Approved by Academic Committee of INFS on 08.04.2003 and
Academic Council on 29.05.2003

Institute of Nutrition and Food Science
University of Dhaka

Syllabus for Four Year B.S. (Hons) Degree in Nutrition and Food Science (Session 2002-2003 and onward)

Year-wise distribution of course credits

Year	Theory	Practical	Viva	Total Credit
First	**20**	**4**	**4**	**28**
Second	**20**	**6**	**4**	**30**
Third	**22**	**6**	**4**	**32**
Fourth	**24**	**10**	**4**	**38**
Total	**86**	**26**	**16**	**128**

Each four credit (previous one unit) will carry 100 marks (60 hours) and each two credit (previous half unit) will carry 50 marks (30 hours).

DETAILED SYLLABUS OF COURSES FOR THE FIRST YEAR

Course number		Name of course	Credit
Theory:	**NFS-101**	Introduction to Nutrition & Food Science	**4**
	NFS-102	Organic Chemistry	**4**
	NFS-103	Inorganic and Physical Chemistry	**2**
	NFS-104	Micro Economics	**2**
	NFS-105	Social Nutrition	**2**
	NFS-106	Microbiology	**2**
	NFS-107	Foundation Course in English	**4**
Sub-total			**20**
Practical	**NFS-111**	Practical : (Chemistry)	**4**
Viva Voce	**NFS-121**	Viva-Voce	**4**
Total			**28**

Course No. NFS-101 Introduction to Nutrition and Food Science 4 Credit

1. History of Nutrition
2. Cell and tissues – classifications and functions. Body fluid and its compartments, homeostasis. Nutrients and cell.
3. Nutrition, health and disease. Life cycle.
4. The cell and its components: cell as the basic living unit, prokaryotes and eukaryotes, structure and function of sub cellular organelles, chemical components of cell.
5. Concept of life and living process, the identifying characteristics of a living matter.
6. Concepts of Food- Nutrition and Nutrients. Macronutrients-carbohydrate, fat and protein; and micronutrients-vitamins and minerals, their chemical structures, basic physiological functions, name of deficiency diseases. Body requirement and RDA.
7. Energy: Energy values of carbohydrate, fat and protein (Atwater factors). Basal Metabolic Rate (BMR). Concepts of energy requirement for different ages and physiological groups.
8. Aspects of food science. Concepts of foods. Food Sources. Classification of foods. Nutritive values of common foodstuffs. Functions of foods. Loss of nutrients in different condition. Food beliefs and misconception.
9. Role of diets in the treatment of diseases.
10. Nutritional status. Role of nutrition in human development. Forms and types of malnutrition. Importance of nutrition. Nutritional assessment.

11. Pattern of malnutrition in developed and developing countries. Major nutritional problems in Bangladesh.
12. Nutrition and National development: development effect in labour productivity, education, population growth and health expenditures
13. Definition, components and development of food science; activities and scopes of food science, content of foods and their significance.

Recommended Books:

1. Proudfit's Normal and Therapeutic Nutrition – C.H. Robinson
2. Advanced Text Book on Food and Nutrition – vol.-1, M. Swaminathan
3. Food Science – N. N. Potter
4. Text Book of Human Nutrition- M.S.Bamji, N.P.Rao and V. Reddy (eds)
5. Human Nutrition in the Developing World-Latham MC
6. Synopsis of Anatomy & Physiology- Van, Fox, Lafleur
7. Essentials of Anatomy & Physiology-Seeley, Stephens, Tate
8. Handbook on Edible Oils and Fats- G.Mowlah

Course No. NFS-102 Organic Chemistry 4 Credit

1. Aliphatic hydrocarbons: Occurrence, structure, nomenclature, preparation, physical and chemical properties of saturated and unsaturated aliphatic hydrocarbons.
2. Aromatic hydrocarbons: Structure of benzene, source of aromatic hydrocarbons, industrially important aromatic compounds, nomenclature of benzene derivatives, electrophilic aromatic substitution.
3. Alcohols, ethers, epoxides and diols: Occurrence, structure, nomenclature, preparation, physical and chemical properties and uses.
4. Dienes and Polyenes:Structure and properties of 1, 3-butadiene, addition reaction, polymerization, Diels-Alder reaction.
5. Aldehydes and ketones: Nomenclature, synthesis, nucleophilic addition reaction, oxidation-reduction of carbonyl compounds, haloform reactions, enolisation, halocarbonyl compounds, aldol-condensation, benzoin condensation.
6. Carboxylic acid and their derivatives: Nomenclature, preparation, classification, properties and reactions, decarboxylation reactions, dicarboxylic acids, esters.
7. Nitro-compounds and amines: Occurrence, nomenclature, preparation, classification, properties, reactions, uses, diazotisation and diazonium compounds.
8. Phenols: Occurrence, nomenclature, preparation, properties and reactions, polyhydric phenols.
9. Heterocyclic compounds (Pyrroles, purines and pyrimidines): Preparation, structure and properties.
10. General idea of organic compounds of sulfur and phosphorus.

Recommended Books

1. Principles of Organic Chemistry--J.English & H.G. Cassidy
2. Organic Chemistry. vol I & II- I.L. Finar.
3. Test book of Organic Chemistry- R.T. Marrison & R.N. Boyd
4. Organic Chemistry- H.Hart & R.D.Schuetz
5. Advanced Organic Chemistry- B.S. Bahl & A. Bahl

Course No. NFS-103 Inorganic and Physical Chemistry 2 Credit

1. Chemical Bonds: Electronic concepts of chemical bonds, ionic bond, co-ordination bond, covalent bond, hybrid orbitals, polarity of bonds, electro-negativity, dipole moment, potential curve, weak bonds, hydrogen bond and hydrophobic interactions, bond energies.
2. Oxidation and Reduction : Classical, valence state, electro-negativity, charge and electronic concept, oxidation state and oxidation number, oxidation reduction reactions, equivalent weights of oxidizing and reducing agents.
3. Chemical Equilibrium. Nature of chemical equilibrium, law of mass action, equilibrium constant, relationship between Δ G and Keq, effect of temperature and pressure.
4. Acid, bases and buffers, Bronsted-Lowry concept, Lewis concept, strength of acids, p^H of solutions, Henderson-Hasselbalch equation, acid base indicator, acid-base titration's, choice of a suitable indicator, Ostwald's theory of acid base indicators, salt hydrolysis, buffer solution and buffer capacity.
5. Colligative properties, osmosis, osmotic behavior in living cell, ionization of electrolytes, degree of ionization, strong and weak electrolytes.

Recommended Books

1. Introduction to Modern Inorganic Chemistry- S.Z. Haider
2. Modern Inorganic Chemistry- R.D. Madan
3. Physical Chemistry with application to Biological systems- R. Chang
4. Elements of Physical Chemistry- S. Glasstone & D. Lewis
5. Test book of Organic Chemistry- R.T. Morrison & R.N. Boyd.
6. The Chemistry of Matter- J.B. Pierce , 1970 (New York, Houghtor Mifflin Company)
7. Principles of Physical Chemistry- M.M. Huque, 1974
8. Principles of Physical Chemistry- M.M.Huque & M. Ali Nawab
9. Test book of Physical Chemistry- S. Glasstone
10. Principles of Physical Chemistry- S.H. Maron & C.F.Prutton
11. Principles of Physical Chemistry - Hamill, Williams, Mackay
12. Elementary Physical Chemistry - S.R. Palit
13. Essentials of Physical Chemistry - B.S. Bahl, G.D. Tuli & Arun Bahl

Course No. NFS-104 Micro Economics 2 Credit

1. Definition and scope of Economics. Basic concepts in economics, Fundamental Quantitative Relationship.
2. The theory of utility and demand. Marginal utility and Indifference curve Analysis consumer surplus, concept of elasticity ; Elasticity of demand and supply, measurement of Elasticity.
3. Production : Factors of Production, Division of Labour, Specialization with Economics of scale. Small and large-scale production, isoproduct curves and production function.
4. Theory of Value : Supply and demand, Market structure and working of the price system. Perfect and Imperfect competition. Pricing under perfect competition and monopoly. Short run and long-run Equilibrium Analysis. Cost Analysis and supply curve.
5. Pricing of the Factors of Production : The theory of Distribution Marginal productivity theory. Theories of wage, rent, interest and profit.

Recommended Books

1. Micro-Economic Theory- R.C. Bilas
2. Economic Theory and operation Analysis - W.S. Baumol
3. Principles of Economics - F. Gottheil

Course No. NFS-105 Social Nutrition 2 Credit

1. Definition, nature and importance of the study of sociology and anthropology.
2. Research methods in sociology and anthropology
3. Some basic concepts of sociology and anthropology: (a) Society (b) Community (c) Association (d) institution (e) Groups: primary and secondary groups, minority groups, ethnocentrism (f) Customs (g) Folkways and mores (h) Culture: material and non-material culture, Ogburn's theory of cultural lag (i) Socialization: Theory of Mead, Durkheim and Freud on socialization (j) Social control: agencies of social control (k) Primitive economy: Hunting, fishing, food gathering, horticulture, pastorialism and agriculture (l) Religion.
4. Geography and social life.
5. Social organization: (a) Kinship (b) Marriage (c) Family
6. Social inequality by sex, age, rank, class, caste, race.
7. Basic demographic process: (a) fertility (b) mortality (c) migration
8. Food habits and food ways : changing food habits, symbolism and prestige foods, festivals and feasts, food faddism, intra-family food distribution.

Recommended books

1. An Introduction to Anthropology - R. L. Beals and H. Hoijer
2. Nutritional Anthropology- F.E. Johnston
3. New Perspectives in cultural Anthropology - R.M.Keesing & F.M. Keesing
4. Foundations of Modern Sociology- M. Spencer
5. Sociology - S. Koenig
6. Principles of Sociology - F. R. Khan
7. Food, Man and Society - D. Dressler

Course No. NFS-106 Microbiology 2 Credit

1. Nutrition of microorganisms (various types of microbiological culture media, their preparation, dilution and dispensation).
2. Isolation of microorganisms (pure culture from various sources by streak, pour and surface plating techniques).
3. Identification of microbial cells by cultural, microscopy, biochemical, serological and by commercially available kits.
4. Cell counting of microbial growth by direct and indirect methods.
5. Growth and death of bacteria (bacterial population curves, exponential and synchronous growth curves).
6. Aseptic techniques in microbiology - various techniques of sterilization of biological and non biological materials.
7. Anaerobic techniques in microbiology.

Recommended Books

1. Microbiology - M.J. Pelczar, E.C.S. Chan and N.R. Krieg
2. Microbiology - an introduction, (6th edn.) - G.J. Tortora, B.R. Funke and C.L. Case.
3. Biology of Microorganisms - T. Saunders and T. Lyles.
4. Biology of Microorganisms (7th edn.) - T.D. Brock, M.T. Madigan, F.M. Martinko and J. Parker.
5. Modern Food Microbiology – James M. Jay
6. Food Microbiology – MR. Adams & M.O. Moss
7. Food Hygiene and Sanitation- S. Roday

Course No. NFS-107 Foundation Course in English 4 Credit

1. **Grammar** : Tense, articles, prepositions, subjects verb agreement, clauses, conditionals, work classes. Transformations of sentences : active- passive transformations. Reported speech, sentence variation.

2. **Developing writing skills sentences**: Sentence variety, generating sentences, sentence clarity and correctness, linking sentences to form paragraphs. Paragraph structure: Topic sentence, developing paragraphs with specific details and examples, paragraph unity and coherence, free writing, **Essays** : Short essay. **Letter writing:** informal and formal letters.

3, **Listening and note taking** : Listening to class lectures and learning to take useful notes based on the listening.

4. **Developing reading skills**: Strategies of reading, skimming, scanning, predicting, inferencing, analyzing and interpreting variety of texts and text types.

5. **Vocabulary building**: Correct and precise diction, affixes, idiomatic expressions, level of appropriateness, colloquial and informal, standard and formal.

6. **Oral presentation**: Brainstorming, discussing and reporting, debates, extempore speech interviews.

Recommended Books :

1. A Practical English Grammar – Thomas and Martinet

Course No. NFS-111 **Practical** **4 Credit**

1. Basic tools of laboratory analysis
2. Laboratory data handling
3. Preparation of standard solutions
4. Standardization of HCI
5. Estimation of acetic acid content of vinegar
6. Estimation of calcium by the permanganate method
7. Estimation of iron content of Mohr's salt by the dichromate method
8. Estimation of iodine content of salt
9. Estimation of ascorbic acid by titrimetric method
10. Determination of saponification number of fat or oil
11. Determination of iodine number of fat or oil
12. Determination of lactose content of milk
13. Preparation of buffer and determination of pK_a of acetic acid
14. Color tests for biomolecules.
15. Demonstration of process of osmosis.

DETAILED SYLLABUS OF COURSES FOR THE SECOND YEAR

Course number	Name of course	Credit
Theory: NFS-201	Biochemistry (Macronutrients)	**2**
NFS-202	Biochemistry (Micronutrients)	**2**
NFS-203	Human Anatomy	**2**
NFS-204	Human Physiology	**4**
NFS-205	Food Chemistry	**2**
NFS-206	Food Microbiology-1	**2**
NFS-207	Biostatistics	**2**
NFS-208	Macro Economics	**2**
NFS-209	Instrumental Methods and Analysis	**2**
Sub total		**20**
NFS-211	Biochemistry Practical	**2**
NFS-212	Physiology Practical	**2**
NFS-213	Biostatistics Practical	**2**
NFS-221	Viva Voce	**4**
Total		**30**

Course No. NFS - 201 **Biochemistry (Macronutrients)** **2 Credit**

1. Carbohydrates: Definition, nomenclature, classification, optical properties, ring structure of common monosaccharides, mutarotation of glucose, chemical properties of sugars, derivatives of monosaccharides-sugar acids and aminosugars. Structure and biological importance of common disaccharides-maltose, lactose, sucrose; and polysaccharides-starch, glycogen, cellulose.
2. Lipids: Definition, nomenclature, structure,classification and functions of different classes of lipids, reaction of fats, fatty acids and sterols. Essential fatty acids.
3. Amino acids and peptides: structural features, classification, physical and chemical properties of amino acids and peptides. Essential aminoacids. Proteins: classification based on shape and biological functions. Structure: Primary, Secondary, Tertiary and Quaternary structures of protein.
4. Nucleosides and nucleotides: Occurrence, structure, physicochemical properties. Polynucleotides: Occurrence, structures of DNA and RNA.
5. Enzymes: Definition, nomenclature and classification, co-enzymes and co-factors, Effect of substrate, temperature and p^H on enzyme-activity. Michaelis-Menten Equation for enzyme kinetics. Enzyme inhibitions-competitive, uncompetitive and non competitive inhibition.

Recommended Books:

1. Harper's Biochemistry – R.K. Murray, D.K. Granner, V.W. Rodwell
2. Biochemistry- A. L. Lehniger
3. Principles of Biochemistry – A.L. Lehninger,
4. Text Book of Biochemistry- E.S. West, W.R. Tood, H.S.Mason, J.T.V. Bruggen.
5. Harper's Review of Biochemistry- D.W. Martin, P.A. Mayes, V.W. Rodwell, D.K. Garnner
6. Biochemistry – L.Stryer

Course No. NFS - 202 Biochemistry (Micronutrients) 2 Credit

1. Vitamins: classification and occurrence.
2. Chemistry, digestion and absorption of vitamins.
3. Biochemical function of vitamins including roles as coenzymes (where known).
4. Minerals: classification and occurrence.
5. Chemistry of minerals and their content in the body.
6. Absorption and excretion of minerals; role of fiber in these processes.
7. Biochemical functions of minerals and trace elements including roles as cofactors (where known).
8. Biochemical aspects of deficiency diseases; RDA of vitamin and minerals

Recommended books

1. Advanced Text Book on Food and Nutrition, vol. 1, M. Swaminathan, 1993.
2. Human Nutrition and Dietetics- J.S. Garrow and W.P.T. James.
3. The vitamins - Gerald F. Combs, Jr.
4. Minerals in animal and human nutrition - L.R. McDowell
5. Present knowledge in nutrition- M.L. Brown, Myrtle, L. Brown Editor.
6. Handbook of vitamins – Lawrence J. Machin.

Course No. NFS – 203 Human Anatomy 2 Credit

1. Alimentary system – Oral cavity and it's contents (lips, vestibule, gums, oral cavity proper, teeth, palate, tongue and it's taste buds). Salivary glands. Stomach- it's location, shape, size, parts, cellular structure. Small intestine - it's different parts and cells. Large intestine – it's different parts and cells. Liver and gall bladder - structure and cell biology of liver. Pancreas – structure and cell biology.
2. Reproductive system – Male and female reproductive organs.
3. Cardiovascular system – Heart and it's chamber, anatomy of circulatory system.
4. Kidney and it's structure.
5. Central nervous system–Brain– size, shape, structure, different parts (cerebrum, cerebellum, pons, medulla oblongata). Hypothalamus. Spinal cord. Special senses – skin, eye (structure).

Recommended books

1. Cunningham's Manual of Practical Anatomy. Ed. G.J. Romans,(Vol. I,II,III)
2. B.D. Chaurasia : Human Anatomy. Regional and Applied (Vol. I,II,III).
3. Langman's Medical Embryology. Ed. T.W. Sadler.
4. Embryology by A.K.Datta.

Course No. NFS – 204 Human Physiology 4 Credit

1. Reproductive system – Spermatogenesis and it's hormonal control, semen and it's composition. Female sex hormone, ovarian cycle, ovulation, menstruation. Pregnancy and lactation – fertilization and implantation of embryo. Placenta and it's function. Hormonal control of pregnancy.
2. Endocrine system – Hormone and it's mechanism of action. Hormones - pituitary, thyroid, para-thyroid, pancreatic and supra renal.
3. Alimentary system – Digestive functions and juices, gastro-intestinal hormone. Digestion and absorption of carbohydrate, fat, protein. Liver and it's function.
4. Circulatory system – Blood, it's composition, function, clotting mechanism. Blood circulation. Blood cells and their function. Normal blood pressure and it's regulation.

5. Basic concepts in immune system – Immunity and it's types, immune cells and antibodies, hypersensitivity reactions.
6. Urinary system – Nephron. Urine formation, concentration and acidification. Composition of urine. Acid-base balance.
7. Respiratory system – respiratory apparatus, gaseous transport in the blood and body fluid.
8. Function of central nervous system (brain, spinal cord).

Recommended books

1. Text book of Medial Physiology : Guyton and Hall.
2. Review of Medical Physiology : W.E. Ganong.
3. Human Physiology : C.C. Chatterjee, Vol. I & II .

Course No. NFS - 205 Food Chemistry 2 Credit

1. Properties of sugars, dextrin, starches, celluloses, homicelluloses, pectins and gums; pectins and gels, gums and mucilages; gum arabic, seaweed polysaccharides, agar, carageenan, locust bean.
2. Physical and chemical properties of proteins, native and de-naturation of proteins.
3. Occurrences and composition of fats and other oils in foods, edible fats and oils, fatty acids; physical and chemical properties of fats and oils.
4. Meat : Structure , postmortem changes, colour changes and tenderness.
5. Milk : Composition of milk, analysis and purity.
6. Cereals and legumes: Structure of grains, composition, properties, constituents of legumes and properties.
7. Vegetables and fruits: Composition, Structure and texture, pigments (carotenoids, chlorophylls, flavonoids, anthocyanins, tannins and other phenolic substances.

Recommended books

1. Food Chemistry - L.H.Meyer
2. Food Science - N.N. Potter
3. Food Chemistry H.D. Belitz and W.Grosch.
4. A Handbook of Edible Oils and Fats - G.Mowlah

Course No. NFS-206 Food Microbiology 2 Credit

1. Effect of environment on bacterial growth (effect of temperature, moisture, $p^{H,}$ oxidation-reduction potential, radiation, pressure, sonic vibration etc.)
2. Study of yeast and fungus related to spoilage of foods.
3. Microbial contamination and spoilage of different types of foods: Plant products (fruits and vegetables; cereals; and sugars); and Animal products (meat, fish, poultry, milk etc.).
4. Microbial contamination and spoilage of fast foods, cooked foods and their ingredients.
5. Control and prevention of microbial contamination and spoilage of foods

Recommended books

1. Food Microbiology- C.Frazier and D.C. Westhoff
2. Food Poisoning and Food Hygiene- B.C.Hobbes and R.J.Gilbert
3. Microbiology- P.L. Carpenter
4. Modern Food Microbiology – James M. Jay
5. Food Microbiology – M.R. Adams & M.O. Moss
6. Food Hygiene and Sanitation- S. Roday

Course No. NFS – 207 **Biostatistics** **2 Credit**

1. Graphical and diagrammatic representation: - Graphs and diagrams.
2. Measures of central tendency: - Arithmetic mean, geometric mean, harmonic mean, median and mode.
3. Measures of dispersion: - Range, mean deviation, variance coefficient of variation, standard deviation.
4. Moments, skewness and kurtosis.
5. Probability distribution: - The normal, binomial and poisson distribution, derivation, means and variances.
6. The basic idea of significance text- Simple significance tests based on the normal distribution, comparison with a known standard, comparison of means of two large samples.
7. The use of 't' tests for small samples, importance of small sample comparison of sample mean with a standard, comparison of means of two small sample (unknown variances-assumed equal, not assumed equal) confidence limits.
8. X^2-tests of goodness of fit and homogeneity introduction to general idea, testing the fit of a whole frequency distribution to data, tests of homogeneity, variance ratio test.

Recommended books

1. Bio statistics - W.W.Daniel
2. Methods in Biostatistics - B.K.Mahajan
3. Methods of statistics - M.G.Mostafa

Course No. NFS - 208 **Macro Economics** **2 Credit**

1. Key concepts of Macro Economics
   Micro and Macro Economic Goals; subject matter and the importance of Macro economics; Aggregate Demand and supply.
2. Measurement of National Income
   Gross Domestic Product (GDP) - Goods flow and earnings flow- Details of national accounts- Nominal and Real GDP- Deflating and price indexes - Gross and Net GDP.
3. Consumption and Investment
   The Consumption function- The Savings function- The Marginal Propensity to consume- The Marginal Propensity to saving- Common theories of Consumption: Absolute, Relative, Life Cycle and Permanent, Income theories of consumption and their implications; Determinants of Consumption- Determinants of Investment- The Investment Demand.
4. The Theory of aggregate demand
   Business cycle theories- Behind AS and AD curves- The downward sloping aggregate demand curves- Determinants of AD and AS curves.
5. The Multiplier Model output determinants
   Consumption and Investment approach- Savings and Investment approach- The Adjustment mechanism and the multiplier process- The role of fiscal policy in the multiplier Model.
6. Money and Inflation:
   Value of money and price movements; quantity theory of money and its various formulations; demand for money. Inflation; measures of inflation, classification of inflation according to the causes: demand-push and cost-push inflation, inflationary and deflationary gap; control of inflation; inflation and employment and unemployment, types of unemployment and their impact on consumption and nutrition.

Recommended books

1. E. Shapiro.- Macro Economic Analysis.
2. G. Ackley.- Macro Economic Theory.
3. R. Dornbusch and S. Fischer. Macro Economics,
4. F.S. Brooman - Macro Economics

Course No. NFS-209 **Instrumental Methods and Analysis** **2 Credit**

1. Introduction to instrumental analysis
2. Basic characteristics of measuring devices; Sensitivity, Selectivity, Accuracy
3. Transducers, basic characteristics of Theromo-electric, Photovoltaic & Photoconductive Transducers
4. Description, working principle and application of p^H meter,Microscope and Chromatography

5. Renewable Energy Sources; utilization of solar energy in water purification, heating and food processing, Solar cooker
6. Electromagnetic wave, wavelength, wavenumber, photon
7. Radiant Energy Sources; Tungsten, Deuterium and Hollow cathode lamp, Nernst glower, Globar
8. Monochromater using diffraction grating, prism, filters
9. Detection of radiant energy using Barrier layer photocell, phototube, photomultiplier tube, thermocouple
10. Display unit: analog, digital, printer, chart recorder, video screen
11. Cells (sample container) and its care
12. Laws of absorption, optical density, percent transmittance, deviation from absorption laws
13. Description, working principle and application of Flame Photometer, Fluoro-photometer Spectrophotometers (UV, VIS,IR and Atomic Absorption), Centrifuge, Calorimeter, Electrophoresis

Recommended books

1. Instrumental Methods of Analysis - Willard et. al.
2. Instrumental methods of chemical Analysis - E. Hill
3. Laboratory Techniques in chemistry & Biochemistry - Diamond & Derman.
4. Chemistry Experiments for Instrumental Methods.
5. Chromatography today - C. F. Poole and S. K. Poole.

Course No. NFS - 211 Biochemistry Practical **2 Credit**

1. Use of spectrophotometer for biochemical analysis.
2. Estimation of glucose content.
3. Determination of blood glucose
4. Determination of creatinine content
5. Determination of urea/uric acid content in serum.
6. Extraction and estimation of liver glycogen.
7. Amino acid separation by paper chromatography.

Course No. NFS-212 Physiology Practical 2 Credit

1. Collection and separation of blood
2. Estimation of hemoglobin
3. Estimation of ESR
4. Determination of total count of RBC
5. Determination of PCV, MCH, MCHC
6. Determination of total count of WBC, differential count of WBC
7. Bleeding time and coagulation time
8. Routine microscopic examination of stool and urine.

Recommended Books:

1. Practical Pathology - Khaleque

Course No. NFS- 213 Biostatistics Practical **2 Credit**

1. Introduction
2. Means and variances: Basic calculation.
3. Estimation : Standard errors and confidence limit.
4. Sample significance test
5. The use of 't' tests
6. X2- tests of goodness-of fit and homogeneity.
7. Calculation of correlation coefficient, significance tests for correlation coefficients.
8. Calculation of regression coefficient, standard errors & significant test
9. Simple experimental design and analysis of variance (testing the homogeneity of variances)
10. Analysis of variance.

DETAILED SYLLABUS OF COURSES FOR THE THIRD YEAR

Course number	Name of Course	Credit
Theory NFS-301	Biochemistry	**4**
NFS-302	Food Science	**4**
NFS-303	Clinical Nutrition	**2**
NFS-304	Maternal and Child Nutrition	**2**
NFS-305	Assessment of Nutritional Status	**4**
NFS-306	Nutritional Problems	**2**
NFS-307	Nutrition Planning	**4**
Sub-total		**22**
Practical: NFS-311	Nutritional Biochemistry Practical	**2**
NFS-312	Clinical Nutrition Practical	**2**
NFS-313	Food Science and Technology Practical	**2**
Viva-Voce:NFS-321	**Viva Voce**	**4**
Total		**32**

Course No. NFS - 301 Biochemistry 4 Credit

1. Introduction: General aspects of metabolism, metabolic and energy transfer path way. Intermediate metabolism.
2. Glycolysis, TCA cycle, electron transport and oxidative phosphyorylation, other Pathways of carbohydrate degradation – pentose phosphate pathway, glucose to glucuronic acid and ascorbic acid.
3. Glycogen metabolism- glycogenolysis, glycogenesis, control of glycogen metabolism.
4. Hormones : introduction, general characteristics and role in metabolism.
5. Biosynthesis of carbohydrate – gluconeogenesis and its regulation, biosynthesis of Di, oligo and polysaccharides, glycoprotein, sugar interconversion, nucleotide sugars formation.
6. Saturated and unsaturated fatty acids. Fatty acid oxidation and synthesis. Ketone Body formation and utilization, regulation of fatty acid metabolism, storage as triglyceride. Metabolism of cholesterol and triglyceride.
7. Different methods for the degradation of amino acids-transamination, deamination, decarboxylation and synthesis of single carbon unit. Urea cycle. Amino acid biosynthesis. Glucogenic and ketogenic aminoacids.Nitrogen balance. DNA organization and replication, RNA synthesis, processing and metabolism.
8. Energy metabolism: Defination, principles of estimation, components of energy requirements, basal metabolic rate (BMR), factors affecting MBR and overall energy requirements, energy cost of activities, energy cost of digestion and absorption, energy cost of growth.

Recommended books

1. Harper's Biochemistry- R.K. Murray, D.K. Granner, V.W. Rodwell.
2. Biochemistry- A.L. Lehninger
3. Principles of Biochemistry - A.L.Lehninger
4. Text Book of Biochemistry – E.S. West, W.R. Todd, H.S.Mason, J.T.V.Brruggen
5. Harper’s Review of Biochemistry – D.W. Martin.P.A.Mayes, V.W.Rodwell. D.K. Granner
6. Biochemistry - L. Stryer

Course No. NFS - 302 **Food Science** **4 Credit**

1. Constituents of foods and significance
2. Deteriorative factors of foods and their control
3. Heat preservation and processing. Method of heat preservations and treatment. Canning methods.
4. Cold preservation and processing: Principle and methods of refrigerated storage, cold storage, and freezing
5. Dehydration and concentration: Principles and methods .
6. Milk and Milk products, milk processing and preservation.
7. Meat and poultry : Grading, inspection and aging pigments and colour changes; curing, smoking, sausages, frank-fourter and freezing , eggs composition, quality, storage and freezing.
8. Sea-foods: Processing , preservation and spoilage.
9. Fats and Oils: Production and processing methods, fats and oils products (butter, hydrogenated products, margarine, shortening and frying oils, mayonnaise production and salad dressing) ;and quality control of fats and oils.
10. Cereals and products: Milling of wheat, rice and corn; principles of baking and major baking ingredients, functions of ingredients.
11. Vegetables and fruits: General properties. harvesting and post harvest.
12. Juices and Beverages: Manufacture and ingredients of fruits juices and non-alcoholic , alcoholic carbonated beverages.
13. Confectionery and chocolate product: types, ingredients and principles of manufacture.

Recommended books

1. Food Science - N.N. Potter
2. A Handbook on Edible Oil and Fats - G. Mowlah
3. Principles of Food Science (vol. l & 2) G. Borgstron

Course No. NFS - 303 **Clinical Nutrition** **2** Credit

Nutritional diseases :

Definition, etiology, classification and management of

1. Protein-energy malnutrition
2. Vitamin A deficiency disorders
3. Iodine deficiency disorder
4. Nutritional Anaemia
5. Diarrhoeal iseases
6. Vitamin B-complex deficiencies
7. Other deficiencies – vitamin C & D, zinc, copper, selenium, calcium.
8. Obesity – cause, types, complications and management.
9. Malnutrition and Infection
10. Gout and allergy

Recommended books

1. Human Nutrition & Dietetics - Garrow .
2. Human Nutrition in the developing world - M.C. Latham.
3. Community Nutritional Assessment - Jelliffe & Jellife.
4. Text book of Preventive and Social Medicine - K. Park
5. Human Nutrition & Dietetics - Davidson & Passmore
6. Modern Nutrition – Shills

Course No. NFS-304 **Maternal and Child Nutrition** **2 Credit**

1. Adolescent nutrition and growth
2. Care during pregnancy and lactation
3. Maternal nutrition and pregnancy outcome.
4. Maternal protein-energy malnutrition, micro-nutrient malnutrition and it's effect on infant growth, development and health
5. Low birth weight and it's consequences
6. Breastmilk and breastfeeding – colostrum, it's composition and importance ; breast milk composition and it's importance on child health and development, comparison of breastmilk, cow's milk and powder milk

7. Weaning and supplementary feeding

Recommended books.

1. Maternal Nutrition and Pregnancy Outcomes : Anthropometric Assessment. Ed. By Katherine Krasovic and Mary Ann Anderson
2. Maternal Anthropometry and Pregnancy Outcomes.–WHO Bulletin, Supplement to vol.73, 1995
3. Protein Energy Malnutrition – J.C.Waterlow

Course No. NFS - 305 Assessment of Nutritional Status 4 Credit

A. Direct Methods

1. Anthropometric Assessment of Nutritional Status: Anthropometric measures: Measuring height, weight and other measures- standardization of equipment and measurements. Weighing infants, older children and adults. Analyzing Anthropometric Data: analysis of height, weight and others. Calculation of indicators : Z scores and percentage of reference median values; presentation of results.
   - Use of BMI as an index of nutritional status of adults: definition and meaning of BMI, classification and interpretation of BMI.
   - Ponderal index
2. Clinical Assessment of Nutritional Status:
   - Signs of protein-energy malnutrition (PEM), signs of micronutrient deficiencies
3. Biochemical Assessment of Nutritional Status

B. Indirect Methods

1. Dietary Intake: Dietary intake assessment methods: Quantitative, Qualitative: Quantitative Dietary Surveys - Inventory method, diary method, recall method, weighing method, duplicate sample method, food balance sheet; Qualitative Dietary Surveys - Dietary history of habitual intake pattern, food frequencies; limitations of different survey methods, translating dietary intakes into nutrients, use of food tables and their limitations, evaluation of adequacy of dietary intakes.
2. Socio-economic and ecological assessment

C. Nutritional survey and surveillance: Purpose, meaning and type; population, sampling; sampling methods, sample size. Initial assessment, indicators of nutritional status, data sources, institutional arrangements for data collection, data processing/analysis.

Recommended books

1. Principles of Nutritional Assessment - R. Gibson
2. Methodology of Nutritional Surveillance - Report of a joint FAO/ UNICEF/ WHO/ Expert committee
3. Community Nutrition Assessment - Jelliffe & Jelliffe
4. Anthropometric Standards for the Assessment of Growth and Nutritional Status- A. R. Frisancho
5. Anthropometric Assessment of Nutritional Status- John H. Himes

Course No. NFS - 306 Nutritional Problems 2 Credit

1. Protein-energy malnutrition - Protein and energy requirements of different age groups; energy intake and expenditure, gender variation in the intake, adaptation theory protein-energy interactions; linear growth retardation- causes and mechanism, chronic energy deficiency (CED) and its consequences.
2. Micronutrients and health development- Micronutrient malnutrition (Hidden hunger), health and social effects of micronutrient deficiencies.
3. Care and Nutrition : Caring Practices: Definitions, concepts and importance of caring practices; Situation of caring practices in Bangladesh; Caring practices of different population groups and physiological outcomes; Constraints to caring practices; Measures to improve caring practices
4. Gender issues in nutrition
5. The nutrition transition

Recommended books

1. Malnutrition - Its causation and Control vol. 1 & 2, - J.R.K. Robson
2. Human Nutrition in the Developing World - M.C. Latham
3. Protein Energy malnutrition- J.C. Waterlow
4. Protein Energy Interaction- Nevin S. Scrimshaw & Beat Schurch
5. Chronic Energy Deficiency : Consequences and Related Issues- Beat Schurch & Nevin S. Scrimshaw
6. Causes and Mechanisms of Linear Growth Retardation-John C. Waterlow & Beat Schurch
7. Linear Growth Retardation in Less Developed Countries- John C. Waterlow
8. Care and Nutrition: Concepts and Measurement- Patrice L. Engle, Purnima Menon, Lawrence Haddad

Course No. NFS - 307 Nutrition Planning 4 Credit

1. Planning: Concepts of planning; Planning in mixed developing economies; Rationale for planning in developing economies. Basic planning models: Aggregate growth model, Imput output Model, Concept of cost-benefit analyses and cost effectiveness analysis.
2. Planning Process: Characteristics of planning process; Limitations of planning models
3. Addressing Malnutrition: Need for nutrition planning; Short term and long term objectives; Strategies of nutrition planning; Sequences of nutrition planning; Sectoral approach to nutrition planning
4. Identification of Nutrition Problem: Food balance sheet approach; Consumer expenditure survey; Food consumption survey; Medical nutrition survey; Advantages and limitations of the approaches
5. Identification of Target Population: Growth monitoring; Interpretation of monitoring data; Advantages and limitations of growth monitoring;
6. Supplementary Feeding: Concepts; Advantages, disadvantages, costs and benefits of feeding programs; Nutritional impact of feeding programs; Measures to improve the nutritional impact of feeding programs
7. Household Food Security: Definitions, concepts and importance of household food and nutrition security; Situation of household food security in Bangladesh; Groups at risk of food and nutrition security; Identification of food insecure households; Measures to improve household food and nutrition security
8. Health Environment: Definitions, concepts and importance of health environment; Components of health environment; Conditions of health environment in Bangladesh; Constraints to improved health environment; Nutritional referrals and utilization of public health facilities; Measures to improve health environment and utilization of public health facilities
9. Approaches to combat malnutrition: Supplementation, Food fortification, Food based approaches : Concepts, Potentials, advantages, costs, Government and private sector involvement; Monitoring and evaluation

Recommended books

1. Economic Development in the Third World - Michael P. Todaro
2. Economic Analysis of Agricultural Projects - J. Price Gittinger
3. The Nutrition Factor - Alan Berg

Course No. NFS - 311 Nutritional Biochemistry - Practical 2 Credit

1. Use of HPLC, GLC, and Atomic Absorption Spectrophotometer for nutrient analysis (demonstration).
2. Determination of serum protein concentration.
3. Determination of serum albumin concentration.
4. Determination of serum cholesterol concentration.
5. Determination of carotene content by column chromatography.
6. Animal experimentation - care of animal and preparation of diet
7. Use of thin layer chromatography (TLC) for nutrient separation.
8. Separation of amino acid by TLC.

Course No. NFS- 312 **Clinical Nutrition - Practical** **2 Credit**

1. Weighing and measuring children
2. Calculation of SD scores
3. Demonstration sings of PEM and vitamin deficiencies
4. Demonstration sings of anemia
5. Demonstration signs of IDD
6. Hospital visit (Children, Diabetic, Cardiovascular, ICDDR,B)
7. Visit to field
8. Slide detection

Course No. NFS - 313 **Food Science and Technology - Practical** **2 Credit**

1. Sensory assessment of food quality
2. Carbohydrate crystallization
3. Gelling of foods
4. Dough formation
5. Food emulsion
6. Formulations and preparations of weaning food, pickles, jam and jelly.
7. Canning, and sausage preparation.
8. Fermentation of milk and other foods.
9. Visits to food industries

DETAILED SYLLABI OF COURSES FOR THE FOURTH YEAR

Course number	Name of Course	Credit
Theory: NFS-401	Epidemiology	2
NFS-402	Food Technology	2
NFS-403	Food Microbiology-II	2
NFS-404	Nutritional Biochemistry	4
NFS-405	Nutrition Education	2
NFS-406	Nutrition in Emergencies	2
NFS-407	Dietetics	4
NFS-408	Computing and Data Analysis	2
NFS-409	Development Nutrition	4
Sub-total		**24**
Practical: NFS-410	Food Groups and Exchange List – Practical	2
NFS-411	Diet Preparation – Practical	2
NFS-412	Food Microbiology - Practical	2
NSF-413	Food Chemistry – Practical	2
NFS-414	Field Assignment	2
Viva Voce: NFS-421	Viva Voce	4
Total		**38**

Course No. NFS- 401 Epidemiology 2 Credit

1. Basic concepts: Introduction, definition and background of Epidemiology.
2. Type of epidemiological studies.
3. Vital statistics - Disease frequency (prevalence rate, incidence rate), category specific and adjusted (standardized rate), crude birth rate, crude death rate, standardized mortality ratio. Growth rate, total fertility rate, infant mortality rate,U-5 mortality rate, maternal mortality rate, peri-natal mortality rate.Malnutrition related morbidity andmortality.
4. Association: Relative risk, Attributable risk and odds ratio Interpretation of measures of association.
5. Evaluating the role of confounders – Reproducibility and validity, sensitivity, specificity, predictive value.

Recommended books

1. Epidemiology in Medicine - C. H. Hennekens & J.E. Buring.
2. Basic Epidemiology (WHO, 1993) - R. Bealehole, R. Bonita, T. Kjellsterm.
3. Clinical Epidemiology & Biostatistics - R.G. Knapp.
4. Nutritional Epidemiology -W. Willet.

Course No. NFS - 402 Food Technology 2 Credit

1. Food irradiation and microwave heating: effect of radiation on foods; dose determining factors; safety and wholesomeness of irradiated foods; properties of microwaves; application of microwave in food processing.
2. Food fermentations: Principles and importance; microbial changes and controlling and fermentations in foods.
3. Nutritional aspects of food processing: browning reactions; food recipe and retention factors.
4. Food additives and their classifications.
5. Basic principles of food packaging; requirements and functions of containers.

Recommended books

1. Food Science - N.N. Potter
2. The Technology of Food Preservation - N .W. Desrosier
3. Food Science and Technology - M. Pyke.

Course No. NFS-403 **Food Microbiology** **2 Credit**

1. Microbial spoilage of foods (causes of spoilage and spoilage of different types of foods).
2. Food borne illness:
   Diseases due to bacterial toxication and infection (clostridium botulinum. C. Perfingens, S. aureus, V. parahaemolyticus, E. coli, B. cereous, Salmonella and Shigella); Diseases due to non-bacterial sources (mycotoxin, viruses, rickettsia and parasites) and Diseases due to poisoneous plant, animals, chemicals, additives etc.
3. Bacteriology and purification of water supply.
4. Maintenance of food hygiene and sanitation in the manufacture, processing and service of food (cleaning and sanitazation).
5. Personal hygiene of the food handlers and production of safe food with special reference to the contamination of pathogenic microorganisms.

Recommended books

1. Principles of Food Sanitation - N.G. Marriot
2. Food Poisoning and Food Hygiene- B.C. Hobbes and R.J.Gilbert
3. Food Microbiology - W.C. Frazier and D.C. Westhoff.
4. Modern Food Microbiology – James M. Jay
5. Food Microbiology – M.R. Adams & M.O. Moss
6. Food Hygiene and Sanitation- S. Roday

Course No. NFS - 404 **Nutritional Biochemistry** **4 Credit**

1. Role of carbohydrate in nutrition. Its function, requirements, food sources, deficiency problems. Importance as main source of energy. Role of carbohydrate in health and nutrition of special groups: sports nutrition, weight management, pregnant
2. Fiber in human health and nutrition-sources, classification and role in nutrition.
3. Protein quality-methods of determination, advantages and disadvantages of the methods. Protein requirements, function, food sources, deficiency problems. Amino acid supplementation and complement of each others deficiencies. Essential amino acids. Limiting amino acids. Amino acid toxicity. New protein sources use to solve deficiency problems.
4. Sources of fats and oils. Requirements as source of energy. Advantages and disadvantages of saturated and unsaturated fatty acids, Essential fatty acids. Role of w-3 and w-6 fatty acids in health and nutrition. Importance of dietary fat on serum lipids and lipoproteins.
5. Protein biosynthesis and the genetic code, Recombinant DNA and in vitro expression. Regulation of gene expression.

Recommended Books:

1. Harper's Review of Biochemistry – D.W. Martin, P.A. Mayes, V.W. Ridwekk, D.K. Granner.
2. Biochemistry – A.L. Lehninger
3. Principles of Biochemistry- A.L. Lehninger
4. Biochemistry – L. Stryer
5. National Biochemistry – T. Brody
6. Human Nutrition and Dietetics – J. S. Garrow & W.P.T. James
7. Advanced Text Book on Nutrition – vol 1 & II, M. Swaminathan
8. Present Knowledge in Nutrition –M.L. Brown, Editor

Course No. NFS - 405 **Nutrition Education** **2 Credit**

1. Nutrition education - historical perspectives: Concepts and importance of nutrition education;
2. Nutritional awareness building; Messages in Nutrition education; Audio and visual aids in nutrition education; Communication strategies in nutrition education;
3. Dissemination of nutrition knowledge through group discussions; Importance of practical demonstrations and role plays in nutrition education; Preparation and demonstration of nutrition education materials;
4. Field-testing of nutrition education materials; Group exercise on the preparation of nutrition education materials;
5. Development of nutrition education schedule and curriculum; Pre - and post nutritional knowledge evaluation-importance, formulation and scoring systems;
6. Role of national organisations in nutrition education; Role of voluntary and international organisations in nutrition education; Limitations of nutrition education programmes;
7. Case assignments on various aspects of nutrition education.

Recommended books

1. Community Nutrition - Md. Aminul Haque Bhuyan and Nayeema Jafar.
2. Community Participation in Nutrition Education - A Training Manual, UNESCO.
3. Visual Aids in Nutrition Education - Alan C Holmes, FAO, 1968.

Course No. NFS - 406 **Nutrition in Emergencies** **2 Credit**

1. Definition of nutritional emergency; Its causes and implications;
2. Disaster situation in Bangladesh; Historical perspectives;
3. Models of early warning; Role of nutritional, health and socio-economic data on early warning; Frame work for disaster relief- needs assessment and targeting intervention design;
4. Disaster management in Bangladesh: concept and practice;
5. Management and practice of different type of emergency feeding programme (general food distribution, mass feeding, therapeutic feeding, special foods during emergency, vulnerable group feeding).
6. Importance of nutritional relief. Field level difficulties- camp administration, transportation, food storage etc.
7. Macro - and micro nutrient deficiencies in emergency. Assessment and surveillance of nutritional status in emergency;
8. Monitoring and evaluation of nutritional emergencies; Responsibilities and mandate of UN bodies and different GOs and NGOs in emergency situation, specially on food relief.

Recommended books

1. The Management of Nutritional Emergencies in Large Populations - Goyet &.Geijer
2. Disaster in Bangladesh - L. Chen
3. The Management of Nutrition in Major Emergencies-WHO, Geneva, 2000.

Course No. NFS - 407 **Dietetics** **4 Credit**

1. Balance diet for different age groups.
2. Menu planning.
3. Diet preparation for subjects of different age groups.
4. Diet for pregnancy, lactation and athletics.
5. Importance of breast feeding, weaning food, supplementary food.
6. Principle, classification, purpose of diet therapy and importance.
7. Dietitian - Classification, involvement in different places.
8. Modified diet in different pathological conditions- PEM, obesity, underweight, diabetes, hypertension, kidney diseases, liver diseases, cardiovascular diseases, pre- and post operative condition diet, peptic ulcer diet, gout, allergy.
9. Diet for inborn error of metabolism.
10. Total parenteral nutrition.

Recommended books

1. Applied Nutrition - R. Rajalakshmi
2. Mannual of Nutrition and Diet Therapy - N.J.Gills & M.V. Bosscher
3. Clinical Dietetics & Nutrition - F.P. Antia & P.Abraham
4. Human Nutrition & Dietetics - Davidson and Passmore
5. Nutrition & Physical Fitness - Bogert, Briggs & Callowey
6. Food and Nutrition - M. Swaminathan

Course No. NFS-408 Computing & Data Analysis 2 Credit

1. A brief history of computer
2. Types of computer: Introduction to Supercomputer, Mainframe, Minicomputer, Workstation, Microcomputer and PDA/Notebook.
3. Hardware: Basics of Computer, CPU, BUS, Memory & Storage, Input and Output devices.
4. Software: Introduction to popular Operating System, Application Package (eg. MS word, Excel, Access Statistical and Graphical Software)
5. Introduction to Data Entry and Data Analysis.
6. Dietary, Anthropometric, and Socio-economic data handling
7. Communication using computer: basics of Networking and internetI

Recommended books

1. An Introduction to Computer - by Peter Norton
2. Computer Porichity/Adhunic Computer by Prof. L. Rahman
3. How Computer Works- by Ron White

Course No. NFS - 409 Development Nutrition 4 Credit

1. Concept of Development: Meaning of economic development; Economic development and economic growth; measurements; Noneconomic factors.
2. Models of growth and development: Lewis model, Harrod - Domar model; Ranis and Fei model.
3. Population: Concepts and measurements of population growth; Theory of demographic transition; Malthusian theory of population trap; Microeconomic theory of fertility; Population problem in Bangladesh; Nutrition and population growth; Measures for population control
4. Urbanization: Concepts and measurements of urbanization; Urbanization in Bangladesh; Causes of urban migration; Urban nutrition problems and their characteristics; Measures for addressing urban nutrition.
5. Food and nutrition policy in Bangladesh, Components of food and nutrition policies, Agricultural policies and programs affecting nutrition; Concept of green revolution; Effects of green revolution on production and consumption of food and nutrition

Recommended books

1. Economic Development in the Third World - M. P. Todaro
2. Leading Issues in Economic Development - G. M. Meier
3. Growth and Development - A. P. Thirlwall
4. Economic Development - G. M. Meier and R. E. Baldwin

Course No. NFS - 410 Food Groups and Exchange List Practical 2 Credit

1. Practical demonstration of different food groups (cost wise).
2. Eye estimation of food weight and match by weighing in balance.
3. Calculation of nutritive values of foods.
4. Effect of cooking on food weight, and nutrient loss.
5. Preparation of exchange list, conversion factor etc.

Course No. NFS - 411 **Diet Preparation Practical** **2 Credit**

1. Different methods of calculation for diet preparation and menu planning.
2. Diet preparation for different age groups by calculation.
3. Diet preparation for family of different size.
4. Diet preparation for different physiological condition-- obesity, under weight, diabetes, cardiovascular diseases, liver disease, kidney diseases.
5. Individual energy intake and expenditure by calculation.
6. Diet Prescription

Course No. NFS - 412 **Food Microbiology Practical** **2 Credit**

1. Handling and use of bright field microscope.
2. Staining techniques : simple staining, negative staining and gram staining etc.
3. Preparation of bacterial culture media of various types.
4. Enumeration of viable organisms in sample of food, water and beverages by plate count method and turbidimetric method.
5. Techniques for isolation of pure culture from food, water and beverages.
6. Characterisation of the microorganism : Cultural, Morphological, Physiological and Biochemical Characterisation and Identification.

Course No. NFS-413 **Food Chemistry Practical** **2 Credit**

1. (a). General Methods and Pracedures used in food analysis. - Proximate Analysis : Estimetions of moisture, Ash, Crude fat, Crude protein, different carbohydrates, Crude fiber in cereals grain, pulses, vegetables, milk and milk products, candies etc.

(b) Estimations of Nitrogen - free extract and minerals.

2. Physiochemical Methods used in food analysis like colorimtry, chromatography, ion-exchange separation and filtrations.
3. Food colours.
4. Food Flavours and Flavouring Agents.

Course No. NFS – 414 **Field Assignment Practical** **2 Credit**

1. Dietary Assignment
2. Anthropometric Assignment
3. Socio-Economic Assignment