of sweeteners used in cooking.
2. **Bread fabrication:** Understanding baking. Ingredients used in bread making. Principles behind bread making. Cooling the baked bread. Basic fruits in bread making. Equipments used in bread making. Breads of the World.
3. **Basic Sponges and Cakes:** Pastry technique and principles. Principles behind making of sponge. Baking and cooling of sponges. Basic sponges and their uses. Equipments used in sponges and cakes making.
4. **Pastes, Creams, Fillings and Sauces:** Making short crust, sweet, choux, marzipan, almond, touille, puff pastry. Adding flavour to the pastry sauces.
5. **Laminated Pastries:** Methods of preparation and uses of puff pastry. Techniques and types of danish pastry and croissant.

Paper: MFSN 403: Basics of Indian Cooking Full Marks: 50 Credit: 4

1. **Introduction to Indian Cooking:** Equipments used in Indian cooking. Techniques employed in Indian cooking.
2. **Condiments, herbs and spices used in Indian Cuisine:** Spices used in Indian cooking- Allspice, ajowar, aniseed, asafoetida, bay leaf, green cardamom, black cardamom, cinnamon, clove, coriander seed, cumin, chilli, cubeb pepper, dill, fenugreek, wild mangosteen, liquorice, mace and nutmeg, mustard, nigella, pepper, poppy seed, saffron, star anise, tamarind, zedoary, turmeric, celery seeds, curry leaf, marjoram, oregano, capers, stone flower, cobra saffron, basil seeds, dried ginger, black salt, root of betel-usage and medicinal features.

3. **Masalas and Pastes:** Concept of dry and wet masalas. Dry masala- Amchoori masala, potil masala, khada masala, garam masala, chaat masala, chana masala, pudina masala, kebab masala, amritsarimachil masala, paanchphoron masala, achari masala, bhatti da masala, dumka masala, gunpowder masala, bafat masala, goda masala, kolapuri masala, rasam masala. Wet masala-malabar masala, sambar masala, chettinad masala, goon masala, xacutti masala, rechado masala, balchao masala, soola masala, tandoori masala, salan masala, ver masala. Pastes used in Indian cooking- ginger paste, garlic paste, cashew paste, coconut paste, poppy seed paste, tamarind pulp, red chilli paste, char magaz paste, almond paste, chironjee seed paste, spinach paste, masala paste, boiled onion paste, fried onion paste.
4. **Understanding commodities and their usage in Indian kitchen:** Souring agents- vinegar, tomato, curd, lemon, kokum, mango, gamboges, korchi, organic salts. Colouring agents-tartaric acid, citric acid, onion, turmeric, red chilli, saffron, green paste, sugar. Thickening agents-onion paste, nut paste, seed paste, masala paste, dairy products. Tenderizing agents- curd, lime, karchi, vinegar, fruits. Flavouring and aromatic agents- Rose petals, mogra, screw pine.
5. **Basic Indian gravies:** Gravies and curries- onion tomato masala, makhni gravy, white gravy, hariyali gravy, kadhai gravy, achari gravy, mala kofta gravy, yakhni gravy, mughlai gravy, Rajasthani yellow gravy, rizala gravy, korma gravy, salan gravy, meenmoilee gravy.

Paper: MFSN 404: Evaluation of Food Quality Full Marks: 50 Credit: 4

1. **Sensory Evaluation:** Sensory characteristic of food-appearance, colour, flavour. Sensory tests-reasons for testing food quality, trained panel member, testing laboratory, preparation of sample, techniques of smelling and testing, time, design of experiment, evaluation card. Types of tests- paired comparison test, duo-trio test, triangle test. Rating tests- ranking test, monadic test, two sample different test, multiple sample difference test, composite scoring test. Sensitivity test- threshold test, dilution test. Instrument used for texture evaluation.

PRACTICAL

Paper: MFSN 405 P1 Techniques Food Preparation, Bakery and Confectionary

Marks: 25 Credit-2

1. Visit the vegetable, seed, nut and fruit market for a survey and list all the vegetables in the market and classify them in family and record the all observation with current price range with seasonal availability-prepare a report.
2. In a group of 3 to 5 students, select 5 vegetables and mark the cuts.
3. Prepare various types of stocks/ soups/ sauces using chicken/ vegetable and palate taste (taste, flavour, color, aroma and texture) the stock and rating with scores (experiences gather by visiting from various types of hotel and restaurant).
4. Prepare various types of salads using vegetables and fruits and palate taste (taste, flavour, color, aroma and texture) the stock and rating with scores (experiences gather by visiting from various types of hotel and restaurant).
5. Visit the meat and fish market for a survey and observe and note the type of cuts.
6. Visit the egg market for a survey and list various types of egg in the market and cook the eggs for boiling, poaching, and pan frying and study the texture-prepare a report.

Paper: MFSN 405 P2 Preparation of Recipes and Quality Evaluation

Marks: 25 Credit-2

1. Make a recipe of bread by just altering the different types of flours.
2. Make dough using five different kind of flour and check the dough and wash the dough under running water and chewy structure for gluten present- compare the gluten in each flour.
3. Visit the various pastry and laminated shops in the city and write down the various types of cakes and pastry products available. Prepare eggless and genoise sponge, pastry and laminated pastry.
4. Visit various Nursing homes, hospitals (Private and Government), restaurant and hotels and write down the various types of food served. Critique the selection and write down the salient features of the dish.

Dish	Colour	Flavour	Aroma	Taste	Texture

5. Visit Ayurvedic stores and enquire about various herbs used in medicine, research on these and see how they can incorporate into cooking.
6. Prepared cake, pastry, spongy etc. must evaluate sensory characteristics- appearance, colour, flavour. Sensory tests-reasons for testing food quality by one or two standard methods.

Paper: MFSN 406 P1 Internship in hospital or food industry Marks: 25

Credit-2

General outline about how to conduct and an idea about how to perform hospital or food industrial training and prepare a report.

Paper: MFSN 406 P2 Project work Marks: 25 Credit-2

General outline about how to conduct research work on a particular topic and formulate a research design with a strong hypothesis and mention the gap in the chosen research area and prepare a report as per a standard SJR journal (Preparation of Manuscript). Present your research output by ppt.