

**Syllabus and Scheme of Examination**

**For**

**B.Sc.(Hons) Physiology**

**(I-VI SEMESTER)**

**2018**



**Raja N. L. Khan Women's College (Autonomous)**

## **Structure of B.Sc. (Hons) Biological Science under CBCS Core Course Syllabus**

C1T: Cellular basis of Physiology And Human Anatomy,

C2T: Chemistry of Biomolecules.

C3T: Blood & Body fluid, Biophysics

C4T: Nerve muscle Physiology

C5T :Cardiovascular System

C6T: Respiratory System.

C7T : Alimentary system and Excretory system

C8T Digestion & Metabolism

C9T :Nutrition & Dietetics

C10T :Nervous System

C11T :Special senses and body temperature regulation

C12T :Genetics , Molecular Biology Biotechnology.

C13T :Endocrinology and Chronobiology

C14T :Reproductive Physiology & Developmental Biology.

### **DISCIPLINE SPECIFIC ELECTIVE (DSE)**

DSE-A : (one course in semester 5 & one course in semester 6 )

1. **Biostatistics & computational biology (Selected for the course)**
2. **Microbiology & Immunology (Selected for the course)**
3. Stress Physiology, Yoga and meditation.
4. Community and social medicine,

DSE – B (one course in semester 5 & one course in semester 6)

1. **Application of instruments in study of physiology (Selected for the course)**
2. **Work and sport physiology and Ergonomics (Selected for the course)**
3. Advanced Molecular biology & Nanotechnology
4. Toxicology & Pharmacology

### **SKILL ENHANCEMENT COURSE(SEC)**

SEC – A (one course in semester 3)

1. **Hematological Techniques (Selected for the course)**
2. Clinical biochemistry

SEC –B (one course in semester 4)

1. Applied food sciences
2. **Fundamentals of computer and Bioinformatics (Selected for the course)**

### **ABILITY ENHANCEMENT COMPULSORY COURSE (AECC)**

AECC -1 :**Communicative English** or any other Modern Indian Language in Sem I

AECC – 2 :Environmental Study in Sem 2

## B.Sc. Physiology (Hons.)

### Semester- I

**C1T: Cellular basis of Physiology And Human Anatomy,** Number of classes  
Cellular Basis of Physiology Cell Structure and function--Electron microscopic structure and functions of Nucleus, endoplasmic reticulum, ribosomes, Golgi bodies, mitochondria, lysosomes, peroxisomes, cytoskeletal elements, centrosomes and plasma membrane . . Cellular transport—Passive and active transport. Ion channels, ionophores. Intercellular communication--- Basic idea of tight junctions, gap junctions, adherens— junctions, desmosomes and cell adhesion molecules.Extracellular matrix components.

**Enzyme.** Number of classes  
Classification-EC nomenclature, Concept of apoenzyme, holoenzyme, coenzyme, cofactors and prosthetic group. Brief concept about mechanism of enzymes action..Michaelis constant, Michaelis-Menten equation, Graphical representation of hyperbolic kinetics--LineweaverBurk plot. Significance of Km and Vmax. Factors influencing enzyme-catalyzed reactions : substrate concentration, enzyme concentration, pH, temperature. Competitive, noncompetitive and uncompetitive inhibitions. Regulation of enzyme activities--covalent modifications, allosteric modifications: K- and M- series. Feed-back inhibition. Rate limiting enzymes. Isozymes, Ribozymes and Abzymes.

**C2T: Chemistry of Biomolecules.** Number of classes  
Carbohydrates :Definition and classification. Monosaccharides— Classification, structure, stereoisomerism, optical isomerism, optical activity, epimerism. Cyclic structures- Pyranose and furanose forms, anomerism, mutarotation. Chemical reactions of monosaccharides (Glucose & Fructose) ---- Reactions with concentrated mineral acids, alkali, phenylhydrazine. Derivatives of monosaccharides and their physiological importance. Disaccharides – Maltose, Lactose and Sucrose : Structure, Occurrence and Physiological importance. Polysaccharides – Starch, Glycogen, Dextrin, Cellulose, Glycosaminoglycans, Glycoproteins, Sialic acids.  
Lipids :Definition and classification. Fatty acids - Classification, systemic nomenclature— and structure. Mono-, Di- and Triglycerides. Properties of Fat and Fatty acids Hydrolysis, Saponification number, Iodine number, Acetyl number, Acid number, Reichert-Meissl number. Cis-trans isomerism. Eicosanoids, Phospholipids, Glycolipids, Sphingolipids,

Cholesterol & its ester ---- their structure and physiological importance. Lipoproteins – classification and functions.

Amino acids :Classification, Structure, properties, Protonic equilibria of amino acids – Zwitterions, Isoelectric point, titration curve of amino acids. Reactions with ninhydrin and formaldehyde. Peptides and Proteins :Structure and properties of peptide bonds -- Phi- and Psi angles. Reactions with Sanger's and Edman's reagent. Biuret reaction. Different levels of protein structure -- Primary, Secondary ( $\alpha$ -helix and  $\beta$ -pleated sheet), Tertiary and Quaternary. Forces stabilizing the structures. Denaturation and Renaturation. Purine and Pyrimidine :Structure, nomenclature and tautomerism.

Nucleic acids :Nucleosides and Nucleotides -- structure. Polynucleotides. DNA double helix model. DNA polymorphism: A-DNA, B-DNA and Z-DNA. RNA – Structure, types and functions

**C1P:** Study of Microscope, Staining of squamous epithelium, Adipose tissue, skeletal muscle, & Node of Ranvier. Determination of optimum pH temperature of amylase by DNSA method.

**C2P:** Qualitative tests for the identification of physiologically important substances: Hydrochloric acid, Lactic Acid, Uric Acid, Albumin, Gelatin, Peptone, Starch, Dextrin, Glucose, Fructose, Lactose, Sucrose, Urea, Acetone, Glycerol and Bile salts, Biochemical estimation of glucose by Nelson Somogyi method, Amino nitrogen by formal titration method, Sucrose by Benedict's method

## Semester-II

### C3T: Blood & Body fluid, Biophysics

Number of classes

Bone marrow: Formed elements of blood—origin, formation, functions and fate. Plasma proteins Origin and functions. Erythropoiesis and its controlling factors. Leucopoiesis. Haemoglobin :Structure, reactions, biosynthesis and catabolism. Foetalhaemoglobin. Abnormal haemoglobins- Sickle-cell anemia and Thalassemia. Blood volume :Regulation and determination by dye and radioisotope methods. Hemostasis :Factors, mechanism, anticoagulants, procoagulants. Disorders of hemostasis- Hemophilia, Thrombosis and Embolism. Blood group :ABO and Rh systems (Chemical nature of relevant biomolecules). Erythroblastosisfoetalis. Blood transfusion and its hazards. Lymph and tissue fluids :Formation, circulation, functions and fate. Lymphatic organs :Histological structures and functions of lymph gland and spleen. Splenomegaly causes and effects. Circulatory disorder :Oedema.

**Biophysical Principles:**Diffusion :Its characteristics, factors influencing and physiological applications. Osmosis: Osmotic pressure – laws, and physiological applications. Surface tension—& viscosity:-- Physiological applications. pH—& Buffer- Henderson Hasselbach- equation (quantitative problems). Determination of pH.Colloids :Classification, properties – optical, electrical, electrokinetic. Physiological— importance of colloids. Gibbs-Donnan membrane equilibrium.—Thermodynamics :Type of surroundings and systems. First Law– Internal energy,– enthalpy. Second Law – Entropy, Free energy change, Endergonic and Exergonic reactions, Reversible and Irreversible processes, Equilibrium constant. Physiological steady-state.

### C4T: Nerve muscle Physiology

Number of classes

**Nerve** : Structure, classification and functions of neurons and neuroglia. Cytoskeletal elements and axoplasmic flow. Myelinogenesis. The resting membrane potential. The action potential. Electrotonic potentials. Current of injury. Propagation of nerve impulse in different types of nerve fibers. Compound action potentials. Properties of nerve fibers : excitability, conductivity, all or none law, accommodation, adaptation, summation, refractory period, indefatigability. Chronaxie, rheobase and utilization time. Synapses : types, structure, synaptic transmission of the impulse, synaptic potentials, neurotransmitters, cotransmitters,

neuromodulators. The neuromuscular junction : structure, transmission, end-plate potential, MEPP, post-tetanic potentiation. Motor unit. Motor point. Injury to peripheral nerves – degeneration and regeneration in nerve fiber. Nerve growth factors.

**Muscle:** Electron microscopic structure of skeletal, smooth and cardiac muscles. The sarco-tubular system. Red and white striated muscle fibers. Single-unit and multi-unit smooth muscle. Muscle groups : antagonists and agonists. Properties of skeletal muscle: excitability, contractility, all or none law, summation of stimuli, summation of contractions, effects of repeated stimuli, genesis of tetanus, onset of fatigue, refractory period, tonicity, conductivity, extensibility and elasticity. Length-tension relationship. Muscle proteins. Mechanism of skeletal and smooth muscle contraction and relaxation : Excitation-contraction coupling. Isometric and isotonic contractions. Chemical, thermal and electrical changes in skeletal muscle during contraction and relaxation. Electromyography.

**C3P:** Preparation of Blood film and identification of blood cells, TC; DC, Hb estimation (Cyan-methemoglobin method), hemin crystal, Measurement of diameter of neutrophil/ Megakaryocytes. Preparation of Buffer & pH measurement.

**C4P:** Study of kymograph, Nerve Muscle Preparation, Simple Muscle Curve, temperature, load, summation. Measurement of physical fitness by Harvard step test. Measurement hand grip strength.

## Semester-III

### **C5T : Cardiovascular System**

Number of classes

Cardiovascular System Anatomy of the heart. Properties of cardiac muscle. Origin and propagation of cardiac impulse. Heart Block. Cardiac cycle :Pressure and volume changes. Heart sounds. Murmurs. Cardiac output :Measurement by application of Fick's principle & factors affecting. Starling's law of heart. Electrocardiography: Electrocardiographic leads, The normal electrocardiogram, Cardiac Arrhythmias & Myocardial Infarctions. The pulse: Arterial and venous. Hemodynamics of blood flow. Cardiac and vasomotor centers, baroreceptors and chemoreceptors, innervation of the heart and blood vessels, cardiac and vasomotor reflexes. Cardiovascular homeostasis – neural and chemical control of cardiac functions and blood vessels. Atherosclerosis. Coronary Circulation. Blood pressure: Its measurement and factors affecting. Cardiovascular adjustment after haemorrhage.

### **C6T: Respiratory System.**

Number of classes

Anatomy and histology of the lung and airways. Mechanics of breathing :Role of respiratory muscles, glottis. Compliance of lungs and chest wall, pressure-volume relationships, alveolar surface tension and surfactant, work of breathing. Spirometry: Lung volumes and capacities. Dead space. Pulmonary Circulation :Ventilation- perfusion ratio. Transport of gases (O<sub>2</sub> and CO<sub>2</sub>) in body :Partial pressure and composition of normal atmospheric gases in inspired, expired, alveolar air and blood. Oxygen dissociation curve of hemoglobin and myoglobin – factors affecting. Carbon dioxide dissociation curve. Regulation of respiration -- neural and chemical, respiratory centers, chemoreceptors, baroreceptors, pulmonary receptors. Disorders of Breathing :Hypoxia : Types& effects. Asphyxia, Voluntary hyperpnoea, Apnoea, Cyanosis, Periodic breathing, Asthma, Emphysema. Non-respiratory functions of lung.

### **C7T : Alimentary system and Excretory system**

Number of classes

**Alimentary system:** Histology of alimentary canal. Digestive glands – histological structures, secretion, functions, and regulation of salivary glands, pancreas, liver. Deglutition. Movements of alimentary canal and their regulations. Secretion, functions, and regulation of gastric, and intestinal juices. Enterohepatic circulation. Basic concepts of Peptic Ulcer, Jaundice and Gallstones.

**Excretory System:** Outline structure of kidney, Histology of nephron. Renal circulation – peculiarities and autoregulation. Formation of urine – glomerular function and tubular

functions. Counter-current multiplier and exchanger. Renal regulation of osmolarity and volume of blood fluids. Diabetes insipidus. Formation of hypertonic urine. Renal regulation of acid-base balance. Renal function tests – creatinine, inulin, urea, and PAH clearance tests. Physiology of urinary bladder and micturition. Constituents of urine. Abnormal constituents of urine, and pathophysiological significance. Renal dialysis. Non-excretory functions of kidney. Renin-angiotensin system.

**C5P** :Determination of Blood pressure by Auscultatory Method. Determination of mean pressure, pulse pressure and pulse rate. Preparation of Amphibian Ringer Solution. Kymographic recording of normal and perfused heart of toad and the effects of acetylcholine and adrenaline on the contraction of heart. Recording of ECG.

**C6P** :Pneumograph , measurement of vital capacity, Lung function Test, measurement of respiratory rate ,Effect of exercise on respiratory rate, Determination of  $VO_{2max}$ .

**C7P** : Recording of intestinal movements by Dale's apparatus; effect of Ach and adrenaline on intestinal movements.

Determination of free and total acidity of gastric juice. Determination of salivary amylase by iodine method. Determination of abnormal constituents of urine.



## Semester-IV

### **C8T :Digestion &Metabolism**

Number of classes

Digestion and absorption of protein fat and carbohydrate. Redox potential. Mitochondrial Electron Transport Chain. Oxidative phosphorylation- inhibitors and uncouplers. Carbohydrate :Glycolysis, R-L cycle. TCA cycle, Gluconeogenesis - Cori cycle. Pentose phosphate pathway. Glycogenesis and Glycogenolysis. Lipid:  $\beta$ -oxidation and biosynthesis of saturated and monounsaturated fatty acids. Biosynthesis of lecithin. Biosynthesis of Cholesterol. Ketone body metabolism. [Hormonal regulation of the above mentioned biochemical pathways not required]. Amino acids: Amino acids - Amino acid pool. Glucogenic and ketogenic amino acids. Deamination, transamination, amination and decarboxylation. Synthesis of Urea and Nitric oxide. Biosynthesis of physiologically important compounds (catecholamines, serotonin, melatonin, GABA, glutathione). Purines and Pyrimidines– Biosynthesis :de novo and salvage pathways. Catabolism.

### **C9T: Nutrition &Dietetics**

Number of classes

Nutrition and dietetics Vitamins: Thiamin, Riboflavin, Niacin, Pyridoxine, Pantothenic Acid, Biotin,– Cyanocobalamin, Folic Acid, Ascorbic Acid, Inositol. Vitamins A, D, E and K. Dietary sources, daily requirements, biochemical functions, deficiency symptoms, hypervitaminosis, antivitamins. Minerals: Sources, biological functions of sodium, potassium, calcium,– phosphorus, iron, zinc, iodine and selenium.SDA, RQ and BMR :Factors affecting. Determination of BMR. Dietary requirements of carbohydrate, protein, lipid and other nutrients. Balanced diet and principles of formulation of balanced diets for adult man, adult woman,lactating woman and pregnant women.. Nitrogen balance.Proteinsparers.Supplementary value of proteins.Biological value of proteins.Net protein utilization.Protein efficiency ratio.Dietary fibers.

### **C10T :Nervous System**

Number of classes

The Nervous System Structural organization of different parts of brain and spinal cord. Reflex– action – definition, reflex arc, classification and properties. Autonomic nervous system :organization, outflow, ganglia, centers and– functions. Chemical transmission in autonomic nervous systems. CSF: Formation, circulation and functions. Blood-Brainbarrier. Ascending and descending tracts (tract of Goll, Burdach, Flechsig, GowrtSpinocortical, Pyramidal, RubroSpinal, Tectospinal, Reticulospinal):origin, courses, termination and

functions. Functions of the spinal cord with special reference to functional changes— following hemisection and complete section of spinal cord. Pain production, perception and regulation. Referred pain. Muscle spindle and golgi tendon organ: their structure, innervations and— functions, postural reflexes. Decorticate, decerebrate rigidity and spinal animal. Brain: Structure, nerve connections and functions of brainstem, cerebellum,— reticular formation, hypothalamus, thalamus, basal nuclei and cerebral cortex- Speech and aphasia. Structure and functions of vestibular apparatus. Limbic system: Structure, connections and functions.— Physiology of sleep and EEG. Learning, memory, and emotion. Cerebral circulation & stroke.

**C8P** : Biochemical estimation by Colorimetric Method , Serum protein by (biuret method), Serum albumin, Blood glucose by Nerlson –Samogyi Method , Serum urea by DAM Method, inorganic phosphate by Fick Subarao method

**C9P** :Diet survey report of a family as per ICMR specification.

Qualitative analysis of milk, potato, flour, rice, pulses..

**C10** :Experiment on Superficial(Plantar) & deep(kneejerk) reflex , reaction time by stick drop test , Short term memory (shape pic word) , two point discrimination test. Postural effect on HR, BP.

H-E staining of spinal cord, cerebellum and cerebral cortex.

## Semester – v

### **C11T :Special senses and body temperature regulation.**

Number of classes

Special Senses Characteristics of special senses, Weber-Fechner law, Vision: Structure of eyeball. Histology of retina. Visual pathway and centers. Effects of lesion in visual pathway. Mechanism of accommodation. Errors of refraction and their corrections. Cataract and Glaucoma. Photopic and scotopic vision. Chemical and electrical changes in retina on exposure to light. Positive and negative after- images.. Light and dark adaptation. Colour vision—Trichromatic, Single and Double Opponent mechanism. Colour blindness. Visual field-- perimetry. Visual acuity Critical fusion frequency. Hearing :Structure and functional significance of auditory apparatus. Organ of Corti. Auditory pathways and centers. Mechanism of hearing – Excitation of Hair Cells, Conversion of Sound Waves into Action Potentials in the Auditory Nerve. Mechanism of discrimination of sound frequencies and intensities. Localization of sound source. Deafness. Olfaction and Gustation: Structure and functions of the receptor organs, nerve pathways, Centers. Signal Transduction of olfactory and gustatory stimuli. Abnormalities of olfactory and taste

**Skin and Body Temperature Regulation** :Structure and functions of skin. Cutaneous circulation. Sweat glands –structure and composition of sweat. Mechanism of sweat formation, secretion and its regulation. Insensible perspiration. Regulation of body temperature in human. Pyrexia, hyperthermia and hypothermia.

### **C12T Genetics , Molecular Biology and Biotechnology.**

Number of classes

**Genetics** Chromosome Structure-- Morphology. Chromosomal DNA packaging-nucleosomes and higher level of organisation of chromatin. Euchromatin and heterochromatin..Human genome and its characteristics. Mitochondrial DNA. Karyotyping. Cell cycle – Events and regulation (Brief). Cell division- Brief idea on Mitosis&Meiosisphases and significance. Crossing-over, Linkage.

**Molecular Biology:** DNA replication—Meselson and Stahl Experiment, DNA Polymerases, Ligases and other proteins and mechanism of regulation (prokaryotes). Transcription -- RNA Polymerase and its functions in prokaryotes.Genetic code – properties and wobble hypothesis. Translation – codon-anticodon interaction and mechanism in prokaryotes. Regulation of gene expression : operon concept – the lac operon. Gene mutation – agents and

types. DNA repairing processes. Concept of oncogenes and properties of cancer cells (Brief). Recombinant DNA technology in brief and its applications – gene therapy, transgenic animal.

**C11P** :Determination of visual acuity by Snellin Chart , Determination of Colour Blindness by Ishihara Char ,perimetry. Determination of Deafness by Tuning Fork Test, Determination of hearing threshold by audio meter. Silver Nitrate Preperation of Corneal Cell Space.

**C12P** :Identification of metaphasic chromosome. Estimation of protein by Lowry method, DNA by DPA method, RNA by orcinol method. Identification of DNA on agarose gel, Isolation of plasmid.

## Semester-VI

### **C13T :: Endocrinology and Chronobiology**

Number of classes

Endocrinology Hypothalamus as a neuroendocrine organ. Anterior and posterior pituitary -- histological structure of the gland. Chemical nature, mechanism of action, functions and regulation of secretion of GH, ADH, oxytocin. Pineal hormone (melatonin). Thyroid and Parathyroid -- Histological structure of the glands. Chemical nature, mechanism of action, functions and regulation of secretion of the hormones. Adrenal cortex and medulla -- Histological structure of the gland. Chemical nature, mechanism of action, functions and regulation of secretion of the hormones. Heart as an endocrine organ. Pancreatic islets -- Histological structure. Chemical nature, mechanism of action, functions and regulation of secretion of the hormones. Hormonal control of blood sugar. Hyperinsulinism and diabetes mellitus. Gastro-intestinal hormones -- Chemical nature, mechanism of action and functions. Hypo and hyper secretion of hormone and hormonal disorder.

### **C14T: Reproductive Physiology & Developmental Biology**

Number of classes

Reproductive Physiology Primary and accessory sex organs and secondary sex characters. Histology of testis. Endocrine functions of testis. Spermatogenesis. Hypothalamic control of testicular functions. Histology of ovary. Ovarian hormones and their functions. Oogenesis and ovulation. Formation and functions of corpus luteum. Hypothalamic control of ovarian functions. Physiology of puberty. Menstrual cycle and its regulation. Abnormalities in menstrual cycle. Onset of menopause and postmenopausal changes. Structure and functions of placenta. Maintenance of pregnancy and the bodily changes during pregnancy. Parturition. Pregnancy tests. Development of mammary glands, lactation and their hormonal control. Developmental Biology Stem cell :Characteristics and applications. Totipotency, Differentiation. Ultra structure :Sperm and Ovum. Fertilization, Blastulation, Implantation, Gastrulation. Organogenesis :Development of Heart, urinary system and genital system. Fetal Circulation.

**C13P** : Identification of lung, Kidney, Skin, Testis, Ovary, Thyroid, Pancreas, Spleen, Lymph gland, salivary gland, stomach, intestine, Liver Adrenal gland, pituitary.

Report on Educational Excursion.

**C14P** :Pregnancy Test, sperm count, Study of estrus cycle. Determination serum calcium, measurement of activity of acid phosphatase (total and prostatic) from serum.

### **DISCIPLINE SPECIFIC ELECTIVE (DSE)**

DSE-A : (one course in semester 5 & one course in semester 6 )

1. Biostatistics & computational biology
2. Microbiology & Immunology
3. Work and sport physiology and Ergonomics
4. Community and social medicine,

DSE – B (one course in semester 5 & one course in semester 6)

1. Application of instruments in study of physiology
2. Advanced Molecular biology & Nanotechnology
3. Toxicology & Pharmacology
4. Stress Physiology, Yoga and meditation.

### **SKILL ENHANCEMENT COURSE(SEC)**

SEC – A (one course in semester 3)

- 1, **Hematological Technics**
2. Clinical biochemistry

SEC –B (one course in semester 4)

1. Applied food sciences
2. **Fundamentals of computer and Bioinformatics**

### **ABILITY ENHANCEMENT COMPULSORY COURSE (AECC)**

AECC -1 : **Communicative English** or any other Modern Indian Language in Sem I

AECC – 2 : Environmental Study in Sem 2

## **Discipline Specific Electives**

### **DSE: GROUP-A**

#### **BioStatistics & Computational Biology**

##### **DSE A1TH**

Basic concepts– Variable, population, parameter, sample, statistic. Classification of data – qualitative and quantitative, continuous and discontinuous. Presentation of data–frequency distribution, bar diagram, pie diagram, frequency polygon and histogram. Mean, median, mode, standard deviation and standard error of ungrouped data. Concept of probability, Null and Alternate Hypotheses, Characteristics and uses of Normal and t-distributions.

##### **DSE A1P**

Computation of mean, median, mode, standard deviation and standard error of the mean using physiological data like body temperature, pulse rate, respiratory rate, height and weight of human subjects. Graphical representation of data in bar diagram, pie diagram frequency polygon and histogram.

#### **Microbiology & Immunology**

##### **DSE A2 TH**

Viruses - DNA virus and RNA virus. Viroids and Prions. Bacteriophages. Bacteria-structure and morphological classification. Gram positive and Gram negative and acid-fast bacteria. Pathogenic and non-pathogenic bacteria - definition with a few examples. Physical and chemical methods used in disinfection,sterilization and pasteurization. Nutritional requirement – complex and synthetic media, preparation of media ; physical factors required for growth (temperature, pH and gaseous requirement). Bacterial growth curve. Elementary idea of bacteriostatic and bacteriocidal agents.

Beneficial and harmful microorganisms in food. Elementary knowledge of innate and acquired immunity. Humoral and cell mediated immunity. Toxins and toxoids.Vaccination –

Passive and active immunisation, types and uses of vaccine. Immunological basis of allergy and inflammation.

### **DSE A2P**

Sterilization, Negative Staining, Gram Staining, Acid-fast Staining, Bacterial Spore Staining, Culture preparation, Isolation of Bacteria.

### **Application of instruments in study of physiology**

#### **DSE B1TH**

Principles uses, advantages and disadvantages: Compound microscope, Phase contrast microscope, Fluorescence microscope, Confocal microscopy, Transmission and Scanning electron microscope. Spectrophotometer and pH meter.

Chromatography: Principles and uses of : TLC, Gel filtration, Affinity chromatography, ion-exchange chromatography. Electrophoresis: Principles and method, uses of Agarose gel electrophoresis, SDS – PAGE. Centrifugation: Density gradient ultracentrifugation. Radioactivity – Radiolabelling of biomolecules and its detection by autoradiography. Principles of RIA, ELISA. Western, Northern and Southern blotting techniques. Polymerase chain reaction-basic concept. Principles and uses of CT scan, MRI and PETscan.

#### **DSE B1P**

Single staining, negative staining, Ion exchange and gel filtration chromatography, TLC, SDS-PAGE.

### **Work & Sports Physiology and Ergonomics**

#### **DSE A3TH**

Concept of physical work and physiological work. Classification of work loads. Energetics of muscular work. Measurement of energy cost. Cardiovascular and respiratory responses to graded exercise. Maximal oxygen consumption and post-exercise oxygen consumption – definition, factors affecting, measurement and significance. Muscle fatigue and recovery. Physical fitness and its assessment by modified Harvard Step Test. Ergonomics. Importance



of ergonomics in occupational health and well being. Definition of anthropometry. Different body dimensions measured in anthropometry and their significance.

### **DSE A3P**

Measurement of resting and working heart rate using thirty beats and ten beats methods respectively. Measurement of blood pressure before and after exercise. Determination of Physical Fitness Index by modified Harvard Step Test. Measurement of some common anthropometric parameters- stature, weight, eye height (standing), shoulder height, sitting height, knee height (sitting), arm reach from wall, mid-arm circumference, waist circumference, hip circumference, neck circumference, head circumference, chest circumference. Calculation of BSA and BMI from anthropometric data.

### **Community and Social Medicine**

#### **DSE A4 TH**

Basic idea about community, public health issues. Malnutrition in a community, over nutrition and possible remedial measures. Diet management of obese, diabetic. 12 Basic idea of PCM and their prevention. PCM -- Marasmus, kwashiorkor. Endemic goiter, rickets, osteomalacia, xerophthalmia, beriberi and their social implications. Etiology, epidemiology and prevention of: Communicable diseases : Malaria, Dengue, Hepatitis and AIDS; Non-communicable diseases – Hypertension and Obesity. Population problem – principles and methods of family planning, and Assisted Reproductive Technologies. Principles of diet survey. Composition and nutritional value of common food stuffs. Principles of formulation of diet chart of growing children, pregnant & lactating women and diabetic patients.

#### **DSE A4P:**

Diet survey report (hand-written) of a family (as per ICMR specification): Each student has to submit a report on his/her own family.

### **Advanced Molecular biology & Nanotechnology**

#### **DSE B2TH**

Elementary idea of Genetic Engineering, Molecular Cloning and its significance, Isolation of DNA fragment to be cloned, Restriction Enzymes, Vectors, Ligation of insert and Vector, Introduction of recombinant DNA into host cell, Screening for Recombinant DNA. Idea about Human Genome Project.

Principles of Nanotechnology, Properties and Characterization of Nanoparticles, Application of nanotechnology in drug delivery.

### **DSE B2P**

Isolation of Genomic DNA, Isolation of Plasmid DNA, DNA gel electrophoresis. Quantification of DNA by DPA Method, Quantification of RNA by Orcinol Method, Quantification of Protein by Bradford Reagent.

### **Toxicology & Pharmacology**

#### **DSE B3TH**

The importance of pharmacology in the study of physiological processes- drugs, agonist, antagonist.

Pharmacokinetics-absorption, distribution, excretion and bioavailability of drugs. Drug biotransformation. The dose effect relationship and the characteristics of dose response curve. Assessment of drug toxicity- LD50 and ED50. Drugs affecting synaptic and neuroeffector functional sites-chemistry, organ system effects and mechanism of action of phenoxybenzamine, phentolamine, propranolol and nifedipine. Drugs affecting catecholamine and cholinergic nerve transmission-guanethidine, reserpine, physostigmine and nerve gases (tabun, sarin). Neuromuscular blocking agents, tubocurarine, succinyl choline, nicotine. Sedative-hypnotics. Barbiturates- actions on organ systems and mechanism of action. Antihistamines: Pharmacological properties.

Diuretics: Effects on renal functions and mechanism of action of benzothiadiazides.

### **Stress Physiology, Yoga and meditation.**

#### **DSE B4TH**

Exercise in cold-physiological responses to exercise in cold, health risks during exercise in cold, effect of cold in human performance, exercise in hot environment, physiological responses to exercise in heat. Exercise in high altitude physiological adaptation at altitude, aerobic performance at high altitude, training for competition at high altitude. Exercise for the disabled physically and mentally challenged. Yogic exercise & Fitness: physiology of yogic exercise, therapeutic use of yoga.

Yoga, meditation & relaxation, sports & mechanics, sports & socialization, yoga & stress management.

## **Skill Enhancement Course (SEC)**

### **Hematological Techniques**

#### **SEC A1TH**

Blood groups - ABO and Rh. Immunological basis of identification of ABO and Rh blood groups. Biochemical basis of ABO system and Bombay phenotype. Blood transfusion - precaution and hazards. Concept of blood bank. Erythropoietin and thrombopoietin. Foetalhaemoglobin. Abnormalhaemoglobins - thalassaemia and sickle-cellanaemia. Definition, determination and significance of TC, DC, ESR, Arneth count, PCV, MCV, MHC, MCHC, bleeding time, clotting time and prothrombin time. Anaemia - types (definition and causes). Leucocytosis, Leucopenia and Leukaemia. Purpura. Disorders of coagulation. (4) 9

#### **SEC A1P**

DC of WBC, Estimation of haemoglobin , Blood group determination, Bleeding time and Clotting time.

### **Clinical Biochemistry**

#### **SEC A2TH**

Pathophysiological significance of the following blood constituents: glucose, serum protein, albumin, urea, creatinine, uric acid, bilirubin and ketone bodies. Lipid profile in health and diseases. Pathophysiological significance of the following serum enzymes and isozymes: Lactate dehydrogenase, Creatine kinase, Amylase, Acid and Alkaline phosphatases,  $\beta$ -glucurodinase, SGPT and SGOT.

#### **SEC A2P**

Determine the abnormal constituents of urine, Estimation of SGOT and SGPT in serum, Estimation of glucose by Folin U method, Estimation of Urea by DAM method.

### **Detection of Food Additives / Adulterants & Xenobiotics**

#### **SEC B1TH**

Definition of food adulterants/ additive. Tests for identifying food adulterants-- Metanil yellow, Rhodamin B, Saccharin, Monosodium glutamate, Aluminium foil, Dioxin, Chicory and Bisphenol. Concept of Xenobiotics- Types, sources and fate. Types of reactions in detoxification and their mechanisms- oxidation, reduction, hydrolysis and conjugation.

### **Fundamentals of computer and Bioinformatics**

#### **SEC B2TH**

Computer: Basic concepts of software and hardware, types of computer, elementary idea of computer

Internet: Webpages, Internet protocols, Search engines, Subject Directories etc. Biological Database management systems: a. Nucleic acid sequences databases b. Genome databases (e.g. Human Genome Project) c. Protein sequence and structure databases d. Literature databases 4. Importance of Bioinformatics.

Introduction to Data archiving systems (FASTA format, Accession number)

Applications of bioinformatics: a. Data retrieval systems: data query and data mining (Pubmed, Entrez), Sequence retrieval system (SRS) and protein identification resource (PIR). b. Molecular sequence analysis software packages and tools, Sequence alignments (Pairwise & multiple alignment) c. Molecule structure: domains, folds and motif analysis. d. Evolutionary study with Phylogenetic trees.