

**PROPOSED SYLLABUS for
M. S. (Public Health Nutrition
and Dietetics)**

Integrated Course

**Eligibility Criteria - 10 + 2
(Science)**

Semester - I to IV

M.S. (Public Health Nutrition and Dietetics)				
COURSE OUTLINE AND SCHEME OF EXAMINATION				
FIRST SEMESTER				
PAPER No.	Title	Instruction Hrs / Week	Duration of Examination	Maximum Marks
Theory				
ND 101T	Nutritional Biochemistry	4	3 Hours	100
ND 102T	Nutrition in Health	4	3 Hours	100
ND 103T	Principles of Dietetics	4	3 Hours	100
ND 104T	Human Physiology	4	3 Hours	100
Practicals				
ND 105P	Clinical Nutrition	8	4 Hours	100
ND 106P	Principles of Dietetics	8	4 Hours	100
III	Seminar	4		
	Total Marks			600
				Theory + Practical

SECOND SEMESTER				
PAPER No.	Title	Instruction Hrs / Week	Duration of Examination	Maximum Marks
Theory				
ND201T	Intermediary Metabolism	4	3 Hours	100
ND202T	Food Science	4	3 Hours	100
ND203T	Diet in Disease	4	3 Hours	100
ND204T	Research Methodology	4	3 Hours	100
Practicals				
ND205P	Food Science	8	4 Hours	100
ND206P	Diet in Disease	8	4 Hours	100
III	Seminar	4		
	Total Marks			600
Note: Internship will be offered during summer vacation between second and third semester and it is mandatory.				Theory + Practical

M.S. (Nutrition and Dietetics)				
COURSE OUTLINE AND SCHEME OF EXAMINATION				
THIRD SEMESTER				
PAPER No.	Title	Instruction Hrs / Week	Duration of Examination	Maximum Marks
Theory				
ND301T	Food Microbiology and Food Safety.	4	3 Hours	100
ND302T	Product Development	4	3 Hours	100
ND303T	Advanced Nutrition	4	3 Hours	100
I.D/ND 304T: 1	Nutrition for Health and Fitness	4	3 Hours	100
Practicals				
ND305P	Food Microbiology & Food Safety	8	4 Hours	100
ND306P	Product Development	8	4 Hours	100
III	Seminar	4		
	Total Marks			600
				Theory+ Practical

FOURTH SEMESTER				
PAPER No.	Title	Instruction Hrs / Week	Duration of Examination	Maximum Marks
Theory				
ND401T	Food Technology	4	3 Hours	100
ND402T	Community Nutrition	4	3 Hours	100
ND403T	Food Service Management	4	3 Hours	100
I.D/ND 404T: 1	Food science and Technology	4	3 Hours	100
Practicals				
ND405P	Project	8	4 Hours	100
ND406P	Internship			100
III	Seminar	4		
	Total Marks			600
Grand Total marks of all the four semester = 600 + 600 + 600 + 600 = 2400				Theory +Practical

SEMESTER - I
ND 101 T NUTRITIONAL BIOCHEMISTRY

UNIT I: CARBOHYDRATES AND LIPIDS

- Carbohydrates: Classification, sources
- Functions and requirements of Carbohydrates
- Digestion and absorption of carbohydrates
- Transport, utilization and storage of carbohydrates
- Lipids: Classification, sources and functions
- Digestion and absorption of lipids
- Deposition and storage of lipids
- Lipotropic factors
- Role of essential fatty acids
- Role of Lipoproteins, Triglycerides and Cholesterol

UNIT II: PROTEINS AND NUCLEIC ACIDS

Amino Acids:

- Classification
- Functions
- Utilization of limiting amino acids
- Urinary excretion of amino acids

Proteins:

- Classification, sources and functions
- Digestion and absorption of proteins
- Transport and storage of proteins
- Nucleic acids: Functions and types
- Protein synthesis
- Protein synthesis (Continued)

UNIT III VITAMINS

Physiological action, transport, utilization, storage, sources, functions and deficiency of:

- Vitamin A
- Vitamin D
- Vitamin E and Vitamin K
- Thiamin
- Riboflavin
- Vitamin B₁₂, Pantothenic acid
- Folic Acid

- Pyridoxine
- Niacin
- Ascorbic acid

UNIT IV: MINERALS AND TRACE ELEMENTS

- Calcium - absorption, utilization, sources, functions and deficiency
- Phosphorous - absorption, utilization, sources, functions and deficiency
- Factors affecting calcium absorption
- Role of calcium in ossification and bone growth
- Inter-relationship between parathormone and vitamin D in the regulation of calcium and phosphorous metabolism
- Iron: Functions, sources, absorption, transport, utilization and storage of iron.
- Role of iron in prevention of anemia
- Iodine: Physiology and source of iodine, Role of iodine in human nutrition
- Physiology, sources, functions and deficiency of Fluorine, Zinc
- Physiology, sources, functions and deficiency of Copper, Manganese, Selenium and Chromium

BOOKS RECOMMENDED

1. Nutritional Science - B. Srilakshmi, New Age International Publishers, 2nd edition.
2. Textbook of Medical Biochemistry - MN Chatterjee, Rana Shinde, 7th edition, Jaypee Brothers.
3. A textbook of Biochemistry - A V S S Rama Rao, 9th edition, UBS Publisher's Distribution Pvt. Ltd.

SEMESTER - I

ND 102 T NUTRITION IN HEALTH

UNIT I: PRINCIPLES OF NUTRITION

- Energy value of foods
- Estimation of energy value of foods by Bomb Calorimeter and by Benedict's oxy calorimeter
- Factors affecting energy requirements; Factors affecting BMR, SDA, RDA, and derivation of RDA.
- Physical activity, Reference man, Reference Woman, WHO reference

- Basic five food groups, Nutritional contribution from each group
- Balanced diet, Food Pyramid
- Basic principles of meal planning
- Steps in meal planning, food cost
- Nutritional requirements of adult man
- Nutritional requirements of adult woman

UNIT II: PREGNANCY, LACTATION AND INFANCY

Pregnancy:

- Growth of fetus from conception till term
- Maternal weight gain, complications of pregnancy
- Increase in Nutritional requirements during pregnancy

Lactation:

- Development of breast, physiology of lactation
- Nutritional component of colostrum and mature milk
- Increase in Nutritional requirements during lactation, Lactogogues

Infancy:

- Growth and development during infancy
- Composition of different types of milk - cow, buffalo, goat and camel, formula milk
- Breast feeding Vs bottle feeding, Feeding of Low birth weight and premature infants
- Weaning: Homemade foods Vs commercial foods

UNIT III: PRE SCHOOLERS, SCHOOLGOING CHILDREN AND ADOLESCENTS

Preschoolers:

- Milestones and Growth Chart
- Nutritional requirements
- Factors to be considered while planning diet for the preschool children

School going children:

- Nutritional requirements
 - Packed lunch
 - Factors to be considered while planning diet for school going children
 - Influence of television on eating habits of school going children
- Adolescents:**

- Sequence of developmental changes, Role of hormones on growth, development and maturation
- Nutritional requirements during adolescence
- Challenges in adolescence: weight control, skipping meals, anorexia, fast foods, smoking, alcohol and drug abuse, teenage pregnancy

UNIT IV: GERIATRIC AND ATHELETES

Geriatric:

- Physiological changes in aging
- Nutritional requirements and Dietary modification
- Common diseases affecting geriatric groups
- Common disabilities affecting geriatric groups Athletes:
- Exercise - Benefits, Types
- Source of energy - Creatinine phosphate, glucose and glycogen, fats, proteins
- Nutritional requirements
- Meal Management - pre, during and post event, supplements
- Water and electrolyte balance
- Ergogenic aids

BOOKS RECOMMENDED

1. Modern Nutrition in Health & Diseases - Eds - Maurice E. Shils, James A. Olson, Moshe Shike, 8th edition, Vol I and II, Williams & Wilkins Publication.
2. Nutrition and Dietetics - Shubhangini A Joshi, 2nd edition, Tata Mc Graw Hill publication.
3. Food, Nutrition and Diet Therapy - Kathleen Mahan & Krause, Sylvia Escott Stump.

SEMESTER - I

ND 103 T PRINCIPLES OF DIETETICS

UNIT I: INTRODUCTION TO DIETETICS

- Role and responsibilities of Dietitian - Administrative, Community, Hospital
- Interpersonal relationship with patient
- Nutritional counseling Nutritional Assessment:
- Anthropometry - Direct
- Anthropometry - Indirect
- Biochemical and Clinical methods, SGA, MNA, MUST
- Diet planning, implementation and follow up
- Dietetics - meaning, need for diet modification
- Modification of normal diets

- Types of hospital diets – clear fluid, full fluid, soft diet

UNIT II: NUTRITION IN CRITICAL CARE

Enteral Nutrition:

- Types – Short term feeding methods : Nasogastric, Nasoduodenal, Nasojejunal
- Long term feeding methods: Gastrostomy, Percutaneous Endoscopic Gastrostomy, Percutaneous Endoscopic Jejunostomy
- Methods of delivery – Bolus, gravity, pump, Formula feeds
- Advantages, Disadvantages and complications of enteral nutrition
- Parenteral Nutrition:
- Types – Total Parenteral Nutrition, Peripheral Parenteral Nutrition
- Advantages, Disadvantages and Complications of parenteral nutrition, Composition of parenteral nutrition solutions

Surgery:

- Physiological response, endocrine and metabolic changes
- Nutritional care in pre and post operative conditions

Burns:

- Severity of burns, Metabolic changes in burns
- Nutritional support in burns

UNIT III ENERGY IMBALANCE AND G.I. DISORDERS

Obesity:

- Definition, types, etiology, assessment and complication
- Management of obesity – exercise, diet, behavior modification, pharmacotherapy and surgery

Leanness:

- Etiology, complications
- Dietary management

Gastrointestinal Disorders:

Etiology, symptoms, diagnosis, treatment and dietary management of

- Gastritis
- Peptic ulcer
- Diarrhea
- Constipation
- Malabsorption syndrome: ulcerative colitis, Crohn's disease, irritable bowel disease, lactose intolerance and celiac disease
- Diverticular diseases

UNIT IV: FEBRILE CONDITIONS, DRUG AND NUTRIENT INTERACTION

- Metabolic changes during fever Febrile conditions:
 - Short duration – Typhoid, Influenza
 - Intermittent duration – Malaria
 - Long duration – Tuberculosis
 - Dietary Management

Drug and Nutrient Interaction:

- Types of drugs – Antibiotics, Analgesics, NSAIDs, Antipyretics, Antihistamines
- Pharmacokinetics of drugs
- Effect of drugs on Pharmacokinetics
- Effect of drugs on food intake, absorption, metabolism and excretion
- Effect of food on drug therapy

BOOKS RECOMMENDED

1. Clinical Nutrition – Ed Michael J Gibney, Marinos Elia, Olle Ljungqvist and Julie Dowsett.
2. Text Book of Human Nutrition – Mahtab S Bamji, N Prahlad Rao, Vinodini Reddy, 2nd edition, Oxford & IBH Publishing Co. Pvt. Ltd.
3. Food, Nutrition and Diet Therapy – Kathleen Mahan & Krause, Sylvia Escott Stump.
4. Normal and Therapeutic Nutrition - Robinson & Lawler, 17th edition, Mac Millan Publishers.

SEMESTER - I

ND 104 T HUMAN PHYSIOLOGY

UNIT I: DIGESTIVE AND EXCRETORY SYSTEM

- Structure and functions of gastrointestinal tract
- Structure and functions of liver
- Functions of gastrointestinal secretions
- Role of enzymes in digestion
- Gut flora, role of prebiotics and probiotics in the maintenance of health of digestive system
- Structure and functions of kidney
- Urine formation
- Organic constituents of urine
- Inorganic constituents of urine
- Water and electrolyte balance

UNIT II: RESPIRATORY AND NERVOUS SYSTEM

- Structure and functions of nose and nasal cavity, pharynx, larynx, trachea, bronchi and lungs
- Mechanism of respiration, Oxygen transport, Carbondioxide transport
- Respiratory rate, Air volume in lung in different situations
- Respiratory abnormalities; Hypoxia, Hypercapnia, carbon monoxide poisoning, Asphyxia, Cyanosis, High altitude sickness
- Emphysema, Asthma, COPD
- Structure of nerve cell, nerve impulses
- Classification of nervous system, Structure and functions of brain, spinal cord
- Peripheral nervous system
- Cerebrospinal fluid, Blood Brain Barrier, Neurotransmitters
- Alzheimer's disease, Parkinson's disease

UNIT III: BLOOD AND CIRCULATORY SYSTEM

- Structure and functions of heart and blood vessels
- Pulmonary, Systemic and Portal circulation
- Blood pressure, Heart rate, Factors affecting BP and heart rate
- Regulation of Cardiac output
- Composition of blood
- Plasma proteins; Functions, role in fluid balance
- Organic and Inorganic compounds in plasma
- Blood Lipids - Chylomicrons, VLDL, LDL, HDL, Cholesterol, Triglycerides
- Enzymes in blood
- Blood coagulation

UNIT IV: ENDOCRINE SYSTEM

- Endocrine glands, Formation and secretion of hormones
- Control of hormone secretion, mechanism of hormone action
- Pituitary gland: Hormones secreted and their functions, abnormalities
- Thyroid gland: Structure of thyroid gland, formation of thyroid hormones, functions of thyroid hormones, hypothyroidism, hyperthyroidism
- Adrenal gland: Structure of adrenal gland, secretions of adrenal cortex and their functions, hypoadrenalism, hyperadrenalism
- Secretions of adrenal medulla and their functions
- Parathyroid gland: Structure of parathyroid gland, functions of parathormone, hypo and hyper secretion of parathormone
- Islets of Langerhans: Structure of islets of Langerhans, functions of Insulin, deficiency of insulin, functions of glucagon
- Testes: Structure of testes, functions of testosterone, deficiency of testosterone
- Ovaries: Structure of ovaries, functions of estrogens and progesterone

BOOKS RECOMMENDED

1. Textbook of Medical Physiology – Guyton, 8th edition, HBJ International Edition, WB Sanders.
2. Essentials of Medical Physiology – Anil Baran Singha Mahapatra, 2nd edition, Current Books International.

SEMESTER - I PRACTICALS

ND 105 P CLINICAL BIOCHEMISTRY

1. Estimation of Hemoglobin in human blood sample
2. Determination of RBC count in human blood sample
3. Determination of WBC count in human blood sample
4. Determination of Packed Cell Volume in human blood sample
5. Identification of blood group
6. Estimation of glucose content in human serum sample
7. Estimation of protein content in human serum sample
8. Estimation of total cholesterol content in human serum sample
9. Estimation of HDL cholesterol in human serum sample
10. Estimation of Triglyceride content in human serum sample
11. Qualitative analysis of urine sample for presence of albumin
12. Qualitative analysis of urine sample for presence of glucose

ND 106 P PRINCIPLES OF DIETETICS

- I. Standardization of raw and cooked foods.
- II. Planning, preparation and calculation of nutritive value for the following conditions:
 1. Pre operative condition
 2. Post operative condition
 3. Burns
 4. Obesity
 5. Leanness
 6. Peptic Ulcer
 7. Diarrhea

8. Constipation
9. Ulcerative colitis
10. Sprue
11. Chronic febrile conditions.

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SEMESTER - II

ND 201 T

INTERMEDIARY METABOLISM

UNIT I: CARBOHYDRATE METABOLISM

- Glycolysis
- TCA cycle
- Pentose phosphate pathway
- Glycogenesis, glycogenolysis, gluconeogenesis
- Electron transport chain
- Fermentation, alcohol metabolism
- Metabolic changes during starvation
- Glycogen storage diseases
- Lactose intolerance
- Galactosemia, Fructose intolerance

UNIT II: LIPID METABOLISM

- Oxidation of fatty acids
- Synthesis of fatty acids
- Biosynthesis of triglycerides and phosphatides
- Cholesterol metabolism
- Bile pigments
- Ketosis

Imbalances of lipid metabolism

- Obesity
- Cachexia, Gaucher's disease, Niemann's picks disease, Tay-sach's, Fabry's disease
- Hyperlipoproteinemia
- Fatty liver

UNIT III: AMINO ACID METABOLISM

- Deamination, transamination
- Decarboxylation, deamidation of amino acids
- Metabolism of tyrosine, tryptophan, phenylalanine
- Metabolism of methionine, leucine and arginine
- Urea cycle
- Special functions of amino acid
- Amino acids: balance, imbalance and toxicity Inborn errors of amino acid metabolism
- PKU
- Tyrosinemia, Maple syrup urine disease
- Homocystinuria, Alkaptonuria

UNIT IV: PROTEIN AND NUCLEIC ACID METABOLISM

- Synthesis of purines and pyrimidines (flow chart)
- Degradation of purines and pyrimidines
- Gout
- Protein synthesis
- Protein synthesis (continued)
- Interrelationship between carbohydrate, fat and protein metabolism
- Milk protein intolerance
- Gluten intolerance
- Hypoalbuminaemia
- PEM

BOOKS RECOMMENDED

1. A Textbook of Biochemistry – A V S S Rama Rao, 9th edition, UBS Publisher's Distribution Pvt. Ltd.
2. Nutritional Biochemistry – Tom Brody, 2nd edition, Academic Press
3. Biochemistry – U Satyanarayana, U Chakrapani, Books & Allied (P) Ltd.
4. Textbook of Biochemistry (for Medical Students) – DM Vasudevan and S Sree Kumari, 4th edition, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi.

SEMESTER - II

ND 202 T

FOOD SCIENCE

UNIT I : CEREALS AND PULSES

- Starch: functions and properties
- Gelatinization, factors affecting gelatinization
- Changes in cooked starches – gel formation, retrogradation, syneresis
- Cereal protein – gluten, factors affecting gluten formation
- Role of natural leavening agents
- Role of yeast
- Pulses: processing – importance of decortication
- Soaking and germination of pulses
- Fermentation of pulses
- Factors affecting the cooking quality of dals and legumes

UNIT II: MILK, EGG AND FLESH FOODS

Milk:

- Types of milk
- Properties of milk proteins – effect of heat, acid and phenolic compounds on milk
- Use of milk in cookery
- Egg:
- Composition of egg
- Use of egg in cookery
- Egg as a binding, foaming and emulsifying agent
- Meat:
- Structure, Post mortem changes in meat – rigor mortis, curing, ageing and tenderization
- Changes during cooking of meat
- Poultry: Advantages of white meat
- Sea foods: Classification, Characteristics of fresh fish, Spoilage of fish, Nutritional importance of fish

UNIT III: FATS AND OILS, SUGARS

- Properties of fats and oils
- Fat as emulsifying agent
- Fat as leavening and shortening agent
- Rancidity – types, mechanism and prevention
- Uses of fat replacers in processed foods
- Factors affecting amount of fat absorbed during cooking
- Types of sugar
- Sugar crystallization and caramalization
- Factors affecting sugar crystallization
- Stages of sugar cookery, preparation of candies – crystalline and non crystalline

UNIT IV: VEGETABLES, FRUITS AND ENZYMES

Plant pigments :

- Water insoluble pigments
- Water soluble pigments
- Factors affecting plant pigments on cooking: acid, alkali
- Factors affecting plant pigments on cooking: metals, heat
- Flavour compounds: terpenoids, flavonoids
- Sulphur compounds and other volatile flavor compounds
- Browning – enzymatic and non enzymatic
- Prevention of browning
- Role of enzymes in food industry
- Role of enzymes in food industry (continued)

BOOK RECOMMENDED

1. Food Science – Norman N Potter, Joseph H. Hotchkiss, 5th edition, CBS Publishers & Distributors, New Delhi.
2. Food Facts and Principles – Shakuntala Manay, New Age International Publishers.
3. Food Science – B Sri Lakshmi, New Age International Publishers.

SEMESTER - II

ND 203 T DIET IN DISEASE

UNIT I: DIET FOR HEPATIC DISORDERS

Liver:

- Structure and functions

Etiology, symptoms, diagnosis/functional test and dietary management of:

- Jaundice – Types – hemolytic, obstructive and infective
- Viral Hepatitis – Types – A, B, C, D, E and G
- Fatty liver
- Cirrhosis
- Alcoholic liver disease
- Hepatic Coma

Gall Bladder:

- Structure, functions and composition of bile

Etiology, symptoms, diagnosis and dietary management of:

- Cholecystitis
- Cholelithiasis

UNIT II: DIET FOR RENAL AND METABOLIC DISORDERS

Kidney:

- Structure and functions

Etiology, symptoms, diagnosis and dietary management of:

- Acute and Chronic Glomerulonephritis
- Nephrosis
- Acute and Chronic Renal Failure
- Urinary calculi – Types – Calcium oxalate, uric acid and struvite
- Dialysis – Types – hemodialysis and peritoneal dialysis, advantages and disadvantages of dialysis

- Dietary management during dialysis

Metabolic Disorders:

- Inborn errors of Metabolism – Definition and causative factors
- Disorders of Amino Acid Metabolism – Phenylketonuria, Tyrosinemia, Maple Syrup Urine Diseases
- Disorders of Carbohydrate Metabolism – Galactosemia, Fructose and Lactose Intolerance, Disorders of uric acid metabolism – Gout – etiology, symptoms and treatment.

UNIT III: DIET FOR HORMONAL DISTURBANCES

Disease of Pancreas:

- Etiology, symptoms, diagnosis and dietary management: Acute Pancreatitis, Chronic Pancreatitis

Diabetes Mellitus:

- Types, metabolic changes
- Etiology, symptoms, diagnosis
- Complications
- Treatment – exercise, hypoglycemic drugs, insulin and diet
- Dietary Management – Role of fibre, glycemic index, food exchange list Diseases of Adrenal Cortex:
- Dietary management in Addison's diseases
- Dietary management in Cushing's syndrome Diseases of Thyroid Gland:
- Dietary management in Hypothyroidism
- Dietary management in Hyperthyroidism

UNIT IV: DIET FOR DEGENERATIVE AND CHRONIC DISORDERS

Disorders of circulatory system

- Dietary management of Hypotension, Hypertension
- Dietary management of hyperlipidemia, Ischemic heart disease
- Dietary management of Arteriosclerosis, Heart Failure Disorders of Musculo – Skeletal system:
- Rheumatoid Arthritis – Types, etiology, symptoms and dietary management
- Osteoarthritis – Types, etiology, symptoms and dietary management Cancer:
- Types, mechanism
- Etiology, metabolic changes, treatment (drugs, chemotherapy and radio therapy)
- Nutritional management of cancer AIDS:
Causes, symptoms, metabolic changes,
diagnosis Treatment and dietary
management

BOOKS RECOMMENDED

1. Clinical Dietetics and Nutrition – F P Anita and Philip Abraham.
2. Food, Nutrition and Diet Therapy – Kathleen Mahan & Krause, Sylvia Escott Stump.
3. Normal and Therapeutic Nutrition – Robinson & Lawler, 17th edition, Mac Millan Publishers.
4. Clinical Nutrition – Ed Michael J Gibney, Marinos Elia, Olle Ljungqvist and Julie Dowsett.

SEMESTER II ND 204 T RESEARCH METHODOLOGY

UNIT I: METHODS OF RESEARCH

- Definition of research, characteristics of research, criteria of good research
- Merits and demerits of scientific research

Different types of research and characteristics of each type:

- Historical research, Ex-post facto research, laboratory experiments
- Field experiments, survey research, evaluative research
- Case study research, operational research, participatory research
- Steps in conducting research
- Hypothesis: Definition, purpose, types
- Reporting: Methods of reporting, Technical reports
- Research Abstract: Definition, guidelines for writing abstract
- Thesis: Definition, parts, steps in writing thesis

UNIT II: SAMPLING DESIGN

- Census and sample survey
- Steps in sampling design
- Sample size and its determination

Types of sampling: Random Sampling:

- Simple random sampling, Stratified random sampling
- Systematic sampling, Cluster sampling Non random sampling methods:

- Judgement sampling
- Convenience sampling, quota sampling
- Benefits of sampling
- Sampling errors
- Non sampling errors

UNIT III: METHODS OF DATA COLLECTION AND COMPLICATION

- Methods of collecting primary data: Questionnaire, Interview, Schedule, Observation, Inventories, Checklists
- Scaling techniques
- Drafting of questionnaire, training of interviewers
- Criteria for evaluation of instruments - reliability and validity
- Sources of secondary data, precautions in the use of secondary data
- Classification of data: types of classification
- Formation of discrete and continuous probability distributions
- Tabulation of data: parts of a table, general rules of tabulation, types of tables
- Diagrammatic representation of data
- Graphic representation of data

UNIT IV: STATISTICAL METHODS

- Measures of central tendency: mean, median and mode, their relative advantages and disadvantages
- Measures of dispersion: Mean deviation, standard deviation
- Coefficient of variation, percentile
- Types of correlation, coefficient of correlation and its interpretation
- Rank correlation
- Regression equations and predictions
- Analysis of variance
- Contingency tables, Chi-square test
- 't' test: student's 't' test, paired 't' test, unpaired 't' test
- 'F' test

BOOKS RECOMMENDED

1. Statistical Methods - S P Gupta, Sultan Chand and Sons Publishers, New Delhi.
2. Research Methodology - methods and techniques - C R Kothari, Wiley Eastern Limited, Madras.
3. A Handbook of Methodology of Research - Dr. Rajammal P Devadas and Dr. K Kulandaveil, Sri Ramakrishna Mission, Coimbatore.
4. Research Methods in Social Science - B H V Sharma, D Ravindra Prasad, P Satyanarayana, Sterling Publications.
5. Biostatistics - Sundara Rao.

SEMESTER II

PRACTICALS

ND 205 P FOOD SCIENCE

1. Gelatinization and factors affecting gelatinization
2. Gluten formation
3. Use of leavening agents - using yeast
4. Effect of heat, acid and enzymes on milk proteins
5. Foaming properties of egg white
6. Tenderization of meat
7. Sugar cookery - Stages of sugar cookery, Caramelization
8. Preparation of fondant and fudge
9. Effect of acid and alkali on colour, texture, flavor and palatability of vegetables
10. Effect of metals and heat application on colour, texture, flavor and palatability of vegetables
11. Enzymatic browning reaction in fruits - apple, banana
12. Enzymatic browning vegetables - potato, brinjal

ND 206 P DIET IN DISEASE

Planning and Preparation of Diets for:

1. Viral Hepatitis
2. Cirrhosis of Liver
3. Nephritis
4. Nephrosis
5. Acute Renal Failure
6. Chronic Renal Failure
7. Renal calculi
8. Diabetes
9. Arteriosclerosis
10. Cancer
11. AIDS
12. Diabetes with Hypertension
13. Diabetes with Arteriosclerosis

SEMESTER III

ND 301 T FOOD MICROBIOLOGY AND FOOD SAFETY

UNIT I: MICROBES AND GROWTH OF MICROBES

- Scope and importance of microbiology in applied areas - medical, soil, milk, air, food, space and industry
- Types of microorganisms and their general characteristics - Fungi (molds and yeast), Bacteria, Protozoa and Viruses
- Intrinsic factors affecting microbial growth - Nutrient content, pH, Redox potential, water activity
- Extensive factors affecting microbial growth - Humidity, temperature, Gaseous atmosphere
- Food borne diseases - Classification, Mode of transmission, Viral infections, Parasitic infestations and Control
- Food adulteration
- Food additives

UNIT II: MICROBIOLOGICAL QUALITY CONTROL AND FOOD TOXICOLOGY

- Principles of food preservation
- Fermented foods and types of fermentation
- Methods of food preservation - Pasteurization, Blanching, Canning, Slow and quick freezing, Freeze drying, Irradiation, Drying and Dehydration
- Use of salt, sugar, vinegar and chemical preservatives
- Naturally occurring toxicants in foods
- Food poisoning
- Antinutritional factors
- Chemical contaminants in foods

UNIT III: FOOD CONTAMINATION AND SPOILAGE

- Food safety - Definition, factors effecting food safety
- Classification of foods by ease of spoilage
- Causes of spoilage in different types of foods
- Sources of contamination - water, air, soil, animals and humans
- Spoilage of cereals and cereal products - molding, ropiness
- Spoilage of milk and milk products - gas production, proteolysis, ropiness
- Spoilage of meat and meat products - aerobic and anerobic
- Spoilage of fish and other sea foods, poultry and eggs
- Spoilage of fresh fruits and vegetables
- Spoilage of canned products - spoilage by spore forming and non spore forming bacteria
- Spoilage of sugar products

UNIT IV: FOOD SAFETY REGULATIONS IN INDIA AND INTERNATIONAL STANDARDS

- Present status of food safety regulations with reference to processed food sector.
- Food safety regulations - Prevention of food adulteration Act, Essential Commodities Act, Bureau of Indian standards, AGMARK, Standards of Weights and Measures Act, Export Quality Control Inspection Act, Consumer protection Act, Certification Marks, Food and Drug Control Authority, Integrated Food Law / Food Safety Standard Authority in India
- Food testing laboratories in India - Municipal labs, FDA Labs, central food testing labs, labs of export inspection council, central grain analysis lab, quality control labs of companies, Quality control labs of consumer co-operatives and private testing labs
- Rights of Food Inspectors
- International Standards :WTO, ISO, SPS, CODEX ALIMENTARIUS, HACCP

BOOKS RECOMMENDED

1. Food Microbiology – M.R. Adams, M.O. Moss, New Age International (P) limited publishers, New Delhi.
2. Modern Food Microbiology – James M. Jay, 4th edition, CBS Publishers & Distributors, New Delhi.
3. Food Microbiology – William Frazier, Dennis c. Westhoff, 4th edition, Tata Mc Graw Hill Publishing Company Limited, New Delhi.
4. Basic Food Microbiology – George J. Banwart, Second Edition, CBS Publishers and Distributors, New Delhi.
5. Microbiology – Michael J. Pelczar, Roger D. Reid, Mc graw Hill Publishers.
6. Essentials of Food Microbiology – John Garbutt, Arnold Publishers.
7. Food Hygiene and Sanitation – S Roday, Tata Mc Graw Hill Publishing Co. Ltd., 3rd reprint.
8. Food Poisoning and Food Hygiene – Hobbs B C and R J Gillbert, 4th edition, English Language Book Society and Edward Arnold Publishers Ltd.
9. Food Contamination and Safety – Vanisha Nambiar.

SEMESTER III

ND 302 T

PRODUCT DEVELOPMENT

UNIT I: FOOD PRODUCT DEVELOPMENT

- Significance of product development, Definition of Product Development
- Future trends in Product Development and Formulation
- New Technologies driving the food product development
- Steps involved in product development
- Food product standardization
- Functional foods: Definition, types of food categorized as functional foods
- Intellectual property rights, Legislations covering IPR in India IPR with special emphasis on GM foods
- Patenting of foods:
- Conditions to be satisfied by an invention to be patentable, Inventions which are not patentable in India
- Filing a patent application, Documents to be submitted by a patentee, Criteria for naming inventors

UNIT II: EVALUATION OF FOOD QUALITY

- Sensory characteristics of food: colour, texture, flavor, odour and taste
- Flavouring substances used in foods Sensory evaluation of foods:
- Laboratory set up, equipment
- Panel selection and training, judging quality

Subjective evaluation techniques:

- Difference tests: paired comparison test, duo-trio test, triangle test
- Rating tests - Ranking single sample, Two sample and Multiple sample difference tests
- Rating tests - Hedonic scaling, Numerical scoring, Composite scoring
- Sensitivity tests and Descriptive tests, analysis of sensory data

Objective tests to assess sensory properties of foods:

- Measurement of colour
- Measurement of viscosity, consistency, texture

UNIT III: FOOD PACKAGING

- Food packaging: Importance, Definition, Principles of packaging Types of packaging material: Metal, glass

Paper, plastic, edible packaging material, miscellaneous packaging materials

Packages with special features:

- Boil-in-bag package, plastic-shrink package
- Cryovac film, microwave oven packaging, high barrier plastic bottles
- Aseptic packaging in composite cartons, military food packaging, ovenable paper boards, distribution packaging
- Packaging Laws and Regulations as per SWMA
- Packaging Laws and Regulations as given under PFA
- Tests for identification of packaging material
- Measurement of water vapour transmission rates, Measurement of gas transmission, Measurement of resistance of packaging

UNIT IV: PRODUCT LABELLING, PRICING AND MARKETING

- Product labelling: purpose, types
- Product labelling regulations
- Nutrition labelling
- Product pricing
- Product marketing – role and strategies
- Product marketing (continued)
- Grading of foods
- Specifications for grading of rice, wheat, eggs
- Emblems and names (prevention of improper use) Act, 1950
- Logistics for success of new product

BOOKS RECOMMENDED

1. Orientation for Food Professionals, A Hand book – P V Suryaprakasa Rao.
2. Hand book of Analysis of Quality Control for Fruit and Vegetable Products – S Ranganna, 2nd edition.
3. Sensory Evaluation Techniques – Mcilgard, Civille, Carr, 3rd edition.
4. Indian Patents Law - Legal and Business Implications, Eds Ajith Parulekar, Saritha D'Souza.
5. The law of Intellectual Property Rights – Ed Shiv Sahai Singh.\

SEMESTER III
ND 303 T ADVANCED NUTRITION

UNIT I: NEUTRACEUTICALS

- Functional Foods: Dietary Fibre
- Omega 3 Fatty Acids, Conjugated Linoleic Acid
- Oligosaccharides, Resistance Starch
- Antioxidants: Formation of free radicals and oxidative stress
- Role of catalases, peroxidases, superoxide dismutase, glutathione reductase and oxygenases in protecting cells
- Clinical significance - Inflammation, cataracts, cancer, ageing, skin
- Nutrients with antioxidant properties: Retinol, Beta carotene, Ascorbic acid and Tocopherol
- Phyto chemicals: Flavonoids
- Phenolic Compounds
- Single cell proteins

UNIT II: BIOAVAILABILITY OF NUTRIENTS

- Animal and human metabolic studies-use in assessment of nutrient bioavailability
- Ethics in conducting human and animal metabolic studies
- Methods of evaluating protein quality - need, Aminoacid score
- NPU, BV, Digestibility coefficient

General methods of determining bioavailability of vitamins and minerals

- Radio-isotopes
- Balance studies
- Growth and specific tissue response, Repletion-depletion techniques, Plasma appearance
- Microbial assays, Invitro studies
- Factors affecting bioavailability of calcium
- Factors affecting bioavailability of iron

UNIT III: NUTRITION ASSOCIATED WITH IMMUNITY AND GENE EXPRESSION

- Active immunity - Humoral, cellular and combination of both
- Passive immunity - Normal human Ig, Specific human Ig, animal antitoxins or antisera
- Immunoglobulins - IgG, IgM, IgA, IgD, IgE
- Role of nutrients on immune function
- Malnutrition and immune function
- Fundamentals of gene structure Principles of gene expressions
- Transcription mechanism and regulation
- Translation mechanism and regulation

- Effects of nutrients on gene expression
- Thrifty genotype - phenotype hypothesis

UNIT IV: RECENT ADVANCES IN NUTRITION

- Designer foods
- Genetically modified foods
- Pre-biotics and pro-biotics
- Novel proteins - leaf protein, single cell protein
- Fortification
- Irradiation of foods
- Application of irradiated foods in armed forces
- Role of leptin and ghrelin in food intake
- Space foods
- Organic foods

BOOKS RECOMMENDED

1. Nutrition and Metabolism - Michael J. Gibney, Marinos Elia, Olle Ljungqvist, Julie Dowsett (Eds.) - Nutrition Society Textbook series, Blackwell Publishers.
2. Nutrition Science - B Sri Lakshmi, New Age International Publishers.
3. Normal and Therapeutic Nutrition - Robinson & Lawler, 17th edition, Mac Millan Publishers.
4. Text Book of Human Nutrition - Mahtab S Bamji, N Prahlad Rao, Vinodini Reddy, 2nd edition, Oxford & IBH Publishing Co. Pvt. Ltd.

Semester III

ID/ND 304T: 1 NUTRITION FOR HEALTH AND FITNESS

UNIT 1: INTRODUCTION TO NUTRITION

- Introduction to food, nutrition, nutrient and Health
- A brief study on the importance, sources, functions, requirements and deficiency disorders of
- Carbohydrates
- Proteins
- Fats
- Vitamin A
- Vitamin D
- Vitamin E
- Vitamin K
- Thiamin
- Niacin
- Riboflavin and
- Vitamin C

UNIT II: MEAL PLANNING

- Food groups basic 3 and 5
- Food exchange list
- Food Pyramid
- Basic principles of meal planning
- Steps in meal planning
- Factors influencing food intake and food habits
- Balanced diet- definition and its importance
- BMR and factors affecting BMR
- Recommended dietary allowances – Definition, Reference Man and Reference Woman, WHO reference
- Explanation of terms- adequate, optimum, good nutrition and malnutrition

UNIT III: NUTRITIONAL REQUIREMENTS IN HUMAN LIFE CYCLE

Nutritional requirements for

- Pregnancy
- Lactation
- Infancy
- Preschoolers
- School going children
- Adolescent girls
- Adolescent boys
- Adult woman
- Adult man
- Geriatrics

UNIT IV: NUTRITION FOR FITNESS

- Obesity- causes, complications and dietary management
- Leanness- causes and dietary management
- Assessment of nutritional status by anthropometry- height, weight and BMI
- Nutrition for Weight management
- Exercise – types, benefits, nutritional requirement
- Relationship between nutrition and fitness
- Nutritional requirement for athletes
- Meal management- pre, during and post event
- Nutritional supplements
- Water and electrolyte balance

BOOKS RECOMMENDED:

1. Nutrition Science- Srilakshmi B, 5th edition, (2002) New Age International publishers.
2. A Handbook of Food and Nutrition- Swaminathan N, 5th edition, volume 1, Bangalore printing and publishing Co.Ltd.
3. Text book of Human Nutrition -Mahtab S. Bamji, N Prahlad Rao, Vinodini Reddy, 2nd edition, Oxford and IBH publishing Co, Pvt.Ltd
4. Food, Nutrition and Diet therapy- L.Kathleen Mahan and Sylvia Escott-Stump, 11th edition, Saunders publications.
5. Perspectives in nutrition, Wardlaw Insel, 3rd Edition, Mosby publications.

SEMESTER III

PRACTICALS

ND 305 P FOOD MICROBIOLOGY AND FOOD SAFETY

1. Sterilization techniques.
2. Methods of media preparation and solution
*Nutrient agar, potato agar, nutrient broth.
*Preparation of staining solution.
3. Inoculation techniques.
4. Preparation of bacterial staining - simple, gram.
5. Identification of fungi using lactophenol blue mount.
6. Microbial analysis of food samples: Water, milk, fruits and vegetables. Eg: Surface microflora and internal microflora.
7. ELISA - demonstration.
8. Identification of adulterants in milk and milk products - water, starch, urea and formalin.
9. Estimation of Free Fatty Acids.
10. Determination of Peroxide value.
11. Determination of Iodine Value
12. Identification of food colours and textile colours.

ND 306 P PRODUCT DEVELOPMENT

I Market Survey

1. Market survey of various processed foods.

II Sensory Evaluation Techniques

2. Threshold test for salt.
3. Threshold test for sugars.
4. Triangle test.
5. Paired Comparison test.
6. Hedonic Rating test.

III Food Product Development

7. Standardization of Basic Recipe.
8. Standardization of Variation I.
9. Standardization of Variation II.
10. Assessment of Nutritive Value of the recipes.
11. Sensory Evaluation of Basic recipe and variations, Analysis of results of sensory evaluation.
12. Determination of any two nutrients (depending upon recipe) in the selected recipe.

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SEMESTER IV
ND 401 T FOOD TECHNOLOGY

UNIT I: TECHNOLOGY OF FOOD GRAINS

Basic steps (flow charts) involved in:

- Milling of rice and wheat
- Parboiling of paddy
- Manufacturing of corn flakes, wheat flakes, oat flakes and soy flakes
- Puffing and popping of rice, sorghum and maize, Dehulling of sorghum and bajra
- Extrusion technology
- Decortications, Germination, Fermentation, Agglomeration and Canning of legumes
- Nutrient changes during processing of grains
- Storage of food grains: Brief description of different methods of storage – Bag storage and bulk storage
- Indoor and outdoor storage structures
- Nutrient changes during storage of food grains, Addition of nutrients to foods

UNIT II: TECHNOLOGY OF NUTS & OILSEEDS, FATS & OILS AND SUGARS

- Basic aspects (flow charts) involved in processing of nuts & oilseeds by Curing, Shelling and Pressing
- Solvent extraction of oils from nuts & oilseeds
- Basic aspects (flow charts) involved in processing of oils & fats by refining of oils, bleaching, deodorization, hydrogenation, winterization, randomization and inter-esterification
- Processing of groundnuts for manufacturing peanut butter
- Storage of fats and oils – melting point, smoking point, rancidity (hydrolytic, oxidative and enzymatic rancidity), prevention of rancidity
- Sugar and Sugar confectionery: Production of sugar
- Factors affecting production of sweets – sucrose inversion, time, temperature, moisture content, added ingredients
- Types of sugar
- Manufacturing of cocoa powder from cocoa beans
- Types of sugar confectionery

UNIT III: TECHNOLOGY OF FRUITS & VEGETABLES, MILK & MILK PRODUCTS

- Pretreatments for processing of fruits and vegetables

Basic aspects (flow charts) for processing of fruits and vegetables by:

- Canning, use of low temperatures (chilling, freezing and freeze drying)

- Preservation by drying (sun drying, air drying, radiation)
- Use of chemical agents, Concentration (evaporation, freeze concentration, membrane concentration)
- Nutrient changes during processing of fruits and vegetables
- Storage of fruits and vegetables – cold storage, hypobaric storage, modified atmosphere storage, radurization.
- Processing of Milk – Clarification, Pasteurization, Homogenization Basic aspects (flow charts) involved in production of milk products:
- Skim milk, Concentrated milk, Cream, Butter, Cheese, Ghee, Ice cream
- Indigenous milk products (dahi, khoa, rabri, malai, kheer)

UNIT IV: TECHNOLOGY OF ANIMAL FOODS, BIOTECHNOLOGY OF PLANT AND ANIMAL FOODS

Basic aspects (flow charts) involved in processing and storage of :

- Eggs; freezing, drying, cold storage
- Meat (beef, pork, organ meats): post-mortem changes, ageing, tenderizing, curing, freezing, smoking, manufacturing of sausages
- Poultry : chilling
- Fish : canning, chilling, freezing, curing, cold storage
- Manufacturing of fish oil and fish meal;
- Biotechnology: definition, types (Traditional and modern)
- Role of biotechnology in improving the nutritional quality and shelf-life of foods
- Genetically modified foods: definition and types
- Present status of GM foods in India
- Safety of GM foods

BOOKS RECOMMENDED

1. Food Science – Norman H Potter, Joseph H. Hotchkiss, 5th edition, CBS Publishers & Distributors, New Delhi.
2. Food Processing – Shoba Udipi
3. Foods Facts and Principles – N Shakuntala Manay and M Shadaksharaswamy, Wiley Eastern Limited, New Delhi.
4. Food Packaging Technology Handbook – NIIR Board of Consultants and Engineers, New Delhi.

SEMESTER IV

ND 402 T COMMUNITY NUTRITION

UNIT I: CONCEPTS OF COMMUNITY NUTRITION

- Definition and concepts of community Vital statistics:

- Mortality
- Morbidity
- Nutrition policies
- Health policies Occupational hazards:
- Physical and chemical
- Biological

Protection of health and nutritional status of workers:

- Women employees in industries and establishments
- Medical measures
- Infrastructure measures and legislation

UNIT II: ASSESSMENT OF NUTRITIONAL STATUS

Anthropometry:

- Weight, height, mid arm circumference, head and chest circumference
- Skin fold thickness, BMI – uses and limitations
- Weight / Height, Weight / Age, Height / Age – ICMR, NCHS standards, Gomez and Waterloo's classification
- Diet Surveys:
- Individual
- Institutional and National
- Uses and limitations of diet surveys
- Biochemical methods: uses and limitations
- Clinical assessment: uses and limitations
- Biomarkers – Definition, Classification – Genetic and biochemical
- Examples of biomarkers – RBC, folate, calcium, LDL receptors in CVD, vitamin A.

UNIT III: NUTRITION EDUCATION AND HEALTH ADMINISTRATION

- Importance of Nutrition and Health Education Tools and techniques of health education
- Audio aids
- Visual aids
- Audiovisual aids, advantages and disadvantages
- Types of approaches: personal, group and mass, advantages and disadvantages
- Responsibilities of nutritional counselor at community level

Health administration

- Central level
- State level
- Village level
- Primary Health Care

UNIT IV: NUTRITION AND HEALTH INTERVENTIONS

- Magnitude of malnutrition in India
- Consequences of malnutrition in India Nutritional problems in India:
- PEM, Anaemia
- Iodine Deficiency Disorder and Vitamin A Deficiency
- Dental caries, Fluorosis Measures to combat malnutrition:
- ICDS, IDDCP
- Vitamin A Prophylaxis Programme
- Anemia Prophylaxis Programme
- Role of National organizations in combating malnutrition: ICMR, ICAR, NIN.
- Role of International organizations in combating malnutrition: CARE, UNICEF, WHO, FAO, ICRISAT.

BOOKS RECOMMENDED

1. Public Health Nutrition – Michale J. Gibney, Barrie M. Margetts, John M. Kearney and Lenore Arab (Eds.) – Nutrition Society Textbook Series, Blackwell Publishing.
2. Nutritional Science – B. Sri Lakshmi, New Age International Publishers, 2nd edition.
3. Text Book of Human Nutrition – Mahtab S Bamji, N Prahlad Rao, Vinodini Reddy, 2nd editon, Oxford & IBH Publishing Co. Pvt. Ltd.
4. Social and Preventive Medicine – Part & Park.

SEMESTER IV
ND 403 T FOOD SERVICE MANAGEMENT

UNIT 1 : FOOD SERVICE ESTABLISHMENT AND MANAGEMENT

Type of food service establishment:

- Commercial, Non Commercial, Street - mobile food unit
- Temporary food service establishment, vending machine, food court, High risk food
- Catering management- Principles of management (basic guidelines)
- Principle of Management (continued)

Function of management:

- Managing, Planning, Organizing
- Directing, Coordinating,
- Controlling and Evaluating

- Tools of management - Tangible
- Tools of management - Intangible tools
- Management of resources - Natural environment, Work environment

UNIT II: ORGANISATION OF SPACE AND EQUIPMENT IN FOOD SERVICES ESTABLISHMENT

- Kitchen Space - Size and types, Developing kitchen plan, Work simplification
- Features to be considered in kitchen designing
- Storage Space - Types of storage
- Factors to be considered while planning storage spaces
- Service Area - Location
- Structural designing and planning storage spaces
- Equipment - Classification of equipment
- Selection of equipment, Designing, installation and operation
- Purchasing equipment
- Care and maintenance of equipment

UNIT III: FOOD MANAGEMENT

- Characteristic of food - Types of food, quality of food - quantity
- Sensory quality and nutritional quality
- Food purchasing - Importance
- Types - open market, formal, negotiated and wholesale
- Receiving and Food storage - Delivery methods
- General guidelines for storing perishable and non perishable foods
- Menu Planning - Importance of menu planning

- Types of menus – Al a carte, table d’hote and combination Food service
- Style of service
- Waiter service, self service and vending

UNIT IV: FINANCIAL MANAGEMENT, HYGIENE IN FOOD SERVICE INSTITUTIONS

Financial management:

- Component of cost
- Behavior of cost
- Concept of contribution and breakeven Cost control:
- Importance of cost control
- Factors affecting losses
- Methods of controlling food cost and labour cost Hygiene:
- Environmental hygiene
- Environmental hygiene (continued)
- Hygienic food handling
- Personal hygiene

BOOKS RECOMMENDED

1. Catering Management – An Integrated Approach – Mohini Sethi, Surjeet Malhan, 2nd edition, New Age International Publishers.
2. Food Hygiene and Sanitation – S Roday, Tata Mc Graw Hill Publishing Co. Ltd., 3rd reprint.
3. Institutional Food Management –Mohini Sethi.

Semester IV
ID/ND 404 T: 1 FOOD SCIENCE AND TECHNOLOGY

UNIT I : INTRODUCTION TO FOOD SCIENCE

- Functions of food
- Food groups
- Food in relation to health
- Food science
- Cooking
- Objectives of cooking
- Preliminary preparations
- Cooking methods
- Microwave cooking
- Solar cooking

UNIT II: TECHNOLOGY OF FOODS

Composition, nutritive value and processing of

- Cereals and Millets- Rice and Jowar
- Pulses and Legumes- Red gram dal and Soybean
- Nuts and Oilseeds- Groundnut and Sesame
- Vegetables- Green leafy vegetables, Other vegetables and Root and Tubers
- Fruits
- Milk and Milk products- Buffalo milk and Cheese
- Egg
- Flesh foods- Meat, Fish and Poultry
- Fats and Oils- Vanaspathi and Sunflower oil
- Sugar and Jaggery

UNIT III: BASIC PRINCIPLES OF FOOD TECHNOLOGY

- Food technology: Introduction, Importance
- Principles of food technology
- Food processing techniques in general
- Food spoilage
- Principles of Food Preservation
- Methods of Food Preservation
- Factors affecting food preservation
- Food adulteration
- Food additives
- Food laws -PFA, FPO

UNIT IV: BIOTECHNOLOGY AND FUTURE FOODS

- Biotechnology in foods
- Biofortification
- Nutraceuticals
- Pre and Probiotics
- Functional foods
- Designer foods
- Organic foods
- Low cost nutrients supplements
- Food packaging
- Nutrition labeling

BOOK RECOMMENDED

1. Food Science – Norman N Potter, Joseph H. Hotchkiss, 5th edition, CBS Publishers & Distributors, New Delhi.
2. Food Facts and Principles – Shakuntala Manay, New Age International Publishers.
3. Food Science – B Sri Lakshmi, New Age International Publishers.