

**JYOTI NIVAS COLLEGE AUTONOMOUS
SYLLABUS FOR 2018 BATCH AND THEREAFTER**

Programme: B.Sc.

Semester: IV

BIOCHEMISTRY PAPER IV

Course Code: 18IVBC4

No. of Hours: 60

COURSE OBJECTIVES:

Through this course, the student is imparted knowledge of:

- The concept of nutrition and its importance
- The concept of health and role of antioxidants in nutrition
- The different roles and detailed nutritional aspects of different biomolecules
- The principles and mechanism of animal physiology and the various biochemical processes involved.

LEARNING OUTCOMES:

On completion of this course, the student should be able to:

- Understand the importance of nutrition
- Be aware of the beneficial or harmful effects of different biomolecules when ingested
- Discuss the importance of antioxidants.
- Understand various physiological processes and the mechanisms that cause them.

UNIT I

NUTRITIONAL BIOCHEMISTRY

Chapter 1.1 DIET AND NUTRITION: ENERGY METABOLISM 5 HRS

Energy balance: Metabolic rate, Energy value of food (carbohydrates, fats and proteins) – Units, Comparison (*in vitro* and *in vivo*). Determination of energy value of food by Bomb calorimeter, Relation between oxygen required and calorific value, Respiratory quotient, Basal Metabolism- Definition, determination of basal metabolism by direct calorimetry (Atwater Rosa respiration calorimetry) and indirect calorimetry (Benedict–Roth respiration apparatus), Factors affecting BMR – age, sex, pregnancy, lactation, old age, different muscular activities. Specific dynamic action (SDA) of food, Recommended dietary allowances (RDA) and mineral requirements with different age groups and Pregnancy. Role of Probiotics.

Chapter 1.2 FREE RADICALS AND DIETARY ANTIOXIDANTS 4 HRS

Free radicals : Definition, types : Reactive Oxygen species (ROS) and Reactive Nitrogen species, (RNS). Effects of free radicals on biomembranes: Lipid peroxidation and its stages – Initiation , propagation and termination. **Antioxidants:** Definition, Types – Enzymatic (Superoxide dismutase, Catalase, Glutathione peroxidase) and non-enzymatic antioxidants (Reduced glutathione, Vitamin C and Tocopherol), ORAC acid. Natural antioxidants – Sources : Green tea, Turmeric, Ginger, Black Pepper, Citrus fruits (lemon, orange, grapes), Role of Antioxidants against Ageing and chronic diseases (Diabetes mellitus, Cancer, Cardiovascular diseases, Neurological diseases)

Chapter 1.3 NUTRITIONAL ASPECTS OF PROTEINS 4 HRS

Introduction, Sources, Nutritional significance of Amino acids, Nutritional classification of proteins: Complete, Partially complete and Incomplete Proteins. Utilization of dietary proteins and amino acids in the body. Methods available for the evaluation of Protein Quality: Biological value, Chemical Score, Coefficient of digestibility, Consequences of protein deficiency, Nitrogen balance: Definition and types: Positive and negative nitrogen balance, Protein Energy Malnutrition : Marasmus and Kwashiorkor.

Chapter 1.4 NUTRITIONAL ASPECTS OF CARBOHYDRATES 5 HRS

Introduction, Sources, Importance of different Carbohydrates in diet, Utilization of absorbed carbohydrates in the diet, Regulation of glucose level in blood – Factors: role of liver, kidneys and hormones, Clinical conditions – Diabetes mellitus: Outline of the changes in carbohydrate, fat and protein metabolism due to diabetes mellitus, Glycosylated Haemoglobin, Glucose Tolerance Test, Diabetic coma, Hyperglycemia and Hypoglycemia. Dietary management of Diabetes mellitus. Dietary fibers and its role in health and disease.

Chapter 1.5 NUTRITIONAL ASPECTS OF LIPIDS 5 HRS

Requirements of fat, Invisible fat, Quality of Fats, Functions of fats (triglycerides), Phospholipids and cholesterol in diet, Essential fatty acids (linoleic acid and linolenic acid) – sources, physiological and biochemical functions. Trans fatty acids, Storage lipids in adipose tissue, deposition of fat in adipose tissue, metabolism of fat from adipose tissue, Regulation of lipogenesis, Role of liver in lipid metabolism. Clinical conditions : Hypercholesterolemia, Hypertension, Obesity and Fatty liver.

Chapter 1.6 VITAMINS AND MINERALS 3 HRS

Vitamins: Sources, daily requirements, functions and deficiency symptoms and diseases of water soluble and fat- soluble vitamins, hypervitaminosis,

Minerals: Sources, daily requirements, Importance and Deficiency of Calcium, Phosphorous, Iron and Iodine in diet, Calcium phosphorous ratio, Importance of trace elements (Magnesium, Manganese, Zinc and Copper) and ultra trace elements (Cobalt, Selenium, Vanadium and Boron) in diet.

UNIT II

ANIMAL PHYSIOLOGY

Chapter 2.1 DIGESTION 6 HRS

Functional anatomy of GIT – Primary digestive organs : Mouth, pharynx, esophagus, stomach, small intestine, large intestine and accessory digestive organs : teeth, tongue, salivary glands. Wall of gastrointestinal tract- mucus, submucus and fibrous layer. GIT hormones: sources and functions of gastrin, secretin, cholecystokinin, gastroinhibitory peptide, vasoactive intestinal polypeptide, glucagon, glicentin, pancreatic polypeptide, somatostatin, motilin, ghrelin. Digestion, absorption and transport of Carbohydrates, Lipids and Proteins.

Chapter 2.2 THE LIVER AND KIDNEYS 4 HRS

Functional anatomy of liver- Hepatic lobes, hepatic lobules, hepatocytes, portal triads. Blood supply to liver – Hepatic artery, portal vein, hepatic vein.

Functional anatomy of kidney- Different layers of kidney, tubular structure of kidney. Ultra-structure of Nephron. Formation of urine – Glomerular filtration, tubular reabsorption and tubular secretion. Abnormal constituents of urine.

Chapter 2.3 ACID- BASE BALANCE

4 HRS

Maintenance of normal pH of the body fluids, buffer systems involved in maintaining blood pH. The role of the kidney and lungs in maintaining acid- base balance

Chapter 2.4 THE BODY FLUIDS.

4 HRS

The intra and extra cellular fluid compartments, distribution of water between the two compartments. The composition and functions of blood, lymph and CSF. Transport of oxygen and carbon dioxide, Partial pressure & Oxygen carrying properties of haemoglobin.

UNIT III

Chapter 3.1 MUSCLE TISSUE

5 HRS

Classification of muscles – Depending upon striation _ Striated (skeletal and cardiac muscles), non-striated muscle (Smooth muscle), Depending upon control – voluntary and involuntary muscle. Structure of skeletal muscle: Muscle mass, muscle fibres – sarcoplasm, structure of myofibril-light and dark band, Sarcomere – myofilament: actin and myosin filaments, contractile elements of muscle, Dystrophin-glycoprotein complex. Sarcotubular system _ T tubules, L tubules. Smooth muscle : Morphology , Types - Visceral and multi – unit smooth muscles, Contractile process in smooth muscle – calcium calmodulin complex. Cardiac muscle: Morphology, Electrical potential in cardiac muscle - resting membrane and action potentials, contractility response – All or none law, Staircase phenomenon, Summation of subliminal stimuli, Refractory period. Isoforms of contractile muscle.

Chapter 3.2 NERVOUS TISSUE

3 HRS

Neurotransmission: General structure of neuron, Conduction of nerve impulses- membrane and action potentials, synaptic transmission-excitatory and inhibitory neurotransmitters, Determination of the magnitude of the membrane potential - Nernst and Goldman equation.

Chapter 3.3 BONE TISSUE

3 HRS

Structure of a long bone, Osteoblasts and Osteoclasts, Bone formation, composition, growth and remodelling. Haversian canal structure, composition (elemental), porosity. Factors affecting growth – nutritional and hormonal factors. Important functions of bone, Deficiency manifestation of the bone tissue : Osteoporosis and Osteomalacia.

UNIT IV

Chapter 4.1 ENDOCRINOLOGY

5 HRS

Endocrine glands: Introduction, Classification, Hormones, functions and abnormalities of Pituitary gland, Adrenal gland, Parathyroid gland, Thyroid gland. Receptor protein, Mechanism and action of steroid and peptide hormones.

REFERENCES:

1. M.Swaminathan-Text Book of Food and Nutrition, 2nd edition, 2010, Bapco Publications.
2. Shubhangi Joshi-Nutrition and Dietetics, 5th edition, 2002, Tata McGraw Hill Publication.
3. William F. Ganong, Review of Medical Physiology, 23rd Edition, 2010, McGraw Hill Publications.

4. MahtabS.Bamji, N.Prasad Rao, Vinodini Reddy-Text Book of Human Nutrition,2nd edition , 1996, Oxford Publication.
5. C.C.Chatterjee-Human Physiology: Vol I and II, 8th edition, 2012, Medical Allied Agency.

IV SEMESTER BIOCHEMISTRY: PRACTICAL PAPER 4

DURATION : 3 HRS / WEEK

NO. OF UNITS :15

1. Estimation of total sugars by anthrone method.
2. Estimation of fructose by Seliwanoff's method
3. Extraction and estimation of soluble sugars from food sample
4. Estimation of total protein in plasma/ serum by Biuret method
5. Estimation of protein by Lowry's method.
6. Estimation of vitamin C by 2, 4-DNPH method.
7. Qualitative analysis of milk.
8. Qualitative analysis of wheat flour.
9. Qualitative analysis of some common food adulterants.
10. Hydrolysis of starch by salivary amylase

Repetition and Tests.

REFERENCES:

1. Varley, Alan, H, Gowenlock - Practical Biochemistry, 6th edition, 2002, CBS Publishers.
2. J. Jayaraman - Manual in Biochemistry, 2001, New Age International Publishers.
3. David Plummer - Practical Biochemistry, 3rd edition, 2017, McGraw Hill Publishers.
4. S.K. Sawhney, Randhir Singh - Introductory Practical Biochemistry, 2nd Edition, 2005, Narosa Publishing house
5. Anita Dua, Vinti Davar, Nutritional Biochemistry - A Practical Approach, 1st Edition, 2013, Anmol Publications Pvt LTD