UNIVERSITY OF GOUR BANGA

(Established under West Bengal Act XXVI of 2007)
N.H.-34 (Near Rabindra Bhawan), P.O.: Mokdumpur,
Dist.: Malda, West Bengal, Pin-732 103

CHOICE BASED CREDIT SYSTEM
B.Sc. FOOD AND NUTRITION
HONOURS

DRAFT

(w.e.f. June 2019)

Yellow highlight indicate Jhimli Banerjee
Blue highlight indicate Arpita Basu

Scheme for CBCS in B.Sc. Honours Program- Food and Nutrition							
ACADEMIC SEMESTERS	**DISCIPLINE CORE (DC) (4+2=6)**	**DISCIPLINR SPECIFIC ELECTIVE (DSE) (4+2=6)**	**GENERIC ELECTIVE (GE) (4+2=6)**	**ABILITY ENHANCEMENT COMPULSORY (AEC) (2)**	**SKILL ENHANCEMENT COURSE (SEC) (2)**	**CREDITS**	**MARKS**
SEM-I	**DC 1: Human Physiology -I**	-	**GE-1 Nutritional Importance of Foods**	**ENVS**		**20**	**200**
	DC 2: Nutritional Importance of Foods	-					
SEM-II	**DC 3: Human Physiology – II**	-	**GE-2 Physiology of Nutrition**	**Communicative English/ Bengali MIL**		**20**	**200**
	DC 4: Physiology of Nutrition	-					
SEM-III	**DC 5: Biochemistry**	-	**GE-3 Nutrition and phases of Life**			**24**	**200**
	DC 6 : Nutrition and phases of Life	-					
	DC 7: Therapeutic Diet – I	-					
SEM-IV	**DC 8: Nutritional Assessment Programme**	-	**GE-4 Nutritional Assessment Programme**			**24**	**200**
	DC 9 : Epidemiology and Community Nutrition	-					
	DC 10: Therapeutic Diet – II	-					
SEM-V	**DC 11. Food Microbiology**	**DSE-1: Human Pathology <u>OR</u> Therapeutic Nutrition and Critical Care**	-		**SEC-1**	**26**	**250**
	DC 12: Medical Microbiology	**DSE-2: Molecular Biology <u>OR</u> Biophysics and Bioinstrumentation**	-				
SEM-VI	**DC 13: Nutraceutical and Functional Food**	**DSE-3: Biostatistics and Bioinformatics <u>OR</u> Concept of Research and Health Management**	-		**SEC-2**	**26**	**250**
	DC 14. Food Safety and Standard	**DSE-4: Food Spoilage and Food Preservation <u>OR</u> Entrepreneurship and Small Catering Units**	-				
TOTAL						**140**	**1300**

- **Students pursuing DC in Food and Nutrition will have to opt for SEC and DSE in Food and Nutrition only**
- **GE subject must be different from DSC in Food and Nutrition (Botany / Chemistry/Zoology/Physiology)**

Marks and Question type distribution for Food and Nutrition (Honours) course of studies								
No. of Courses	Total Credit	Total Marks	Full Marks of Each Course	Internal Assessment (IA)		End Semester Examination (ESE)		
				Attendance (4%)	Cont. Evaluation (6%)	Theoretical		Practical
						Descriptive	MCQ	
DC 14 courses	14x6=84	14x50=700	50	4+6=10		25	nil	15
DSE 04 Courses	4x6=24	4x50=200	50	4+6=10		25	nil	15
GE 04 Courses	4x6=24	4x50=200	50	4+6=10		25	nil	15
SE 02 Courses	2x2=4	2x50=100	50	4+6=10		40	nil	nil
AEC-1 (ENVS)	1x2=2	1x50=50	50	10 project		nil	40	nil
AEC-2 Communicative Bengali/English	1x2=2	1x50=50	50	4+6=10		nil	40	nil
Grand Total	140	1300	-	-		-	-	-

- **DISCIPLINE CORE (DC)**
- **DISCIPLINR SPECIFIC ELECTIVE (DSE)**
- **GENERIC ELECTIVE (GE)**
- **SKILL ENHANCEMENT COURSE (SEC)**
- **ABILITY ENHANCEMENT COMPULSORY (AEC)**

DETAILED COURSE STRUCTURE

DISCIPLINE CORE (DC)

YEAR 1

SEMESTER I

DC 1: Human Physiology-I (Theory) (Total Lectures 60)

DC2: Nutritional Importance of Foods (Theory) (Total Lectures 60)

SEMESTER II

DC 3: Human Physiology-II (Total Lectures 60)

DC 4: Physiology of Nutrition (Theory) (Total Lecture 60)

YEAR 2

SEMESTER III

DC 5: Biochemistry (Theory) (Total Lecture 60)

DC 6: Nutrition and phases of Life (Theory) (Total Lecture 60)

DC 7: Therapeutic Diet – I (Theory) (Total Lecture 60)

SEMESTER IV

DC 8: Nutritional Assessment Programme (Theory) (60Lectures)

DC 9: Epidemiology and Community Nutrition (Theory) (60 Lectures)

DC 10: Therapeutic Diet – II (Theory) (60 Lectures)

YEAR 3

SEMESTER V

DC 11: Food Microbiology (Theory) (60 Lectures)

DC 12: Medical Microbiology (Theory) (60 Lectures)

SEMESTER VI

DC 13: Nutraceutical and Functional Food (Theory) (Total Lectures 60)

DC 14. Food Safety and Standard (Theory) (60 Lectures)

DISCIPLINE SPECIFIC ELECTIVE (DSE)

YEAR 3: SEMESTER V: DSE-1 and DSE-2, SEMESTER VI: DSE-3 and DSE-4 (Project)

(Any three from the following; One each for each DSE course)

DSE 1 : Human Pathology OR
Therapeutic Nutrition and Critical Care
DSE 2 : Molecular Biology OR
Biophysics and Bioinstrumentation
DSE 3 : Biostatistics and Bioinformatics OR
Concept of Research and Health Management
DSE 4 : Food Spoilage and Food Preservation OR
Entrepreneurship and Small Catering Units

GENERIC ELECTIVES (GE)

YEAR 1: SEMESTER I: GE-1; SEMESTER II: GE-2

YEAR 2: SEMESTER III: GE- 3; SEMESTER IV: GE-4

(Any four from the following; One each for each GE course)

GE 1 : Nutritional Importance of Foods
GE 2 : Physiology of Nutrition
GE 3 : Nutrition and phases of Life
GE 4 : Nutritional Assessment Programme

SKILL ENHANCEMENT COURSES (SEC)

YEAR 3: SEMESTER V: SE- 1, SEMESTER VI: SE-2

(Any two from the following; One each for each SE course)

SEC 1 : Technology of Fruits and Vegetables OR
Environment Management and Public Health

SEC 2 : Rural Technology and Public Welfare OR
Immunology, Toxicology and Public Health

Discipline Core (DC)

YEAR 1: SEMESTER I

(Credits: Theory-4, Practical-2)

DC 1: PAPER-1: Human Physiology – I (Theory) (Total Lectures 60)

1. **Body composition:**
   - Generalized structural makeup of human body.
   - Structure and functions of animal cell with special reference to Plasma membrane (Fluid Mosaic Model), Mitochondria, Ribosome, Endoplasmic reticulum.
   - Nucleus (nuclear membrane, nuclear chromatin and nucleolus).
2. **Circulatory and Cardiovascular system:**
   - Blood and its composition, Blood groups, Mechanism of blood coagulation.
   - Structure and functions of heart.
   - Cardiac cycle, cardiac output, blood pressure and its regulation.
3. **Digestive system:**
   - Structure and functions of G.I. tract.
   - Process of digestion and absorption of food.
   - Structure and functions of liver, gallbladder and pancreas.
4. **Respiratory system:**
   - Structure of Lungs and gaseous exchange (oxygen and carbon dioxide transport), Brief idea on Acclimatization.
5. **Musculoskeletal System:**
   - Formation and functions of muscles, bones and teeth (Brief idea).

DC-1: PAPER 2 (Practical)

1. Determination of pulse rate.
2. Determination of blood pressure by Sphygmomanometer (Auscultatory method).
3. Determination of Bleeding Time (BT) and Clotting Time (CT).
4. Detection of Blood group (Slide method).
5. Measurement of Haemoglobin level (Sahli`s method).

Suggested readings:

- Chatterjee CC (1988). Text Book of Physiology – Vol I & II.
- Chaudhuri SK (2000). Concise Medical Physiology. New Central Book Agency (P) Ltd.
- Guyton AC, Hall JE (1966). Text book of Medical Physiology. 9th Ed. Prism Books (Pvt.) Ltd. Bangalore.
- Guyton AC (1985). Function of the Human Body, 4th Edition, W.B. Sanders Company, Philadelphia.
- Hadley ME (2000). Endocrinology. 5th ed. Pearson Education.
- Hoar WS (1984). General and comparative Physiology. 3rd ed. Prentice-Hall of India.
- Wilson (1989). Anatomy and Physiology in Health and Illness. Edinburgh, Churchill Livingstone.
- Winword (1988): Sear's Anatomy and Physiology for Nurses. London, Edward Arno ll.

DC2: PAPER 3: Nutritional Importance of Foods (Theory) (Total Lectures 60)

1. **Concept and definition of terms:**
   - Food, Food Groups, Food Pyramid, Functions of food.
   - Nutrient and Nutritive value, Concept of Balanced Diet.
2. **Cereals, Pulses and legumes:**
   - Nutritional aspects of wheat, rice and oat.
   - Types of pulses and legumes, uses, and nutritional aspects.
3. **Milk and milk Products**:
   - Nutritive value and composition of milk, Concept of milk processing and Pasteurization
   - Types of processed milk, milk products (butter, curd, paneer and cheese).
4. **Egg, Fish and meat:**
   - Nutritional aspects and uses.
   - Nutritional aspects of edible fish and meat, concept of red and white meat.
5. **Vegetables and fruits:**
   - Uses and nutritional aspect of commonly available vegetables.
   - Fresh fruits and dry fruits– raw and processed product.
6. **Salts, Fats and oils:**
   - Uses and nutritional aspects of various salts.
   - Types, sources, use and nutritional aspects of fats and oils.
7. **Beverages:**
   - Common types (tea, coffee and wines) and their uses, nutritional aspect.
8. **Methods of cooking:**
   - Dry, moist, frying and microwave cooking.
   - Effect of various methods of cooking on foods, nutrient losses in cooking.

DC2: PAPER 4 (Practical)

1. Food preparation and nutritive value as per portion size wherever applicable -
   1. **Beverages:** Milk shake and Lassi.
   2. **Cereals:** Fried Rice and Chapatti.
   3. **Milk and milk products:** Custard and Payasam.
   4. **Eggs:** Egg pudding and Pouch (Water pouch and Butter pouch).
   5. **Snacks:** Poha and Sandwiches.

Suggested readings:

- Hughes O, Bennion M (1970). Introductory Foods, Macrnillan & Co. New York.
- Lavies S (1998). Food Commodities.
- Pomeranz Y (Ed) (1991). Functional Properties of Food Components, (2nd edition), Academic Press, New York.
- Tindall HD (1983). Vegetables in the Tropics, MacMillan Press, London.
- Winton AL, Winton KB (1999). Techniques of Food Analysis. Allied Scientific Publishers.

Discipline Core (DC)

YEAR 1: SEMESTER II

(Credits: Theory-4, Practical-2)

DC 3: PAPER 5: Human Physiology – II (Theory) (Total Lectures 60)

1. **Excretory system*:***

- Structure and function of skin.
- Regulation of temperature of the body.
- Structure and functions of kidney in special reference to nephron.
- Physiology of urine formation.

2. Reproductive system:

- Structure and functions of gonads, concept on menstrual cycle.
- Brief idea of pregnancy, parturition, lactation and menopause.
- Brief concept on spermatogenesis and Oogenesis process.

3. Nervous System:

- Concept on sympathetic and parasympathetic nervous system.
- Brief anatomy and functions of cerebrum, cerebellum, hypothalamus and neuron.
- Concept on synapse and synaptic transmission.

4. Endocrine system:

- Structure and functions of pituitary, thyroid and adrenal gland.
- Structure and functions of pancreas.

DC 3: PAPER 6 (Practical)

1. Total count (TC) of RBC, WBC and Platelets.
2. Differential count (DC) of WBC.
3. Erythrocyte Sedimentation Rate (ESR) (Westergren method)
4. Identification with reasons of histological slides (Lung, Liver, Kidney, Small intestine, Stomach, Thyroid, Adrenal, Pancreas, Testis, Ovary and Muscle of mammals).

Suggested readings:

- Chatterjee CC (1988). Text Book of Physiology – Vol I & II.
- Chaudhuri SK (2000). Concise Medical Physiology. New Central Book Agency (P) Ltd.
- Guyton AC, Hall JE (1966). Text book of Medical Physiology. 9th Ed. Prism Books (Pvt.) Ltd. Bangalore.
- Guyton AC (1985). Function of the Human Body, 4th Edition, W.B. Sanders Company, Philadelphia.
- Hadley ME (2000). Endocrinology. 5th ed. Pearson Education.
- Hoar WS (1984). General and comparative Physiology. 3rd ed. Prentice-Hall of India.
- Wilson (1989). Anatomy and Physiology in Health and Illness. Edinburgh, Churchill Livingstone.
- Winword (1988): Sear's Anatomy and Physiology for Nurses. London, Edward Arno ll.

DC 4: PAPER 7: Physiology of Nutrition (Theory) (Total Lecture 60)

1. **Concept and definition of terms:**
   - Growth, Development, Nutrition, Malnutrition and Health, Scope of Nutrition.
2. **Role of Vitamins:**
   - Fat soluble vitamin-Physiological role, dietary sources and deficiency disorders.
   - Water soluble vitamin- Physiological role, dietary sources and deficiency disorders.
3. **Role of Minerals (Ca, Fe, Na, K, I, Zn, Mn, Mg, Co):**
   - Physiological role, dietary sources and deficiency disorders.
4. **Principles of meal planning:**
   - Food exchange list, Factors affecting meal planning and food related behavior.
   - Dietary guidelines for Indians.
5. **Minimum nutritional requirement and RDA:**
   - Formulation of RDA, dietary guidelines with reference to man and woman.
6. **Energy in human nutrition:**
   - Energy and its unit, Energy assessment and balance, Factors of energy requirement, BMR and its regulation, SDA of food.

DC 4: PAPER 8 (Practical)

1. Growth chart: Plotting and Interpretation using primary or secondary data in accordance with both ICMR and WHO Chart.
2. Clinical assessment and sign of nutrient deficiency disorders: Protein energy malnutrition (PEM), Anaemia, Rickets, Goiter, Vitamin A, Vitamin C and Vitamin B-complex (Slide/Photography).
3. Diet survey in accordance with ICMR method (at least 3 days).

Suggested readings:

- Gopalan C (198). Nutritive value of Indian Foods. Indian Council of Medical Research.
- Guthrie AH (1986). Introductory Nutrition, 6th Ed. The C.V. Mesby Company.
- Indian Council of Medical Research (2003). Nutrient Requirements and Recommended-Dietary Allowance for Indians. New Delhi.
- WHO (1979). A growth chart for International use in Maternal and Children Health Care, Geneva.
- Winword (1988). Sear's Anatomy and Physiology for Nurses. London, Edward Arno ll.
- Swaminathan M (2009). Essentials of Foods and Nutrition, Vols -1 and II. Ganesh and Co. Madras.

DC 5: PAPER 9: Biochemistry (Theory) (Total Lecture 60)

1. **Carbohydrate:**
   - Classes of carbohydrates (monosaccharides, oligosaccharides and polysaccharides).
   - Properties and dietary importance of starch, sucrose, lactose, glucose and fructose.
   - Metabolism: Glycolysis, Tricarboxylic acid (TCA) cycle, Gluconeogenesis, Glycogenesis, Glycogenolysis and regulation of blood sugar level.
2. **Protein:**
   - Classes, properties, functions and secondary structure of protein (alpha helix, beta pleated sheet).
   - Concept and definition: Complete and incomplete proteins, Biological value, Protein Efficiency Ratio (PER), Net Protein Utilisation (NPU), Essential and non-essential amino acids.
   - Protein metabolism: Deamination, Transamination and Urea cycle.
3. **Lipid:**
   - Classes of lipids, Properties and functions of fats, oils and fatty acid (PUFA, MUFA, SFA. TFA).
   - Lipid metabolism (Beta - oxidation of fatty acids).
4. **Enzyme:**
   - Classification, properties and factors affecting enzyme activity. Brief idea on mechanism of enzyme action (Fischer Lock and key model) and preliminary concept of enzyme inhibition.

DC5: PAPER 10: (Practical)

1. Qualitative detection of sugar (Molisch's test, Benedict`s test, Iodine test), Non-reducing sugar (Hydrolysis test or Inversion test).
2. Qualitative detection of protein (Biuret and Ninhydrin).
3. Colorimetric estimation of Carbohydrate (Anthrone method).
4. Colorimetric estimation of Protein (Folin-Phenol reagent).

Suggested readings:

- Boyer R (2000). 3rd Ed. Modern Experimental Biochemistry. Person Education, Asia.
- Devlin TM (Ed) (2002). Textbook of Biochemistry with clinical correlations. 5th ed. Wiley-Liss.
- Murray RK, Granner P, Mayes A, Rodwell VW (2003). Harper's Illustrated Biochemistry. McGraw-Hill.
- Switzer RL, Garrity LF (1999). Experimental Biochemistry. WH. Freeman & Company.
- Nelson DL & Cox MM (2004). Lehinger's Principles of Biochemistry. 2nd ed., Macmillan worth Publishers.
- Voet D, Voet JG & Pratt CW (1999). Fundamentals of Biochemistry. Upgrade edition. John Wiley & Sons

DC 6: PAPER 11: Nutrition and phases of Life (Theory) (Total Lecture 60)

1. Nutrition during infancy:

- Breast feeding, Formula feeding, Weaning, Supplementary foods, Nutritional management of Preterm baby.

2. Nutrition for children:

- Diet in early childhood, elementary school age, high school age.

3. Nutrition during pregnancy and lactation:

- Nutritional demands of Pregnancy, Food selection during Pregnancy, Complications of pregnancy and dietary management, Diet during Lactation.

4. Nutrition to athletes:

- Nutritional requirements and dietary management in sports man and athletes, Meal planning for athletes.

5. **Geriatric nutrition:** Planning of meals for older people, Nutrition of aged persons, Physiological complications in geriatric group and dietary modifications required, Oxidative stress and aging and role of antioxidative nutrients for preventing aging.

DC 6: PAPER 12: Practical

1. Preparation of normal diets for infant (Dahl soup).
2. Preparation of normal diets for preschool children (Dalia).
3. Preparation of normal diets for college student (Suji Upma).
4. Preparation of normal diets for pregnant lady and lactating mother (Khicheri with mixed vegetables).

Note: In laboratory note book, calculation of nutritive value should be recorded according to portion size of specific diet for particular individual.

Suggested readings:

- Hoar WS (1984). General and comparative Physiology. 3rd ed. Prentice-Hall of India.
- Indian Council of Medical Research (2003). Nutrient Requirements and Recommended-Dietary Allowance for Indians. New Delhi.
- Sherwood L (2004). Human Physiology: From cells to systems. 5th ed. Thomson Brooks Cole.
- Swaminathan M (2009). Essentials of Foods and Nutrition, Vols -1 and II. Ganesh and Co. Madras.
- Walker WA and Watkins JB (Ed.) (1985). Nutrition in Pediatrics, Boston, Little Brown & Co.
- WHO (1979). A growth chart for International use in Material and Children Health Care. Geneva.
- Wilson (1989). Anatomy and Physiology in Health and Illness. Edinburgh, Churchill Livingstone.

DC 7. PAPER 13: Therapeutic Diet – I (Theory) (Total Lecture 60)

1. **General ideas of diet therapy:**
    - Therapeutic adaptations of normal diet, Classification of therapeutic diets (Progressive diets – Normal, Soft, Clear and Full fluid).
2. **Dietitians and hospital basic diets:**
    - Types of dietitians and role of dietitian.
    - Nutritional adequacy of hospital diets, Basic concept and methods of (i) Oral feeding (ii) Tube feeding (iii) Parenteral feeding.
3. **Etiology, symptoms, diagnostic tests and dietary management:**
    - Gastro-intestinal tract and liver diseases - Diarrhoea, Constipation, Irritable Bowel Syndrome, Flatulence, Peptic ulcer, Ulcerative Colitis, Viral hepatitis and Cirrhosis of liver.
4. **Etiology, symptoms, diagnostic tests and management:** Malabsorption syndrome.
5. **Dietary management of inborn error in metabolism:**
    - Lactose intolerance, Phenylketonuria (PKU) and Alcaptonuria.
6. **Allergies:**
    - Definitions, symptoms, diagnosis and dietary management in special reference to food allergy.

DC 7: PAPER 14: Practical

1. Therapeutic diet chart preparation for Diarrhoea (Case specific).
2. Therapeutic diet chart preparation for Constipation (Case specific).
3. Therapeutic diet chart preparation for Ulcer (Case specific).
4. Therapeutic diet chart preparation for Liver cirrhosis (Case specific).
5. Therapeutic diet chart preparation for Anaemia (Case specific).

Discipline Core (DC)

YEAR 2: SEMESTER IV

(Credits: Theory-4, Practical-2)

DC 8: PAPER 15: Nutritional Assessment Programme (Theory) (60 Lectures)

1. **Assessment of Nutritional Status and Surveillance:**
   - Direct Nutritional status assessment of human groups - Biochemical, Biophysical and anthropometric methods.
   - Indirect assessment: Secondary sources of community health data.
2. **Concept of Surveillance systems:**
   - Role of international and national organizations and agencies (WHO, FAO, UNICEF, CARE, NIN, CFTRI, ICMR).
3. **Communication in Nutrition and Health Education:**
   - Type, process and media of communication.
   - Interpersonal, Group and Mass communication.
   - Importance and relevance of Information, Education and communication (IEC) in Nutrition and Public Health.
4. **National Nutritional Intervention Programmes:**
   - Objective, Target group, Scheme details - Integrated Child Development Services (ICDS), Mid Day Meal Programme (MDMP), Vit A prophylaxis Prophylaxis programme, Anemia prophylaxis programme, Iodine deficiency disorders control programme.
   - Concept on public distribution system.
5. **Immunization Programme:**
   - Preliminary concept of immunity-innate, acquired, active and passive immunity.
   - Immunization: National Immunization schedule for children and adults, Immunization for foreign travelers.

DC 8: PAPER 16: Practical

1. Anthropometric measurement of Weight for age, height for age, weight for height and its comparison with reference value.
2. Determination of BMI and comments on results.
3. Measurement of circumference of chest, upper arm, waist - hip ratio.
4. Measurements of fat using skin fold thickness.

Suggested readings:

- Jelliffe DB and Jelliffe EFP (1989). Community Nutritional Assessment, Oxford University Press WHO. The growth chart: A tool for use in infant and child health care. Geneva: WHO; 1986.
- Gopalan C (1992). Growth charts in Primary Health Care – Time for Reassessment. NFI Bulletin.
- Ghosh S (1997). Nutrition and child care – A practical guide. 1st ed. Jaypee Brothers; New Delhi.
- NIPCCD. Growth Monitoring Manual. 1st ed. Deptt. Of Women and child development. Ministry of HRD: 1988.

DC 9: PAPER 17: Epidemiology and Community Nutrition (Theory) (60 Lectures)

1. **Concept of population and Community:**
   - Definition and characteristic features of population
   - Concept of community and community health, types of community.
   - Factors affecting health of community – environmental, social, political, cultural and economical.
2. **Community water and waste management:**
   - Source of water, safe drinking water, etiology and effects of toxic agents.
   - Microbial examination of water, Water-Potability test (MPN Test).
   - Sewage disposal and treatment.
3. **Nutritional problems in community:**
   - Etiology, Clinical signs and management-Kwashiorkor, Marasmus, Goiter and Nutritional anemia.
4. **Concept of Disease**:
   - Endemic, Epidemic, Pandemic, Acute and Chronic, Incubation period and Quarantine period.
   - Communicable and Non-communicable diseases, Zoonosis, Epizootic and Enzootic.
5. **Principles of Epidemiology**:
   - Epidemiological study-Descriptive and Analytical.
   - Factors that Influence the Epidemiology of Disease.
   - Rate of Disease in a Population-Attack rate, Mortality and Morbidity rate, Prevalence and Incidence of a disease.

DC 9: PAPER 18: Practical

1. Microbiological examination of water (drinking water, supply water & pond water):
i) Presumptive test ii) Confirmatory test iii) Completed test for coliform
iv) Determination of MPN index.

2. Visit to old age home / ICDS Centre / Nutrition Rehabilitation Centre (NRC) / Slum area / Any public place and Report Preparation on nutritional status and health concern (In any area at least 8-10 case studies to be done). **OR** Visit to a Rural Technology Centre/Community Welfare Centre and field report preparation.

Suggested readings:

- Park K (2009). Park's Textbook of Preventive and Social Medicine, 20th Edition, M/s Banarasidas Bhanot, Jabalpur.
- Gordis L (1996). Epidemiology, Saunders, Pennsylvania.
- Norell SE (1998): Workbook of Epidemiology. Oxford: University Press, New York.
- Owen AY and Frankle RT (1986). Nutrition in the Community, The Art of Delivering Services, 2nd Edition, Times Mirror/Mosby.
- Roday, S. (1999) Food Hygiene and Sanitation. 1st Edition, Tata McGraw Hill, New Delhi.
- Saha A, Shattock F, Mustafa T. Epidemology in Primary Health Care. The McGraw- Hill Companies.

DC 10: PAPER 19: Therapeutic Diet – II (Theory) (60 Lectures)

Etiology, clinical features and dietary management:

- Weight Imbalances**:** Underweight, Overweight and Obesity.

2. Eating disorder:

- Concept of Anorexia nervosa and bulimia.

3. Etiology, Risk factor, Sign and Symptom, Diagnosis and dietary management:

- Diabetes mellitus, Diabetes insipidus and Cancer

4. Etiology, Risk factor, Sign and Symptom, Diagnosis and dietary management:

- Hypertension.
- Renal diseases (Nephritis, Glomeurlonehiritis, Uremia, Kidney failure, Nephrosis).

5. Diseases of the cardio vascular system:

- Brief review of lipoproteins (TC, TG, LDL, HDL, VLDL)
- Atherosclerosis–etiology and risk factor.
- Dietary care: Ischemic heart disease, arteriosclerosis and hyperlipidemia.

DC 10: PAPER 20: Practical

1. Therapeutic diet chart preparation for Diabetes mellitus (Case specific).
2. Therapeutic diet chart preparation for Hypertension (Case specific).
3. Therapeutic diet chart preparation for Atherosclerosis (Case specific).
4. Therapeutic diet chart preparation for Obesity (Case specific).
5. Therapeutic diet chart preparation for Renal diseases (Case specific).

Suggested readings:

- Anderson L, Dibble MV, Tukki PR, Mitchall HS, and Rynbergin HJ.: Nutrition in Health and Disease. 17th edition, J.B. Lipincott & Co. Philadelphia.
- Anita FP. Clinical Dietetics and Nutrition. 2nd Edition, Oxford University Press, Delhi.
- Davis J and Sherer K (1994). Applied Nutrition and Diet Therapy for Nurses, 2nd Edition, W.B. Saunders Co.
- Escott-Stump S (1998): Nutrition and Diagnosis Related Care, 4th Edition, Williams and Wilkinson.
- Garrow JS, James WPT and Ralph A (2000). Human Nutrition and Diabetics, 10th Edition, Churchill Livingstone.
- Srilakshmi B (2016). Dietetics. New Age International.

Discipline Core (DC)

YEAR 3: SEMESTER V

(Credits: Theory-4, Practical-2)

DC 11. PAPER 21: Food Microbiology (Theory) (60 Lectures)

1. **History of Microbiology:**
   - Microorganisms involved in food fermentation and their role.
2. **Food contamination:**
   Primary sources of food contamination
3. **Control of microorganisms:**
   - Physical and chemical methods used in sterilization and disinfection.
   - Uses of high and low temperature, dehydration, freezing, freeze drying, irradiation and use of preservatives.
4. **Nutrition and culture of microorganisms:**
   - Microbial nutrition-Types of culture media, Methods of pure culture and sub culture.
   - Bacterial growth-Extrinsic and intrinsic factors affecting growth.
5. **Food infections:**
   - Bacterial food infections-Salmonellosis, Shigellosis and Listeriosis.
   - Food poisoning (Staphylococcal and Botulism) - Symptoms, mode of transmission and methods of prevention, Concept of aflatoxin intoxication.

DC-11: PAPER 22: Practical

1. Preparation of liquid (broth) and solid media Slant and Stab.
2. Microbiological techniques: Pure culture technique-Spread plate, Pour plate and Streak plate; Staining-Simple stain, Differential stain (Gram stain).
3. Biochemical tests for characterization: (catalase, nitrate-reduction, indole production, methyl red and voges–Proskauer test), Sugar fermentation test, IMViC reaction.
4. Microbiological examination of milk (Methylene blue reduction test).

Suggested readings:

- Pelzar MJ, Chan ECS, and Krieg NR (2004). Microbiology. 5th edition Tata McGraw Hill.
- Prazier WC and Westhoff DC (1988). 4th edition, Food Microbiology, MaGraw Hill Inc.
- Prescott SC, Dunn CG (2009). Industrial Microbiology.
- Roday S (1999). Food Hygiene and Sanitation, 1st Edition, Tata McGraw Hill, New Delhi.
- Stanier RY, Ingraham JL, Wheelis ML, and Painter PR (2005). General Microbiology. 5th edition. McMillan.
- Talaro K and Talaro A (2011). Foundations in Microbiology, 8th ed. McGraw-Hill
- Tortora GJ, Funke BR, Case CL (2008). Microbiology. An Introduction. 9th ed. Benjamin/Cummings Publishing.

DC 12: PAPER 23: Medical Microbiology (Theory) (60 Lectures)

1. **Normal microflora of the human body and host pathogen interaction:**
   - Predominant normal microbial flora of human body: Skin, Respiratory Tract, gastrointestinal Tract, Urinogenital Tract.
   - Host pathogen interaction: Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Carriers and their types, Opportunistic infections, Nosocomial infections. Transmission of infection.
2. **Bacteria and Bacterial diseases:**
   - Bacterial structure: Cell walls of Gram positive and Gram negative, Bacteria capsule, Flagella-composition, structure and types, Cell membrane- structure, composition and Properties, Bacterial endospore.
   - Bacterial Diseases: Name of pathogen, symptoms, pathogenesis, mode of action & preventive measures of following diseases: Typhoid, Cholera and Tuberculosis, Tetanus, and Ulcer by *Helicobacter pylori*.
3. **Viruses, viroids, prions:**
   - General characteristics of viruses, structure, isolation, cultivation and identification of viruses, viral multiplication, lytic and lysogenic phages (lambda phage),
   - Concept of viroids and prions.
   - Viral Diseases: Name of pathogen, symptoms, pathogenesis, mode of action & preventive measures of following diseases: Polio, Herpes, Hepatitis, Rabies and AIDS.
4. **Antibiotic and chemotherapeutic agents:** Sulfur drugs, Antibiotics and their classification, Mode of action, antibiotic assay and sensitivity test

DC 12: PAPER 24: Practical

1. Preparation of medically important culture media: EMB Agar, McConkey agar, Mannitol salt agar, Triple Sugar Iron agar.
2. Study of bacterial flora of skin by swab method.
3. Isolation and enumeration of bacteria from rotten food- bread and carrot.
4. Antibiotic Sensitivity Test by disc-diffusion method.
5. Detection and enumeration of indicator and index microorganisms for water borne pathogens (total enterobacteria, total coliform).

Suggested readings

- Prescott, Harley, and Klein's Microbiology, 8th edition, (2011), Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, McGraw Hill International. ISBN-13:978 0071313674.
- Bailey and Scott's Diagnostic Microbiology, 12th edition (2007), Betty A. Forbes, Daniel F. Sahm and Alice S. Weissfeld; Mosby Elsevier Publishers, ISBN-13: 978-0808923640.
- Microbiology, 6th edition (1993), Pelczar, Chan and Krieg; McGraw Hill International, ISBN-13: 978-0070492585.
- Brock Biology of Microorganisms, 13th edition (2010), Michael T. Madigan, John M. Martinko, David Stahl and David P. Clark, Pearsons, Benjamin Cummings, ISBN-13: 978-0321649638.
- Microbiology: A Laboratory Manual, 10th edition, (2013), James.

Discipline Core (DC)

YEAR 3: SEMESTER VI

(Credits: Theory-4, Practical-2)

DC 13: PAPER 25: Nutraceutical and Functional Food (Theory) (Total Lectures 60)

1. **Nutraceutical and Health:**
   - Concept, classification, sources and importance of nutraceutical.
   - Role of nutraceutical on diabetes, obesity and cardiovascular diseases.
2. **Oxidative stress and Nutraceutical:**
   - Concept of oxidant, antioxidant, oxidative stress and nutraceutical on oxidative stress.
3. **Dietary fibre, Prebiotics and Probiotics:**
   - Classification and nutritional significance of dietary fibre.
   - Prebiotics-Concept, important features, role on health.
   - Probiotics in fermented milk product and non milk products.
4. **Enhancing the nutritional quality of foods:**
   - Fundamentals of Germination and Fermentation.
5. **Genetically modified food and Food fortification:**
   - Concept, available genetically modified (GM) foods in India, techniques for GM food preparation, steps adopted for acceptability of GM food.
   - Concept, importance and application of food fortification.

DC 13: PAPER 26: Practical

Submission of Short Review / Term paper on topic under broad area of Nutraceutical / Prebiotics / Probiotics / Genetically modified food / Food fortification / Any topic on Nutrition and Public Health (Points to be focused-Introduction, Objective, Review of Literature, Summary and conclusion, References).

Suggested readings:

- Cho S. S. and Dreher, M.L. (2001): Handbook Dietary Fibre, Marcel Dekker Inc., New York.
- Yurawecz, M.P., M.M. Mossoba, J.K.G. Kramer, M.W. Pariza and G.J. Nelson eds (1999) Advances in Conjugated Linoleic Acid Research, Vol. 1. AOCS Press, Champaign.
- Wildman, R.E.C. ed. (2000) Handbook of Nutraceuticals and Functional Foods, CRC Press, Boca Raton.
- Fuller, R. ed. (1997) Probiotics Applications and Practical Aspects, London: Chapman and Hall, New York. Prazier, W.C. and Westhoff, D.C. (1988): 4th edition, Food Microbiology, MaGraw Hill Inc.
- Gopalan, C. et al: Nutritive value of Indian Foods. Indian Council of Medical Research.
- Gibson, G., Williams, C. eds (2000): Functional Foods. Woodhead Publishing Ltd. U.K.
- Trease and Evans, Pharmacognosy.

DC 14: PAPER 27: Food Safety and Standards (Theory) (60 Lectures)

1. **Food additive and food safety:**
   - Concept of food safety, factors affecting food safety.
   - Food safety measures: basic concept of HACCP, Safe food handling practices and storing food safely.
   - Food additives-various types and their effects on health.
2. **Food security:**
   - Concept of food security**,** factors affecting food security.
3. **Food adjuncts and preserved products:**
   - Spices (Chilies, Turmeric, Garlic and Ginger), use and nutritional aspect.
   - Jams, Jellies, Pickles, Syrup, Squashes–uses and nutritional aspects.
4. **Food adulterants:**
   - PFA definition of food adulteration, adulterants in commonly consumed food items.
   - Common adulterants in food and their effects on health.
   - Common household methods to detect adulterants in food,
5. **Food laws and regulatory authority:**
   - Prevention of Food Adulteration (PFA) Act.
   - Regulating authority-Codex Alimentarius, ISI, Agmark, Fruit Products Order (FPO), Meat Products Order (MPO), Bureau of Indian Standards (BIS), MMPO, FSSAI**.**

DC 14: PAPER 28: Practical

1. Detection of vanaspati in Ghee.
2. Detection of vanaspati in Butter.
3. Detection of Khesari flour in Besan.
4. Detection of Argemone oil in Edible oil.
5. Detection of Metanil yellow in Turmeric.

Suggested readings:

- Gopalan C and Kaur S (Eds.) (1993). Towards Better Nutrition, Problems and Policies, Nutrition Foundation of India.
- Tovel AP (1984). Standardising Food Service for Quality and Efficiency. AVI Publishing Company INC.
- Dept. of WCD, Govt. of India. (1993): National Nutrition Policy.
- Food and Nutrition Board, Dept. of WCD, Govt. of India (1995): National Plan of Action on Nutrition.
- Roday S (1999). Food Hygiene and Sanitation, 1st Edition, Tata McGraw Hill, New Delhi.
- Diehl JF (1995). Safety of Irradiated Foods Marcel Dekker Inc, New York.
- Raheena Begum: A textbook of food, nutrition and dietetics Sterling Publishers, New Delhi.

DISCIPLINE PLINE SPECIFIC ELECTIVE (DSE)

DSE 1:	**Human Pathology**	**OR**
	Therapeutic Nutrition and Critical Care	
DSE 2 :	**Molecular Biology**	**OR**
	Biophysics and Bioinstrumentation	
DSE 3 :	**Biostatistics and Bioinformatics**	**OR**
	Concept of Research and Health Management	
DSE 4 :	**Food Spoilage and Food Preservation**	**OR**
	Entrepreneurship and Small Catering Units	

Discipline Specific Elective

1. Human Pathology

(Credits: Theory-4, Practical-2)

THEORY **(Lectures: 60)**

1. **Cellular Adaptations, Cell Injury and Cell Death:**
   - Causes and mechanisms of cell injury.
   - Brief concept of cellular responses: Hyperplasia, Hypertrophy, Atrophy, Metaplasia, Necrosis, Apoptosis.
2. **Hemodynamic Pathology:**
   - Brief concept on Edema, Hyperaemia, Haemorrhage, Haemostasis and Thrombosis.
3. **Cell proliferation and Cancer:**
   - Characteristics of benign and malignant neoplasms, grading and staging of cancer, biology of tumor growth (In brief).
   - Concept of oncogenes, tumor suppressor genes and cancer stem cells.
4. **Enzymes: Diagnostic significance:**
   - Distribution, Function and Clinical significance: Creatine kinase, Lactate dehydrogenase, SGPT, SGOT, Amylase, Lipase.
5. **Pathology of Urine:**
   - Physical characteristics-Color, transparency, pH and specific gravity.
   - Chemical characteristics-Protein, Sugar, Ketone bodies, Bile.
   - Microscopical features- RBC, Epithelial cell, Pus cells, Casts and Crystals.

Practical:

1. Colorimetric estimation of hemoglobin level (Drabkin's method).
2. Qualitative detection of sugar and protein in urine sample.
3. Measurement of blood glucose using single touch glucometer (Accucheck).
4. Pregnancy test from urine sample using strip.
5. Routine microscopic examination of urine.

OR

Internship under Pathology department (at least 1 week) of Govt. Hospital / Pvt. Hospital/ Nursing home and documentation of the work followed by report preparation.

OR

Training/Workshop/Short-Term Course from Nutrition and Dietetics/Nutrition and Public Health department of any University/Research Institute/Community Science Centre/Rural Technology Department and documentation of the work followed by report preparation.

Suggested readings:

- Robbins and Cotran Pathologic Basis of Disease, 8th edition (2009), Vinay Kumar, Abul K. Abbas, Jon C. Aster, Nelson Fausto; Saunders Publishers, ISBN-13: 978-1416031215.
- General and Systematic Pathology, 2nd edition (1996), J., Ed. Underwood and J. C. E. Underwood; Churchill Livingstone, ISBN-13: 978-0443052828.
- Robbins Basic Pathology, 9th edition (2012), Kumar, Abbas, Fausto and Mitchell; Saunders Publication, ISBN-13: 978-1437717815.
- Medical Laboratory Technology Methods and Interpretations Volume 1 and 2, 6th edition (2009), Ramnik Sood; Jaypee Brothers Medical Publishers, ISBN-13: 978-8184484496

OR

DSE 1: Therapeutic Nutrition and Critical Care
(CREDITS: THEORY-4, PRACTICAL-2)
Theory: **Total Lecture-60**

1. Diets for febrile conditions, infections and surgical conditions.
2. **Etiology, Pathophysiology, Critical care and Dietary management:**
   - Sepsis
   - Trauma
   - Burns.
3. **Etiology, Pathophysiology, Sign and Symptom and Dietary management:**
   - Osteoarthritis
   - Lupas arthritomatosis.
4. **Etiology, Pathophysiology, Sign and Symptom and Dietary management:**
   - Cold fever
   - Typhoid fever
5. **Etiology, Pathophysiology, Sign and Symptom and Dietary management:**
   - Diarrhoea
   - Cholera

Practical:

1. Therapeutic diet chart preparation for Osteoarthritis (Case specific).
2. Therapeutic diet chart preparation for Typhoid fever (Case specific).
3. Therapeutic diet chart preparation for Burns (Case specific).
4. Therapeutic diet chart preparation for Cholera (Case specific).

OR

Internship under dietetics department (at least 1 week) of Govt. Hospital / Pvt. Hospital / Nursing home and documentation of the work followed by report preparation.

OR

Training/Workshop/Short-Term Course from Nutrition and Dietetics/Nutrition and Public Health department of any University/Research Institute/Community Science Centre/Rural Technology Department and documentation of the work followed by report preparation.

Suggested readings

- Khanna K, Gupta S, Seth R, Passi SJ, Mahna R, Puri S (2013). Textbook of Nutrition and Dietetics. Phoenix Publishing House Pvt. Ltd.
- Mahan L K and Escott Stump S (2013). Krause's Food & Nutrition Therapy, 13th ed. Saunders-Elsevier.
- Stacy Nix (2009). William's Basic Nutrition and Diet Therapy, 13th Edition. Elsevier Mosby.
- ICMR (1999). Nutritive Value of Indian Foods. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad.
- Seth V and Singh K (2007). Diet Planning through the Life Cycle Part II: Diet Therapy. A Practical Manual, 4th edition. Elite Publishing House Pvt. Ltd.

Discipline Specific Elective
Molecular Biology
(Credits: Theory-4, Practical-2)

THEORY **Lectures: 60**

1. Nucleic acid: Bases, nucleosides and nucleotides.
2. DNA structure: DNA double helix (Watson and Crick Model).
3. Types of DNA and RNA, DNA and RNA as genetic material.
4. DNA replication: Semi-conservative replication, Basic mechanism of replication (Prokaryotes).
5. Transcriptional unit and basic concept of transcription (Prokaryotes).
6. Genetic code and basic mechanism of translation (Prokaryotes).
7. Introduction to recombinant DNA techniques and their application.
8. Basic concept of genomics, proteomics and metabolomics.

Practical:

1. Demonstration of plasmid DNA isolation.
2. Demonstration of of Agarose Gel electrophoresis.
3. Demonstration of PCR.
4. Demonstration of SDS-PAGE.
5. Exposure visit in any laboratory of Biological Sciences / Biodiversity Research Centre / Biotechnology Laboratory / Rural Technology Laboratory and documentation.

Note: Wherever lab experiments are not possible, the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.

Suggested readings

- Bolandar, M. (2001). Molecular Endocrinology. Elsevier Science.
- Alberts, B. et al. (2008). Molecular Biology of the Cell. 5th Ed. Garland Publishing House.
- Yoshinori Mine (Editor), Kazuo Miyashita (Editor), Fereidoon Shahidi (Editor): Nutrigenomics and Proteomics in Health and Disease: Food Factors and Gene Interactions.
- Van Ommen, B. (2004). Nutrigenomics: Exploiting systems biology in the nutrition and health arenas. Nutrition.20:4-8. Simopoulos, A.P. and Ordovas, J.M. (Editors) (2004). Nutrigenetics and Nutrigenomics.
- Roche, H.M. (2004). Dietary lipids and gene expression. Biochem Soc Trans. 32 (Pt6): 999-1002.
- Mount, D. W. Bioinformatics. Sequence and Genome Analysis, CSHL Press.
- Jones.N. C., Pevzner, P. A. (2004). An Introduction to Bioinformatics Algorithms, MPI Press.
- Kaput J, Rodriguez RL. (2004)Nutritional genomics: The next frontier in the postgenomic era. Physiol Genomics.16:166-177.
- Kaput J. and Rodriguez. R. L. (2006). Nutritional Genomics. John Wiley & Sons, Inc.

Discipline Specific Elective
Biophysics and Bioinstrumentation
Credits: Theory 4, Practical 2

Theory **Lectures: 60**

1. Basic principles of electromagnetic radiation:

- Concept of energy, wavelength, wave numbers and frequency

2. UV-visible spectrophotometry:

- Beer-Lambert law, light absorption and its transmittance.
- Fluorescence spectroscopy-Theory of fluorescence, static and dynamic quenching, fluorescent probes in the study of protein and nucleic acids.

3. Sedimentation:

- Physical basis of centrifugation, Svedberg equation, differential and density gradient centrifugation, ultracentrifugation techniques.

4. Separation and identification of materials:

- Concept of chromatography-Mobile phase, Stationary phase, Partition chromatography, Absorption chromatography.
- Principal, Methods and Application-Paper chromatography, Thin layer chromatography (TLC), Gas liquid chromatography (GLC), High performance liquid chromatography (HPLC).

5. Flow cytometry:

- Basic principle of flow cytometry and cell sorting, detection strategies in flow cytometry.

Practical:

1. Demonstration on Instrument details, operation and maintenance –
   a. Colorimeter/UV visible spectrophotometer.
   b. Centrifuge machine (high speed and low speed).
   c. High Performance Liquid Chromatography (HPLC).
   d. Flow cytometry.
2. Exposure visit in any laboratory of Biological Sciences / University Science Instrumentation department/centre (any university) and documentation.

Note: Wherever the instruments are not available the instrument details can be demonstrated through any other material or medium including videos/virtual labs etc.

Suggested readings

- Physical Biochemistry: Principles and Applications, 2nd edition (2009), David Sheehan, John Wiley. ISBN-13: 978-0470856031.
- Physical Biochemistry: Applications to Biochemistry and Molecular Biology, 2nd edition (1982), David Freifelder, W.H. Freeman and Company. ISBN-13: 978-0716714446.
- Tinoco K, Sauer JC, Wang and Puglisi JD, Prentice Hall, ISBN-13: 978-0130959430.
- Biophysics, 1st edition (1983), W. Hoppe, W. Lohmann, H. Markl and H. Ziegler, Springer-Verlag, ISBN-13: 978-3540120834.

Discipline Specific Elective

Biostatistics and Bioinformatics

(Credits: Theory-4, Practical-2)

THEORY **Lectures: 60**

1. Data and Data Types: Primary data and Secondary Data, Methods of data collection, presentation of data-diagrammatic and graphical.
2. Measures of Central Tendency: Mean, Median, Mode.
3. Dispersion: Range, Standard Deviation.
4. Hypothesis Testing: Chi-square Test, Student't' test, Analysis of Variance (ANOVA).
5. Bioinformatics and Health Informatics: Concept and applications.
6. Nutrigenomics and Pharmacogenomics: Concept and applications.
7. Nucleic acid and Protein Data Bases, Nutrient data bases.
8. Sequence similarity searching by BLAST, Principle, features and types of BLAST, Significance of Multiple Sequence Alignments, Phylogenetic Tree.

Practical:

1. Computerized (MS Excel) presentation of bar diagram, histogram, line diagram, pie chart using various data.
2. Retrieval of nucleic acid/protein sequence from data bases, Storing of sequence and conversion of one sequence format to another, Sequence alignment (pair-wise alignment and multiple sequence alignment).
3. Retrieval of protein structure from Protein Data Bank, Protein structure visualization.

Suggested readings

- Saxena Sanjay (2003) A First Course in Computers, Vikas Publishing House.
- Pradeep and Sinha Preeti (2007) Foundations of Computing, 4th ed., BPB Publications.
- Lesk M.A. (2008) Introduction to Bioinformatics. Oxford Publication, 3rd International Student Edition.
- Rastogi S.C., Mendiratta N. and Rastogi P. (2007) Bioinformatics: methods and applications, genomics, proteomics and drug discovery, 2nd ed. Prentice Hall India Publication.
- Primrose and Twyman (2003) Principles of Genome Analysis & Genomics. Blackwell.
- Debjyoti Das (2012). Biostatistics.
- E. Batschelet : Introduction to Mathematics for Life Scientists,Springer Verlag, International Student Edition, Narosa Publishing House, New Delhi (1971, 1975).
- A. Edmondson and D. Druce: Advanced Biology Statistics, Oxford University Press; 1996.

Discipline Specific Elective
Concept of Research and Health Management
(Credits: Theory-4, Practical-2)

THEORY **Lectures: 60**

1. **Fundamental of research:**
   - Objectives, Types of research-Action research, Applied research, Experimental research, Steps of research.
   - Types of sampling, Design of Sampling, Characteristics of good sampling.
2. **Research and academic activities:**
   - Concept and purpose - Seminar, Workshop, Conference, Symposium.
3. **Health planning and management:**
   - Brief idea on health planning, different health planning committee and their recommendation.
   - Concept on National health policy, Population policy and Nutritional policy.
   - Concept of Rural Development and Integrated Rural Development Programme (IRDP).
   - Techniques and methods of management (organizational design, communication and information systems, cost-benefit analysis, cost effective analysis, cost accounting, network analysis- Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM).
4. **Health care system:**
   - Health Problems: Fundamentals of communicable and non communicable disease problem, Nutritional problem, Environmental sanitation problem, Medical care problem, Population problems.
   - Indian health care system- Primary, Secondary and Tertiary (Elements, principles and service delivery).

Practical:

Submission of Project report (Outline to be followed: Introduction, Objective, Review of Literature, Methodology, Results, Discussion, Summary and Conclusion, References).

Suggested readings

- Kumar, R. (2005) Research Methodology: A Step by Step Guide for Beginners. Sage Publications, New Delhi.
- Kerlinger F. N. and Lee, H.B. (2000) Foundations of Behavioural Research 4th Ed. Harcourt College Publishers.
- Kothari, C. R. (2008) Research Methodology: Methods and Techniques 2nd Ed. New Age International Pvt Ltd, New Delhi.
- Black, J.A. & Champion, D. J. (1976) Methods and Issues in Social Research. New York: John Wiley and Sons.
- K. Park (2013). Preventive and Social Medicine.

Discipline Specific Elective

Food Spoilage and Food Preservation

(Credits: Theory-4, Practical-2)

THEORY **Lectures: 60**

1. **Fundamentals of food spoilage:**
   - Classification of food based on pH.
   - Definition-shelf life, perishable and semi perishable foods, shelf stable foods.
   - Role of microorganisms in the spoilage of different kinds of food – cereal and cereal products, vegetables and fruits, fish and other sea foods, meat and meat products.
2. **Preservation by low and high temperature:**
   - Principle of freezing, changes occurring during freezing.
   - Types of freezing - slow freezing, quick freezing.
   - Heat preservation methods: Sterilization, Pasteurization and blanching.
3. Preservation by Moisture control:
   - Concept of drying and dehydration, differences between sun drying and dehydration (i.e. mechanical drying).
   - Factors affecting rate of drying, types of driers used in the food industry.
4. Preservation by Irradiation:
   - Units of radiation, kinds of ionizing radiations used in food irradiation.
   - Mechanism of action, concept of cold sterilization.

Practical:

Visit to Food Industry / Dairy Industry and Report Preparation (Special attention: Processing, Packaging, Preservation techniques, food plant sanitation and hygiene).

OR

Training/Workshop/Short-Term Course on Food Processing Technology/Food Microbiology/Food Preservation from Nutrition and Dietetics/Nutrition and Public Health/Food and Nutrition department of any University/Research Institute/Community Science Centre/Rural Technology Centre and documentation of the work followed by report preparation.

Suggested readings

- B. Srilakshmi, Food science, New Age Publishers, 2002.
- Meyer, Food Chemistry, New Age, 2004.
- Bawa. A.S, O.P Chauhan et al. Food Science. New India Publishing agency, 2013.
- Frazier WC and Westhoff DC, Food Microbiology, TMH Publication, New Delhi, 2004.
- Raina U, Kashyap S, Narula V, Thomas S, Suvira, Vir S, Chopra S (2010). Basic Food Preparation: A Complete Manual, Fourth Edition. Orient Black Swan Ltd.
- Manay S. and Shadaksharaswamy M (2002). Foods–Facts and Principles. Wiley Eastern Ltd.
- Potter H (1995). Food Science, 5th Edition. CBS Publishers & Distributors.

Discipline Specific Elective

Entrepreneurship and Small Catering Units

(Credits: Theory-4, Practical-2)

THEORY **Lectures: 60**

1. **Introduction to Food Service and Menu Planning:**
   - Concept of Food service, Food hygiene and sanitation.
   - Origin of Food Service units, kinds of food service units.
   - Types of menu, Importance of menu, factors affecting menu planning.
2. **Food Production Process:**
   - Quantity food production: Standardization of recipes, Recipe adjustments and portion control, Food purchase and receiving, Storage.
3. **Organization and Management:**
   - Principles of management, functions of management/ manager.
   - Space-Types of kitchen areas, Flow of work and work area relationship.
   - Equipment-factors affecting selection of equipment, equipment needs for different situations.
   - Financial Management-Importance of Financial Management, Concept of cost, Budgets and budgeting process.
4. **Planning of A Small Food Service Unit:**
   - Survey of types of units, identifying clientele, menu, operations and delivery.
   - Identifying resources, Developing Project plan, Determining investments, Development of a business plan.

Practical:

1. Market survey for food items both raw and processed.
2. Survey of food service units.
3. Planning menus for the following:
   - Packed meals for office employees.
   - Nutritious tiffins for school children.
   - School/college canteens
4. Demonstration of a specialized cuisine
5. Develop a checklist for good hygiene practices

Suggested readings:

- West B Bessie & Wood Levelle (1988). Food Service in Institutions 6th Edition Revised By Hargar FV, Shuggart SG, & Palgne Palacio June, Macmillian Publishing Company New York.
- Sethi Mohini (2005). Institution Food Management New Age International Publishers.
- Knight JB & Kotschevar LH (2000). Quantity Food Production Planning & Management 3rd edition John Wiley & Sons.
- Kazarian EA (1977). Food Service facilities Planning 3rd Edition Von Nostrand Reinhold New York.
- Taneja S and Gupta SL (2001). Enterpreneurship development, Galgotia Publishing.

GENERIC ELECTIVES (GE)

GE 1: Nutritional importance of Foods
GE 2: Physiology of Nutrition
GE 3: Nutrition and phases of Life
GE 4: Nutritional Assessment Programme

Generic Elective
Nutritional importance of Foods
(Credits: Theory-4, Practical-2)

THEORY **Lectures: 60**

1. Concept and definition of terms:
- Food, Food Groups, Food Pyramid, Functions of food.
- Nutrient and Nutritive value, Concept of Balanced Diet.

1. Cereals, Pulses and legumes:
- Nutritional aspects of wheat, rice and oat.
- Types of pulses and legumes, uses, and nutritional aspects.

2. Milk and milk Products:
- Nutritive value of milk, composition of milk,
- Types of processed milk, milk products (butter, curd, paneer and cheese), Pasteurization.

3. Egg, Fish and meat:
- Nutritional aspects and uses.
- Nutritional aspects of edible fish and meat, concept of red and white meat.

4. Vegetables and fruits:
- Uses and nutritional aspect of commonly available vegetables.
- Fresh fruits and dry fruits– raw and processed product.

5. Salts, Fats and oils:
- Uses and nutritional aspects of various salts.
- Types, sources, use and nutritional aspects of fats and oils.

6. Methods of cooking:
- Dry, moist, frying and microwave cooking.
- Effect of various methods of cooking on foods, nutrient losses in cooking.

Practical:

Food preparation and nutritive value as per portion size wherever applicable -

1. Beverages: Lassi

2. Cereals: Fried Rice

3. Milk and milk products: Payasam

4. Eggs: Egg pudding

5. Snacks: Sandwiches

Suggested readings:

- Hughes O, Bennion M (1970). Introductory Foods, Macrnillan & Co. New York.
- Lavies S (1998). Food Commodities.
- Pomeranz Y (Ed) (1991). Functional Properties of Food Components, (2nd edition), Academic Press, New York.
- Tindall HD (1983). Vegetables in the Tropics, MacMillan Press, London.
- Winton AL, Winton KB (1999). Techniques of Food Analysis. Allied Scientific Publishers.
- Winton AL, Winton KB (1999). Techniques of Food Analysis. Allied Scientific Publishers.

Generic Elective
Physiology of Nutrition
(Credits: Theory-4, Practical-2)

THEORY **Lectures: 60**

1. Concept and definition of terms:
- Growth, Development, Nutrition, Malnutrition and Health, Scope of Nutrition.

2. Role of Vitamins and Minerals:
- Fat soluble vitamin-Physiological role, dietary sources and deficiency disorders.
- Water soluble vitamin- Physiological role, dietary sources and deficiency disorders.
- Minerals-Physiological role, dietary sources and deficiency disorders in special references to calcium, iron, sodium and potassium.

3. Principles of meal planning:
- Food exchange list, Factors affecting meal planning and food related behavior.
- Dietary guidelines for Indians.

4. Minimum nutritional requirement and RDA:
- Formulation of RDA, dietary guidelines with reference to man and woman.

5. Energy in human nutrition:
- Energy and its unit, Energy assessment and balance, Factors of energy requirement, BMR and its regulation, SDA of food.

Practical:

1. Growth chart: Plotting and Interpretation using primary or secondary data in accordance with both ICMR and WHO Chart.
2. Clinical assessment and sign of nutrient deficiency disorders: Protein energy malnutrition (PEM), Anaemia, Rickets, Goiter (Slide/Photography).
3. Clinical assessment and sign of vitamin deficiency disorders: Vitamin A, Vitamin C and Vitamin B-complex (Slide/Photography).

Suggested readings:

- Gopalan C (198). Nutritive value of Indian Foods. Indian Council of Medical Research.
- Guthrie AH (1986). Introductory Nutrition, 6th Ed. The C.V. Mesby Company.
- Indian Council of Medical Research (2003). Nutrient Requirements and Recommended-Dietary Allowance for Indians. New Delhi.
- WHO (1979). A growth chart for International use in Maternal and Children Health Care, Geneva.
- Winword (1988). Sear's Anatomy and Physiology for Nurses. London, Edward Arno ll.
- Swaminathan M (2009). Essentials of Foods and Nutrition, Vols -1 and II. Ganesh and Co. Madras.

Generic Elective
Nutrition and phases of Life
(Credits: Theory-4, Practical-2)

THEORY **Lectures: 60**

1. Nutrition during infancy:

- Breast feeding, Formula feeding, Weaning, Supplementary foods, Nutritional management of Preterm baby.

2. Nutrition for children:

- Diet in early childhood, elementary school age, high school age.

3. Nutrition during pregnancy and lactation:

- Nutritional demands of Pregnancy, Food selection during Pregnancy, Complications of pregnancy and dietary management, Diet during Lactation.

4. Nutrition to athletes:

- Nutritional requirements and dietary management in sports man and athletes, Meal planning for athletes.

5. Geriatric nutrition:

- Planning of meals for older people, Nutrition of aged persons, Physiological complications in geriatric group and dietary modifications required.

Practical:

1. Preparation of normal diets for infant (Dahl soup).
2. Preparation of normal diets for preschool children (Dalia).
3. Preparation of normal diets for pregnant lady and lactating mother (Khicheri with mixed vegetables).

Note: In laboratory note book, calculation of nutritive value should be recorded according to portion size of specific diet for particular individual.

Suggested readings:

- Hoar WS (1984). General and comparative Physiology. 3rd ed. Prentice-Hall of India.
- Indian Council of Medical Research (2003). Nutrient Requirements and Recommended-Dietary Allowance for Indians. New Delhi.
- Sherwood L (2004). Human Physiology: From cells to systems. 5th ed. Thomson Brooks Cole.
- Swaminathan M (2009). Essentials of Foods and Nutrition, Vols -1 and II. Ganesh and Co. Madras.
- Walker WA and Watkins JB (Ed.) (1985). Nutrition in Pediatrics, Boston, Little Brown & Co.
- WHO (1979). A growth chart for International use in Material and Children Health Care. Geneva.
- Wilson (1989). Anatomy and Physiology in Health and Illness. Edinburgh, Churchill Livingstone.

Generic Elective
Nutritional Assessment Programme
(Credits: Theory-4, Practical-2)

THEORY **Lectures: 60**

1. Assessment of Nutritional Status and Surveillance:

- Direct Nutritional status assessment of human groups - Biochemical, Biophysical and anthropometric methods.
- Indirect assessment: Secondary sources of community health data.

2. Concept of surveillance systems:

- Role of international and national organizations and agencies (WHO, FAO, UNICEF, CARE, NIN, CFTRI, ICMR).

3. Communication in Nutrition and Health Education:

- Type, process and media of communication.
- Importance and relevance of Information, Education and communication (IEC) in Nutrition and Public Health.

4. National Nutritional Intervention Programmes:

- Objective, Target group, Scheme details - Integrated Child Development Services (ICDS), Mid Day Meal Programme (MDMP), Vit A prophylaxis Prophylaxis programme, Anemia prophylaxis programme.

5. Immunization Programme:

- Immunization: National Immunization schedule for children and adults, Immunization for foreign travelers.

Practical:

1. Anthropometric measurement of Weight for age, height for age, weight for height and its comparison with reference value.
2. Determination of BMI and comments on results.
3. Measurement of circumference of chest, upper arm, waist - hip ratio.

Suggested readings:

- Jelliffe DB and Jelliffe EFP (1989). Community Nutritional Assessment, Oxford University Press WHO. The growth chart: A tool for use in infant and child health care. Geneva: WHO; 1986.
- Gopalan C (1992). Growth charts in Primary Health Care – Time for Reassessment. NFI Bulletin.
- Ghosh S (1997). Nutrition and child care – A practical guide. 1st ed. Jaypee Brothers; New Delhi.
- NIPCCD. Growth Monitoring Manual. 1st ed. Deptt. Of Women and child development. Ministry of HRD: 1988.

Skill Enhancement Courses

SEC 1: Environment Management and Public Health OR
Technology of Fruits and Vegetables

SEC 2: Rural Technology and Public Welfare **OR**
Immunology and Toxicology

Skill Enhancement Course

Environment Management and Public Health

(Credits: 2) **Lectures: 30**

1. **Environmental Hazard:**
   a. Sources of Environmental hazards, Hazard identification and accounting, Fate of toxic and persistent substances in the environment.
2. **Global Warming:**
   a. Greenhouse gases and global warming, Acid rain, Ozone layer destruction, Effect of climate change on public health.
3. **Pollution and Environmental Waste:**
   a. Sources and effects on health: Air, water and noise pollution, Pollution control.
   b. Sources of waste, types and characteristics.
   c. Sewage disposal and its treatment / management, Solid waste disposal.
   d. Biomedical waste handling and disposal, nuclear waste handling and disposal, Waste from thermal power plants.
4. **Causes, Symptoms and Effects on health:**
   a. Pneumoconiosis-Silicosis, Asbestosis, Bagassosis, Byssinosis.
   b. Minamata disease, Arsenicosis, Fluorosis.
5. **Vector Biology and Public Health:**
   a. Biology, Importance and control- *Anopheles, Culex, Aedes* and Sandfly
   b. Causative agents, Pathogenicity and Control of Dengue and Encephalitis.
   c. Integrated Management of Mosquito control.
   d. Mode of action and Role of Bio-insecticides*: Bacillus thuringiensis* and *Bacillus sphaericus.*

Suggested readings

- Cutter SL. Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
- Kolluru Rao, Bartell Steven, Pitblado R and Stricoff "Risk Assessment and Management Handbook", McGraw Hill Inc., New York, 1996.
- Kofi Asante Duah "Risk Assessment in Environmental management", John Wiley and sons, Singapore, 1998.
- Kasperson JX and Kasperson RE and Kasperson RE. Global Environmental Risks, V.N. University Press, New York, 2003.
- Joseph F Louvar and B Diane Louver Health and Environmental Risk Analysis fundamentals with applications, Prentice Hall, New Jersey 1997.

Skill Enhancement Course

Technology of Fruits and Vegetables

(Credits: 2) **Lectures: 30**

1. **Fundamentals of Fruits And Vegetables:**
   a. Importance of fruits and vegetable, history and need of preservation, reasons of spoilage, method of preservation (short & long term).
   b. Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments.
   c. Pathological and chemical changes during the storage of fruits and vegetables.
2. **Canning and Bottling of Fruits and Vegetables:**
   a. Selection of fruits and vegetables, process of canning, factors affecting the process-time and temperature, containers of packing, lacquering, syrups and brines for canning, spoilage in canned foods**.**
3. **Fruits Beverages:**
   a. Introduction, Processing of fruit juices (selection, juice extraction, deaeration, straining, filtration and clarification), preservation of fruit juices (pasteurization, chemically preserved with sugars, freezing, drying, tetra-packing, carbonation),
4. **Jams, Jellies and Marmalades:**
   a. Jam - Constituents, selection of fruits, processing and technology**.**
   b. Jelly-Essential constituents (Role of pectin), Theory of jelly formation, processing and technology, defects in jelly**.**
   c. Marmalade-Types, processing and technology, defects.
5. **Pickles, Chutneys, Sauces and Tomato Products:**
6. Processing, Types, Causes of spoilage in pickling**.**
   a. **S**election of tomatoes, pulping and processing of tomato juice, tomato puree, paste, ketchup, sauce and soup.
7. **Dehydration of Fruits and Vegetables:**
   a. Drying and mechanical dehydration, process variation for fruits and vegetables, packing and storage**.**

Suggested readings:

- Girdharilal, Siddappaa, G.S and Tandon, G.L.1998. Preservation of fruits & Vegetables, ICAR, New Delhi.
- W B Crusess.2004. Commercial Unit and Vegetable Products, W.V. Special Indian Edition, Pub: Agrobios India.
- Manay, S. & Shadaksharaswami, M.2004. Foods: Facts and Principles, New Age Publishers.
- Ranganna S.1986. Handbook of analysis and quality control for fruits and vegetable products, Tata Mc Graw-Hill publishing company limited, second edition.
- Srivastava, R.P. and Kumar, S. 2006 . Fruits and Vegetables Preservation- Principles and Practices. 3rd Ed. International Book Distributing Co.

Skill Enhancement Course

Rural Technology and Public Welfare

(Credits: 2) **Lectures: 30**

1. **Concept on Rural Sociology and Welfare:**
   Characteristics of rural society, Characteristics of urban life, Contrast between rural and urban life.
2. **Environment and Biodiversity Conservation:**
   Definition of Biodiversity, levels of biodiversity, uses of biodiversity, India's biodiversity and its conservation, Concept of People`s Biodiversity Register (PBR).
3. **Mushroom Cultivation Technique:**
   Types of edible Mushroom species, Nutritional value of Mushrooms, Medicinal value of mushrooms.
   Mushroom Production Technique of Button Mushroom (*Agaricus*), Oyester Mushroom (*Pleurotua)*, Paddy Straw Mushroom (*Volvariella*).
   Spawn Production Techniques: Preparation of culture, Mother Spawn Production, Multiplication of spawn.
4. **Apiculture:**
   Definition of apiculture, Origin, Classification and its silent feature, Species of honeybee and their castes.
   Equipments and Appliances: Bee Hive, Comb, other appliances for bee keeping.
   Properties of Honey: Physical and chemical properties of honey, Honey bee products and their values
5. **Nutraceutical Enrich Medicinal Plants:**
   Importance of Medicinal Plants**:** Amla, Brahmi, Arjuna, Garlic, Ginger, Tulsi, Turmeric, Ashwagandha, Aloe-Vera, Sarpgandha, Isubgol.
6. **Extension Strategies for Rural Development:**
   Krishi Vigyan Kendra, Lab to Land Programme, Operational Research Project, Role of ICAR and ICMR in transfer of technology.

Suggested readings:

- Jalihal KA & Veerabhadraiah V. 2007. Fundamentals of Extension Education and Management in Extension . Concept Publ.
- Van Den Ban AW & Hawkins HS. 1998. Agricultural Extension .2nd Ed. CBS.
- Rural Sociology: Dr. Kumar, Lakshmi Narain Agrwal, Educational Pubilsher, Anupam Plaza-I, Block No. 50, Sanjay Place, Agra-2.
- Mushroom Growing, S.C. Day, Agrobios India.
- Mushroom and their Cultivation Technique, R. C. Ram, Aavishkar Publishers, Distibutors, Jaipur,India.
- Vermiculture and Organic Farming, T. V. Sathe, Daya Publishing House, New Delhi.

Handbook of Beekeeping: Dharm Singh/ Devendra Pratap Singh, Agrobios, India.**Skill**

Skill Enhancement Course

Immunology and Toxicology

(Credits: 2) **Lectures: 30**

1. **Immunology:**
   - Basic concept of immunity, Types of immunity-Naturally acquired active and passive immunity, artificially acquired active and passive immunity.
2. **Humoral immune system:**
   - Mechanisms, the antigens and antibodies-their structure, immunoglobulin isotypes-IgG, IgM, IgA, IgD, and IgE.
3. **Cell mediated immune system:**
   - Types of effector T cells, mechanisms of cell mediated immunity.
4. **Toxicology:**
   - Brief history, Different areas of modern toxicology, classification of toxic substances, various definitions of toxicological significance.
5. **Toxic agents:**
   - Human exposure, mechanism of action and resultant toxicities of the following xenobiotics: **Metals:** lead, arsenic, **Pesticides:** organophosphates, carbamates, organochlorine and anticoagulant pesticides.
6. **Eco-toxicology:**
   - Brief introduction to avian and aquatic toxicology, movement and effect of toxic compounds in food chain (DDT, mercury), bioaccumulation, biomagnification, concept of BOD and COD.
7. **Clinical toxicology:**
   - Management of poisoned patients, clinical methods to decrease absorption and enhance excretion of toxicants from the body use of antidotes.

Suggested reading:

- Immunology, 8th edition, (2012), Male, D., Brostoff, J., Roth, D.B. and Roitt, I., Elseivier-Sauders. ISBN-13: 978-0323080583.
- An Introduction to Immunology, Immunochemistry and Immunobiology, 5th edition, (1988), Barrett, James T., Mosby Company, St. Louis. ISBN-13: 978-0801605307.
- Immunology: An Introduction, 4th edition, (1994), Tizard, I.R., Saunders College Publishing, Philadelphia. ISBN-13: 978-0030041983.
- Cassarett and Doull's "Essentials of Toxicology" 2nd edition (2010), Klaassen and Whatkins, McGraw Hill Publisher. ISBN-13: 978-0071622400.
- Introduction to Toxicology, 3rd edition (2001), John Timbrell, Taylor and Francis Publishers. ISBN 13: 9780415247627.
- Principles of Toxicology, 2nd edition (2006), Stine Karen and Thomas M Brown, CRC press. ISBN-13: 978-0849328565.