GUJARAT UNIVERSITY

Ahmedabad – 380009,
Gujarat, India.

SYLLABUS

M. Sc.

In

FOOD SCIENCES AND NUTRITION

GUJARAT UNIVERSITY

Ahmedabad – 380009, Gujarat, India.

M. Sc. In FOOD SCIENCES AND NUTRITION

Gujarat University has developed phenomenally in the last couple of years from the span of 58 years to be recognized as a premier University in the region and country today, providing education in a wide rang of discipline. The university is expanding in all directions and has introduced new age relevant courses as well as market oriented courses. The university directs all efforts to keep pace with progress in accordance with university motto.

Society is developing in Fast pace. Urbanization, Computerization and Comfortable life Styles change the physiological needs of Human kind. The main need is food. Innovation in foods and their recipes impact disruptions in digestive process. Knowledge of physiology, digestive potential of different human beings, basic, supplementary and disorders or diseases based designer diets is very necessary. Persons with this knowledge are required to guide in charge of the mess, restaurants canteen of multinational company industries, residential academic and research institutes, Hospital and Hotels. Person with this knowledge can/ also perform duties as free Lance consultants. They can also support the physicians and specialized doctors to design the diets according to the physiological need of the patients.

Gujarat University understands present and future needs of Society, at State, Country and Global levels. In connection of this, University proposes a full fledged Master/ Post graduate course in Food Science and Nutrition. Ultimately it will help the students to be equipped with knowledge and capacity to choose the profession in this field. There is wide future scope in this field. Graduated students along with chefs they can advice or also run food joints, restaurants, which serve balanced diets based on person to person needs (*i.e.* designer based meals, recipes). They can work as dieticians or nutrition consultants. The faculty also provides consultancy services to the needy people at counseling Centre/clinics and provides expertise to food industry/hospital/others on invitation.

MASTER OF SCIENCE

(Full 2 Years-Semester Scheme)

FOOD SCIENCE AND NUTRITION SYLLABUS

EFFECTIVE JUNE 2010 SEMESTER I & II

EFFECTIVE FROM JUNE 2011 SEMESTER III & IV

1. There shall be Four papers each of four hours (3+1) duration and two practical each of Nine hours per week.
2. Each Course (Theory & Practical) shall carry 100 (Hundred) marks (Internal 30 marks and External 70 marks). External exam for each theory is of 3 hours and practical exam is of more than 6 hours.
3. The major emphasis of this Course is to motivate students for improvement through regular internal assessment .They should be encouraged for self study and seminar according to allotted times of the course per week.
4. Each theory paper is divided into four units. Each unit will have equal weightage of teaching and while setting question paper.
5. Question or its sub question including the options will be set from the same unit.
6. Practical batch will be consisting of maximum 10 students.
7. There shall be at least one study tour during the span of two years of P.G. study, pertaining to different Food science, Meal planning, Food preservation, Sensory evaluation, Diet Therapy, Nutrition Lab, Food analysis, Food Testing Lab, Microbiology, Food Microbiology, Biochemistry, Quantity Cookery etc. even outside Gujarat State. The study tour is highly essential for studying various concepts, processes and technology pertaining to Food Sciences.

Gujarat University

Design and Structure of Life Sciences PG Courses for Credit Based Semester system to be implemented from June 2010

Department	Semester	Course		No. of Hours per week				Course credits
		No	Name	Lectures	Others	Practicals	Total	
Food Science & Nutrition	1	**FSN401**	Nutritional Biochemistry	3	1		4	4
		FSN 402	Functional Properties of Food	3	1		4	4
		FSN 403	Molecular Cell Biology	3	1		4	4
		FSN 404	Human Nutrition and Nutrients	3	1		4	4
		FSN 405PR	Practical – I +Viva voce			6	6	4
		FSN 406PR	Practical – II +Viva voce			6	6	4
			Total	12	4	12	28	24
	2	**FSN 407**	Nutrition for Fitness	3	1		4	4
		FSN 408	Nutritional Physiology	3	1		4	4
		FSN 409	Food Production Development & Marketing	3	1		4	4
		FSN 410	Food Science and Food Microbiology	3	1		4	4
		FSN 411PR	Practical – III +Viva voce			6	6	4
		FSN 412PR	Practical – IV +Viva voce			6	6	4
			Total	12	4	12	28	24
	3	**FSN 501**	Community Health Nutrition	3	1		4	4
		FSN 502	Research Methodology	3	1		4	4
		FSN 503	Clinical Nutrition & Dietetics	3	1		4	4
		FSN 504	Nutrition In Critical Care, Food Safety and Law	3	1		4	4
		FSN 505PR	Practical – V +Viva Voce			6	6	4
		FSN 506PR	Practical – VI +Viva Voce			6	6	4
			Total	12	4	12	28	24
	4	**FSN 507PT**	Dissertation / Project Work				20	16
		FSN 508S	Seminar / Field /Industrial visit				4	4
		FSN 509M	Assignment / Group Discussion				4	4
			Total				28	24

M. Sc. Semester I

Course No.	Course Name	Hours Per Week	Credits	Marks		
				Internal	External	Total
FSN 401	Nutritional Biochemistry	04	04	30	70	100
FSN 402	Functional Properties of Food	04	04	30	70	100
FSN 403	Molecular Cell Biology	04	04	30	70	100
FSN 404	Human Nutrition and Nutrients	04	04	30	70	100
FSN405PR	Practical – I +Viva voce	09	04	30	70	100
FSN406PR	Practical – II +Viva voce	09	04	30	70	100
	Library	02	-	-	-	-
Total		**36**	**24**	**180**	**420**	**600**

M. Sc. Semester II

Course No.	Course Name	Hours Per Week	Credits	Marks		
				Internal	External	Total
FSN 407	Nutrition for Fitness	04	4	30	70	100
FSN 408	Nutritional Physiology	04	4	30	70	100
FSN 409	Food Production Development & Marketing	04	4	30	70	100
FSN 410	Food Science and Food Microbiology	04	4	30	70	100
FSN 411PR	Practical – III +Viva voce	09	4	30	70	100
FSN 412PR	Practical – IV +Viva voce	09	4	30	70	100
	Library	02	-	**-**	**-**	**-**
Total		**36**	**24**	**180**	**420**	**600**

SEMESTER I

❖ FSN 401: Nutritional Biochemistry

Unit – 1 : Energy, Enzyme and Thermodynamics

- Acids , Bases , Salts , pH , Ionization constants (pka) ,
- Concepts of internal energy, enthalpy, and entropy,
- First and second Law of thermodynamics,
- Free energy and their applications in bioenergetics processes.
- Enzyme-Classification, nomenclature, general properties- stereo and reaction specificity,
- Kinetics and mechanisms of enzyme action,
- Regulation of enzyme activity, Enzyme inhibition,
- Coenzymes and cofactors, their structure and functions.
- Isoenzymes, immobilized enzymes,

Unit – 2 : Biomolecules - I

- Carbohydrate - Classification, Structure and properties of carbohydrates,
- Monosaccharides and related compounds, disaccharides, polysachharides,
- Inter conversion of hexoses, suger derivatives of biomedical importance

- Lipids – Classification, Structure and properties of fatty acids, triglycerides, Phospholipids and derivatives, Cholesterol and derivatives,
- Dietary fats, biological functions of lipids, glycolipids.

Unit – 3 : Biomolecules - II

- Amino acids - Classification and structure, properties, reactions and identification techniques, Isoelectric points of amino acids,
- Formation of peptide linkages, amide plane and biological activity,
- Protein - Structure and organization, , physico-chemical properties and functional diversity of proteins,
- Nucleic acids – Components, structure and level of organization, Physico chemical properties, biological importance,
- Structure and polymorphism of DNA.

Unit – 4 : Metabolism

- Integration and regulation of metabolism: Interrelationship of carbohydrate, protein and lipid metabolism, role of liver, muscle and adipose tissues;
- Metabolic pathways of macronutrients: Carbohydrates: Aerobic and anaerobic degradation, glycogenesis, glycogenolysis, gluconeogenesis, HMP shunt pathway.
- Hormonal regulations of blood glucose.
- Protein and amino acids: protein degradation, fate of nitrogen (urea cycle), metabolism of aromatic, sulfur containing, BCAA and other amino acid pool. Glutamine and alanine cycle, protein biosynthesis.
- Lipids: Metabolism of triaclyglycerol, B oxidation of fatty acids, cholesterol. Regulation of lipid metabolism and ketone bodies.
- Nucleic acids: metabolism of nucleic acid components, biosynthesis of nucleotides.

❖ FSN 402: Functional Properties of Foods

Unit – 1 : Sensory Evaluation of Foods

- Importance and application for product formulation, Basic tastes, threshold tests for basic tastes,
- Requirements for sensory analysis, sensory panel, type, selection and training, subjective and objective sensory evaluation, different types of tests.
- Instrumental tests for sensory attributes - colour, texture and odour.

Unit – 2 : Properties of Foods

- Physico-chemical properties of foods- Organic food components, colloids, osmotic pressure, food dispersions (sols, gels, emulsion, foam), Hydrogen ion concentration etc.
- Functional properties of proteins: modified proteins, application in product formulation.
- Role of water in foods: free water and bound water, functional properties, water activity and intermediate moisture foods.
- Starch, hydrocolloids and gums: occurrence, functions in food systems, properties, gelatinization, retro gradation and modified starches.

Unit – 3 : Food Technology

- Fermentation technology: different fermented products.
- Browning in foods: Enzymatic and non enzymatic- mechanism, method of prevention, relationship to health.
- Sugar and jaggery: Principles of sugar crystallization, stages of cookery and role in Indian traditional sweet preparations, manufacturing of candies and sweets.

- Fats and oils: Properties, manufacture, uses in food systems (as cooking media and shortening). Rancidity- types, mechanism and prevention. Uses of fat replacers in processed foods.

Unit – 4 : Processing

- Enzymes in food processing
- Brief manufacturing process: coffee, tea, cocoa,
- Alcoholic beverages (fruit wines),
- Ready to serve beverages.
- Effect of processing on components,
- properties and nutritional value of foods

❖ FSN 403 : Molecular Cell Biology

Unit – 1 : Evolution of the Cell:

- Cell as a unit of living organisms.
- Diversity of cell size and shapes,
- Structure of Prokaryotic and Eukaryotic cells,
- Single cell to multicellular organism
- Cell - Cell interactions; Cell adhesions, and cell junctions
- Molecular Basis of the Cell and Macromolecular recognition process,

Unit – 2 : Biomembrane and Cytoskeleton :

- Molecular organization of Biomembrane: Ultrastructure and molecular composition of membrane,
- Physical and Dynamic properties of membrane,
- Movement of molecules/ions across biomembrane and Human perspective-defects in ion channels.
- Cytoskeleton topography: Membrane Cytoskeleton interactions,
- Microtubule and its dynamics, motor proteins,
- Microfilament and its functions, Intermediate filaments and their functions

Unit – 3 : Cell Organelles I:

- Molecular organization of Mitochondria
- Respiratory Chain Complexes – Organization and Stoichiometry,
- Q- cycle, Mechanism of Oxidative Phosphorylation, uncouplers and inhibitors;
- Molecular organization of Chloroplast,
- Photosynthetic pigments, Photosystem I & II

Unit – 4 : Cell Organelles II:

- Nucleus – Organization, compositions and functions
- Molecular Organization and functions of : Endoplasmic reticulum,
- Golgi complex,
- Lysosomes and disease;
- Microbodies: Peroxisomes,
- Ribosomes,

❖ FSN 404 : Human Nutrition And Nutrients

Unit – 1 : Basic of Nutrition:

- Basis for computing nutrient requirements:

- Latest concepts in dietary recommendations, RDA- ICMR and WHO: their uses and limitations.
- Body fluids and water balance: Body water compartments. Regulation of water balance, disorders of water balance.
- Body composition: Methods of study, compositional changes during life cycle, nutritional disorders and their effect body composition.

Unit – 2 : Components of Food

- Carbohydrates: Occurrence and physiological functions, factors influencing metabolism. Lactose intolerance.
- Dental caries. Artificial sweeteners. Role of dietary fiber in health and disease. Disorders related to carbohydrate metabolism.
- Glycemic index of foods and its uses.
- Lipids: Concepts of visible and invisible fats. EFA, SFA, MUFA, PUFA- sources and physiological functions.
- Role of lipoproteins, cholesterol and triglycerides in health and disease.
- Proteins: Concepts of essential and non-essential amino acids- their role in growth and development. Physiological functions of proteins.
- Requirements, nitrogen balance concept. Methods for evaluating protein quality. Protein energy malnutrition-clinical features and biochemical changes.

Unit – 3 : Regulation of nutrients metabolism

- Regulation of food intake: role of hunger and satiety centers, effect of nutrients.
- Energy metabolism: Basal and resting metabolism- influencing factors.
- Methods to determine energy requirements & expenditure.
- Thermo genesis, adaptation to altered energy intake,
- Latest concepts in energy requirements and recommendations for different age groups.

Unit – 4 : Nutrients

- Note: All the nutrients will be dealt with Digestion, absorption and transport and excretion, functions, interaction with other nutrients (if any), RDA, Deficiency and toxicity, major sources, Assessment of nutriture and analysis in food material.
- Macro minerals: Calcium, Phosphorus Magnesium, Sodium, Potassium chloride.
- Micro minerals: Iron, Zinc, copper, selenium, chromium, iodine, manganese, Molybdenum and fluoride.
- Ultra trace minerals: Arsenic, Boron, Nickel, Silicon, Vanadium & cobalt: Digestion & absorption, Functions, Toxicity, interaction with other nutrients.
- Fat soluble Vitamins: Vitamin A, Vitamin D, E & K.
- Water soluble vitamins: Vitamin C, Thiamine, Riboflavin, Niacin, Pantothenic acid, Biotin, Folic acid, Vitamin B12, VitaminB6.

❖ **FSN 405PR : Practical and Viva voce based on FSN 401 & FSN 402;**

❖ **FSN 406PR : Practical and Viva voce based on FSN 403 & FSN 404;**

SEMESTER II

❖ FSN 407 : Nutrition for Fitness;

Unit – 1 : Basic of Fitness

- **Basic Nutrition:** Relation between foods and nutrition Nutrients: Macro nutrients-their functions, food sources, digestion, absorption, Deficiency symptoms and toxicity. Micro nutrients**:** functions, food sources digestions and absorption, deficiency and toxicity.
- Non nutrient components: their association to health.
- Fluid balance**:** Water compartments in human body, fluid regulation water intake in different conditions, dehydration and water intoxication. Recommended dietary allowances and balanced diet.

Unit – 2 : Nutritional status

- Factors influencing dietary intake**:** Food habits, food fads and fallacies, their influence on health and wellbeing.
- Definition of health and fitness, Factors influencing health and wellbeing Gender and health.
- Nutritional status**:** Definition, methods to assess nutritional status- (Relevant to maintenance of fitness),
- Specific fitness and health status.

Unit – 3 : Management of Fitness

- Approaches to the management of fitness and health**;**
- Diet and exercise**:** Effect of specific nutrients on work performance and physical fitness.
- Fuel and other nutrients that support physical activity (metabolic pathways) Mobilization of fuel stores during exercise.
- Importance of carbohydrate loads. Nutrition, exercise, physical fitness and health- their inter relationship

Unit – 4 : Sports, Yoga and Health

- Nutrition in sports**:** Sports specific requirements diet manipulation pre game and post game meals,
- Use of different nutragenic aids and commercial supplements. Sports drinks.
- Diets for persons with high energy requirements stress, fracture and injury.
- Significance of physical fitness and nutrition in prevention and management of weight control regimes**.**
- Nutrition guidelines for maintenance of health and fitness.
- Awareness about the alternative systems for health and fitness, like ayurveda, yoga, Meditation, vegetarianism and traditional diets.

❖ FSN 408 : Nutritional Physiology;

Unit – 1 : Movement and Coordination

- Organization of Body
- Structure of skeletal, cardiac and smooth and Physiology of muscle contraction.
- Structure of Brain and Neurons.
- Physiology of nerve impulse conduction, excitability of membranes, electrical and chemical transmission between cells.
- Sensory organs and their functions.

- Hormones: Classification, synthesis, regulatory functions and mechanism of hormone action. Prostaglandin- structure, biosynthesis, metabolism and biological action and their role in pathology.,

Unit – 2 : Digestion and Respiration

- Physiological basis of Nutritional Biochemistry,
- Structure of digestive tract, enzymes in digestion, regulators of GI activity, mechanical and biochemical aspects of digestion, absorption and transport of major nutrients.
- Liver: Role of liver in processing and distribution of nutrients absorbed from SI, inter relationship of major metabolism in liver, excretory functions and storage.
- Structure of Lung, Physiology of respiration
- Exchange and transport of gases and its regulation.

Unit – 3 : Transport and Defence

- Blood: Composition- plasma, blood cells, haemoglobin, blood clotting process.,
- Heart : beat, initiation , conduction and regulation
- Physiology of Circulation
- Adipose tissue: Structure, composition, deposition of triglycerides in adipose tissue, formation of fat stores from non lipid and dietary lipids, role of brown adipose tissues in thermo genesis.
- Immunity: Immune response, antibody, cell mediated and humoral immunity complement system.

Unit – 4 : Excretion Detoxification and Reproduction

- Internal structure of Kidney and Nephron
- Fluid and electrolytes balance, Acid Base balance,
- Physiology of Excretion, Roles of kidney in body water regulation.
- Detoxication: Definition, xenobiotics, enzyme systems involved mechanism of detoxification.
- Metabolic adaptation during starvation, exercise, stress and diabetes mellitus.
- Oxidative stress and Antioxidants: Free radicals: definition, formation in biological systems, defense against free radicals. Role of free radicals and antioxidants in health and disease. Determination of free radicals, lipid peroxides and antioxidants.
- Reproduction: Female and male reproductive organs – structure and functions; Reproductive health and nutritional requirements

❖ FSN 409 : Food Product Development And Marketing;

Unit – 1 : Product strategies

- **Product Development** - Designing new product - types and drawing forces, Need for product development, Stages of product development, Success in product development, Consumer research, Role of sensory evaluation in consumer product acceptance.

Unit – 2 : Food Trends

- Changing food trends and consumer behavior in purchasing foods.
- Life style changes: economic, socio-cultural,
- Psychological influences and marketing influences.
- Introduction to advanced technologies used in food processing - agglomeration, agitation, air classification,
- Membrane technology (reverse osmosis and ultra filtration), high pressure, surface heat exchanger, ohmic resistance heating, super critical extraction.

Unit – 3 : Food Packaging

- ❖ Food fortification - objectives, principles, and technologies.
- ❖ Food packaging - Principles in the development of safe and protective packing,
- ❖ Packaging materials (metals, glass, paper and plastics) use of packaging in extending shelf life of unprocessed foods (modified atmosphere packaging, Biodegradable plastics).

Unit – 4 : Food Additives

- ❖ Sweetening agents: Natural and artificial sweeteners, composition, use.
- ❖ Food additives: Functions and uses in processed food products.
- ❖ Chemical, technological and toxicological aspects.
- ❖ Food Flavors: Spices and flavoring constituents, flavors in food industries.
- ❖ Entrepreneurship and marketing - starting and managing an enterprise,
- ❖ Entrepreneurship, advertising, marketing.

❖ FSN 410 : Food Science and Food Microbiology

Unit – 1 : Quality criteria and Safety of foods

- Introduction and Types of Criteria
- ICMSF Sampling plans
- Plan Stringency and Problems involved,
- HACCP approach,
- Quality Assurance and Production Control,

Unit – 2 : Principles of Food Microbiology

- Scope and development of Food microbiology,
- Sources of Microorganisms in food,
- Factors influencing Microbial growth in Food,
- Microbial Examination of Food,
- Beneficial activities of microbes in foods : Fermented foods, Probiotics,

Unit – 1 : Food spoilage

- Classification of food in relation to shelf life: Spoilage in food and its control:;
- Spoilage caused by microorganisms (bacteria, fungi, and virus), enzymes, pets and rodents.
- Contamination and spoilage of: Cereals and pulses; sugar and sugar products; vegetables and fruits; flesh foods; eggs; milk and milk products.

Unit – 4 : Principles of Food Preservation

- Principles of food preservation and their application
- Practice of Cleaning and Sanitation,
- Food dehydration and concentration
- Use of high temperature and Canning in Food Preservation,
- Use of Low temperature in Food Preservation,
- Use of Drying , Irradiation, Modified Atmosphere and Chemical preservatives,
- Food irradiation and microwave heating**.**
- Hurdle Concept

❖ FSN 411PR : Practical and Viva voce based on FSN 407 & FSN 408;

❖ FSN 412PR : Practical and Viva voce based on FSN 409 & FSN 410;

MASTER OF SCIENCE

EFFECTIVE FROM JUNE 2011 SEMESTER III & IV

M. Sc. Semester III

Course No.	Course Name	Hour Per Week	Credits	Marks		
				Internal	External	Total
FSN 501	Community Health Nutrition	04	04	30	70	100
FSN 502	Research Methodology	04	04	30	70	100
FSN 503	Clinical Nutrition & Dietetics	04	04	30	70	100
FSN 504	Nutrition In Critical Care, Food Safety and Law	04	04	30	70	100
FSN505PR	Practical – V +Viva Voce	09	04	30	70	100
FSN506PR	Practical – VI +Viva Voce	09	04	30	70	100
	Library	**02**	**-**	**-**	**-**	**-**
	Total	**36**	**24**	**180**	**420**	**600**

SEMESTER III

❖ FSN 501: Community Health and Nutrition;

Unit-1: Introduction to Public Health nutrition

(Concept of Public health nutrition)

- Relationship between health and nutrition, Role of public health nutritionists in the health care delivery.
- Determinants of health status, vital statistics-mortality, morbidity rate and life expectancy.
- Assessment of nutritional status of individuals and population, anthropometry, biomarkers (biochemical and biophysical), clinical measures, dietary assessment and immunization.

Unit-2: Nutritional problems in the community

- Common nutritional problems in the community: etiology, prevalence, clinical manifestation and assessment of macronutrient malnutrition (PEM)
- Micronutrient malnutrition-vitamin-A, iron, iodine, and zinc its prevention measures.
- Nutrition and infection.

Unit-3: Maternal and infant nutrition:

- **Maternal Nutrition:** Physiological aspect and nutritional requirements in pregnancy and lactation .Effect of malnutrition on pregnancy out come. Factors affecting lactation, Effect of lactation on maternal malnutrition and fertility.
- **Infant Nutrition:** Breast feeding and its implication, hazards of bottle feeding Human milk v/s milk substitutes. Weaning practices formulation and preparation, commercial supplements v/s homemade preparation. Growth and development of an infant, nutritional requirement and nutritional problems specific to this age group.

Unit -4: Role of national and international organization:

- National organization – ICMR, ICAR, CSWB, SSWB, NIN, CSIR. Fortification and enrichment of food. Other nutrition intervention programmes for control of 1. Energy Malnutrition 2. Vitamin A Deficiency 3. Anemia Prophylaxis 4. Goiter control 5. Flurosis 6. Epidemic Dropsy 7. Lathyrism
- International organization- FAO,WHO,UNICEF,AFPRO,WORLD BANK CARE
  Their role in combating malnutrition, Food and nutrition security

❖ **FSN 502: Research Methodology:**

Unit – 1: Biostatistics:

- Types of data, concepts of population, sample and sampling techniques. basic probability theory and theory of distribution
- Analysis of data: graphical and diagrammatic presentation, measures of central tendencies-mean, median, mode. Measures of dispersion-range, mean deviation and standard deviation, simple linear correlation and regression, tests of significance-'t' test and chi square test
- Methods of data collection: Schedules and questionnaire, survey, interview, case study, home visits, and scaling methods. Reliability and validity of measuring tools.
- Access to sequence database on the internet.

Unit - 2: Research methods

- Research methodology: Meaning, objectives and types of research, significance of research. Definition and identification of a research problem, justification, theory and hypothesis.
- Research design: Features of a good design, concepts of variables, experimental and control groups. Hypothesis testing
- Interpretation: Meaning of interpretation and techniques. Interpretation of tables and figures.
- Reporting: Significance of report writing, steps in report writing and types of reports.

Unit – 3: Isolation and separation techniques:

- **Centrifugation:** Theory and principles of centrifugation, sedimentation velocity and sedimentation equilibrium, types of centrifugation and centrifuge machines, differential centrifugation, density gradient centrifugation and ultra centrifugation.
- **Chromatography:** Principles of chromatographic separation, principles and application of Paper, Gel-permeation, ion exchange, affinity and thin layer chromatography(TLC) and HPLC.
- **Electrophoresis**: Principles and factors affecting separation,
  Principles and application of paper, starch, agarose, polyacrylamide and gel electrophoresis

Unit – 4: Microscopic and analytical technique:

- **Microscopy:** Principles, working and application of bright field and dark field microscopy, Contrast and interference, fluorescence microscopy, confocal microscopy, specimen
- Fixation, processing and staining in light microscopy. Electron microscopy-TEM, SEM, STEM. Cryo-electron microscopy etc.

- **Spectroscopic methods:** pH meter-electrochemistry principles and application, Principles of spectroscopy, electromagnetic spectrum, absorption of light. Colorimeter in UV and visual range, flame photometer and flourimeter.
- **Radiochemial methods:** Principles and application of tracer techniques in biology, RIA, IRMA, EIA, and radio receptor assays.
  Basics of Molecular Biology Techniques

❖ **FSN 503: Clinical Nutrition and Dietetics**

Unit – 1: Introduction to clinical nutrition

- Definition and history of dietetics, Dietetics in modern health care management
- Principles of planning a normal diet, objectives of diet therapy
- Role of dietitian**-** functions and classification of a dietitian. Team approach in patient care, interpersonal relationship with patients.

Unit – 2: Dietary management in common disease conditions

- Febrile diseases- acute and chronic fever, tuberculosis, poliomyeletis, typhoid, malaria.
- Gastrointestinal disorder-etiology symptoms and treatment of gastritis, peptic ulcer, diarrhea, constipation, dumping syndrome, malabsorption syndrome, steatorrhoea irritable bowel syndrome, ulcerative colitis, diverticulosis, crohn's disease etc.
- Liver diseases-Infective hepatitis .cirrhosis, chole cystis, chole lithiasis, hepatic encephalopathy and liver transplant.
- Renal diseases- nephritis and nephrosis, acute renal failure, chronic renal failure, urolithiasis, dialysis, renal transplant.

Unit – 3: Dietary management in degenerative, metabolic and other diseases

- Obesity and its clinical manifestation.
- Cardiovascular diseases-Role of fat in the development of atherosclerosis, risk factors, hypercholesterolemia, dyslipidemia, physical activity and heart disease. Dietary management in short term and long term treatment in coronary diseases.
- Hypertension- causes, symptoms, implication and prevention.
- Diabetes mellitus- Hyper and hypoglycemia, symptoms, diagnosis, treatment and prevention. glycemic index and glycemic load. Compliaions in diabetes.
- Inborn errors of metabolism-phenyl ketonuria, fructosuria, galactosemia, maple syrup urine disease.

Unit – 4: Recent trends in nutrition

- Principles of dietary management in gout, rheumatism, AIDS/HIV
- Cancer-risk factors, symptoms, dietary management, role of food in prevention of Cancer.
- Role of functional foods, health foods and novel foods, organically grown foods, recent concepts in human nutrition like nutrigenomics, neutraceuticals etc.

❖ **FSN 504: Nutrition in Critical Care, Food Safety and Food Laws:**

Unit-1: Nutritional care of hospitalised patients

- Hospital malnutrition, screening and nutritional assessment, nutritional care plan, implementation of nutritional care.

- Metabolic response and adaptation to starvation, infection, trauma and surgery-(carbohydrate protein and fat metabolism)
- Assessing the nutritional status in critically ill patients: anthropometry, biochemical, clinical and dietary.

Unit – 2: Medical nutrition therapy

- **Enteral nutrition:** Types, routes, composition of feeds, precautions while feeding
- **Parenteral nutrition:** Types modes and composition of feeds and precautions while feeding. Complications of parenteral and enteral therapy, refeeding syndrome.
- Palliative care and rehabilitation diets in stages.
- **Nutrition in critical care:** HIV/AIDS, mechanical ventilation, hepatic insufficiency, trauma, sepsis, MOF (multiple organ failure) other life saving measures for the critically ill.Role of immunonutrition,

Unit – 3: Nutritional support sysytem in relief and rehabilitation

- Surviellance of nutritional status in emergency relief situations such as flood,cyclone,earthquake ,drought,war etc.
- Assessment of food needs,food distribution strategy,mass and supplimentary feeding,special foods/ rations for nutritional relief,organizations for mass feeding/food distribution,transportation and storage,feeding centres,sanitation and hygiene.

Unit – 4: Food safety and Food Laws

- Food safety and quality control in food industries, physical,biological,and chemical hazards to food supply,bioterrorism a threat to food safetyss
- Regulation of food safety, food labeling, food laws and food adulteration with respect to India
- Waste disposal in food industries.

❖ **FSN 505PR : Practical and Viva voce based on FSN 501 & FSN 502;**

❖ **FSN 506PR : Practical and Viva voce based on FSN 503 & FSN 504;**

M. Sc. Semester IV

Course No.	Course Name	Hours Per Week	Credit	Marks		
				Internal	External	Total
FSN507PT	Dissertation / Project Work	24	16	100	300 (200+100)	400
FSN 508S	Seminar / Field /Industrial visit	06	4	50	50	100
FSN 509M	Assignment / Group Discussion	06	4	50	50	100
	Total	**36**	**24**	**200**	**400**	**600**

M. Sc.

Semester.	Course Name	Hours Per Week	Credit	Marks		
				Internal	External	Total
I	Principles of Food Sciences	36	24	180	420	600
II	Principles of NutritionI	36	24	180	420	600
III	Research Methodology and Clinical Nutrition	36	24	180	420	600
IV	Dissertation & Seminar+ Assignment	36	24	200	400	600
Total		**144**	**96**	**740**	**1660**	**2400**

Examinations for the 4th semester

Dissertation

Internal Examination
70 marks are based on day-to-day work of the concern student in terms of experimental designing, Practical performance in the laboratory, interpretation of the results obtained, regularity etc.

Internal 30 marks viva: Presentation of the work in front of the faculty of the department at least 3 times during this project work as follows.
(1) Deciding of the project and state of the art presentation ……10 marks
(2) Discussion of the materials and methods and protocols…… ……. 10 marks
(3) Presentation of the obtained results ……. ……10 marks

External Examination
(1) 200 marks examination of the dissertation by two examiners 100 marks each
(2) 100 marks viva-voce conducted by examiners

Evaluation of seminars and assignments/ training reports/ study tour report etc

Internal: 50 marks for the presentation of seminar which includes content, presentation slides, explanation, understanding of the topic and response to the raised questions (10 marks each)
External: 50 marks evaluation of the prepared hard copy of the seminar and viva (marks distribution: 30 marks for viva and 20 marks for the report).

Reference Books and Suggested Reading

No.	Book	Author	Publisher	Year
1.	Biochemistry	J. M. Berg, J. L. Tymoczkot, L. Stryer	N. H. Freewant & Co., NY	2004
2.	Biochemistry & Microbiology	Elliot & Elliot	Oxford Press, Oxford	2005
3.	Cell Biology, Genetics, Molecular Biology, Evolution & Ecology	P. S. Verma, V. K. Agarwal	S.Chand Pub., New Delhi	2004
4.	Cell Growth and Division-A Practical Approach	R. Basega	IRL Press, Oxford Uni.	Latest
5.	Community Health	Robert .J. Bensley and	Jones and Bartlett Pub.	2008

	Education Methods	Jodi Brookins		
6.	Developments in Food Microbiology	R. Davis	Appl.Sci.Publ, London	2004
7.	Diary Microbiology	H. A. Modi	Aavishkar Publisher, Jaipur	2009
8.	Discovering Nutrition	Paul Insel, R.Elaine Turner, Don Ross	Jones and Bartlett Pub.	2010
9.	Elementary Microbiology Vol-I and II	H. A. Modi	Akta Prakashan	1995/96
10.	Encyclopedia of Food Analysis (Basic Foods)	S. N. Mahindru	A.P.H. Pub.	2010
11.	Encyclopedia of Food Analysis (Savoring Additives)	S. N. Mahindru	A.P.H. Pub.	2010
12.	Encyclopedia of Food Analysis Vol-III (Beverages)	S. N. Mahindru	A.P.H. Pub.	2010
13.	Enzymes- Biochem, Biotech, Clinical Chem.	Grevor Palmer	A East West Press, New Delhi	2004
14.	Fit to be Well	Alton C Thygerson , Steven .M. Thygerson	Jones and Bartlett Pub.	2009
15.	Food Additives	H. A. Modi	Aavishkar Publisher, Jaipur	2011
16.	Food chemistry, A Laboratory Manual	Inter science publication	John Willey & Sons Inc	Latest
17.	Food chemistry	Seema Yadav,	Anmol Pvt., Ltd	1997
18.	Food Microbiology	M. R. Adams & M. O. Moss	The Royal Society of Chemistry, Cambridge	2000
19.	Food Science and Processing Technology. Vol-II	Mridula Mirajkar, Sreelata Menon	Kanisaka Publishers	2002
20.	Fermented Food Biotechnology	H. A. Modi	Aavishkar Publisher, Jaipur	2011
21.	Fundamental of Biochemistry	D. Voet, J. G. Voet & C. W. Pratt	John Wiley & Sons, Asia	2006
22.	Fundamentals of Enzymology	Nicholas C Prise & Lewis Steven	Oxford Uni. Press, Oxford	2003
23.	Harper's Biochemistry	R. K. Murray, D. K. Granner, A. A. Mayer & V. W. Rodwell	Mac. GrawHill, Asia	2003
24.	Human nutrition and dietetics	Garrow, ED SANAL, James	Churchill Livingston, Publication U.K	1993.
25.	Introductory Food Microbiology	H. A. Modi	Aavishkar Pub., Jaipur	2007
26.	Life Cycle Nutrition	Sari Edelstein, Judith Sharlin	Jones and Bartlett Pub	2008
27.	Managing Food and Nutrition Services	Sari Edelstein	Jones and Bartlett Pub.	2007
28.	Maternal and Child Nutrition	Ritchey, S.J and J. Taper	Harpers and Publishers	Latest
29.	Methods in Biostatistics	B. K. Mahajan	Jaypee Brothers Medical Publishers. Pvt. Ltd	2006
30.	Methods of Biostatistics	T. Bhaskara Rao	Paras Pub.	2004
31.	Modern Nutrition in Health & Diseases	Mauris E Shills, Vermon R Young	K. M. Varghese, Com.	1988 Latest
32.	Modern Statistics for the	Alan Grafer and Rosie	Oxford Uni. Press	2008

	Life Science	Hails		
33.	Catering management – An integrated approach-2nd edtn.	Mohinisethi and Surjeet Mohan	Wiley Eastern limited, New Delhi.	1993
34.	Molecular Cell Biology	H. Lodish, D. Bathinore, A. Berk, S.L Zipursky, P. Matsudara & J. Darnell	Scientific American Books, USA	1995
35.	Normal Nutrition	Robinson, OH & Lawyer	Mc. Milam Pub.	Latest
36.	Nutrition , Monitoring & Assessment	Tara Gopala Das & Subadra Seshadari	Oxford Uni. Press	Latest
37.	Nutrition Counseling Skills for the Nutrition Care Process	Linda Sretselaar	Jones and Bartlett Pub.	1997
38.	Nutrition in major metabolic diseases	Gopalan., Kamala Krishna swamy	Oxford University	2000
39.	Nutrition in the Community-The Art of Delivering Services	Owen, A.Y & Fracle, R.T	-	-
40.	Nutrition Problems Of India	Shukla. P.K	Printiace Hall of India	Latest
41.	Nutrition problems of India	Shukla. P.K	Prentiace hall of India	1982
42.	Nutrition, principles and application in health promotion	Carol west suitor merrily forbes, Crowley	Lippincot companay Ltd.	1984
43.	Pediatric nutrition in clinical practices	William. O	Willey publishing co	1981
44.	Principles & Techniques of Biochemistry & Molecular Biology	K. Wilson & J. Walker	Cambridge Uni. Press, NY	2006
45.	Principles of Nutrition	Eva D. Wilson, Catherine H Fisher	Willey Eastern Pvt Ltd.,	1971
46.	Principles of nutrition	Wilson Fisher	Willey Eastern Pvt Ltd.,	
47.	Public Health & Nutritional care	Bhavana Shabarwala	Common wealth publisher	1999
48.	Research Methods and Techniques	Kothari	Wishwa Prakashan , New delhi	2001
49.	Statistics	Gupta. S.P	S.Chand & Sons, New Delhi	1995
50.	Text book of Biotechnology	H. K. Das	-	Latest
51.	Text Book of Human Nutrition	Mahtab. S. Bamj	Oxford & 113 H Pub. Co.	1999
J 1	Indian journal of nutrition and dietetics			
J 2	Journal of food science and nutrition			
J 3	Journal of nutrition and dietetics			
J 4	Journal of food science and technology			
J 5	Journal of Nutrition research			