

**PHYSIOLOGY COURSE OUTCOME SEMESTER 1**

Semester	Topic	Sub Topics	Course Outcome
1 GE1/CC1 TH	Cellular Basis of Physiology	Structure and functions of plasma membrane, nucleus and different cell organelles – Endoplasmic reticulum, Golgi bodies, Mitochondria, Lysosome and Peroxisome	Prediction of knowledge about cells and different organelles and gaining idea about their functions in our body.
	Biophysical Principles, Enzymes and Chemistry of Bio-molecules	<p>Physiological importance of the following physical processes: Diffusion , Osmosis and Surface tension. pH and Buffers – Significance in human body and maintenance of pH in the blood. Colloids - Classification and physiological importance.</p> <p>Enzymes: Classification, factors affecting enzyme action. Concept of coenzymes and isozymes.</p> <p>Carbohydrates : Definition and classification. Monosaccharides – Classification, structure, physiological importance.</p> <p>Disaccharides – Maltose, Lactose and Sucrose: Structure, occurrence and physiological importance.</p> <p>Polysaccharides – Starch, Glycogen, Dextrin, Cellulose.</p> <p>Lipids : Definition and classification. Fatty acids Classification.</p> <p>— Definition and importance of, Saponification number and, Iodine number.. Phospholipids, Cholesterol &amp; its ester -- physiological importance.</p> <p>Amino acids, Peptides and Proteins: Classification and structure. Structure of peptide bonds.</p> <p>Nucleic acids: Structure of DNA and RNA.</p>	<p>Idea about different biophysical and biochemical reactions of the system and how equilibrium is maintained.</p> <p>Knowledge of different biochemical molecules in detail about their structure function and classification.</p>

	Digestion & Metabolism	<p>Structure in relation to functions of alimentary canal and digestive glands.</p> <p>Composition, functions and regulation of secretion of digestive juices including bile. Digestion and absorption of carbohydrate, protein and lipid. Movements of the stomach and small intestine.</p> <p>Glycolysis, TCA cycle, Importance of Glycogenesis, Glycogenolysis and Gluconeogenesis. Beta oxidation of saturated fatty acid. Importance of Ketone bodies . Deamination &amp; Transamination. Formation of urea.</p>	<p>Basic idea about the digestive process of the human body along with knowledge of different enzymatic biochemical procedures which helps in metabolism.</p>
1 GE1/CC1 P		<p>Examination and staining of fresh tissues : Squamous, Ciliated and Columnar Epithelium by Methylene Blue stain.</p> <p>Qualitative tests for identification of : Glucose, Fructose, Lactose, Sucrose, Starch, Dextrin, Lactic acid, Hydrochloric acid , Albumin, Acetone, Glycerol and Bile Salts.</p> <p>Quantitative estimation of amino nitrogen by Sorensen's formol titration method</p>	<p>Basic knowledge and practice of biochemical experiments including titration and identification of cellular materials by proper histological procedures.</p>

**PHYSIOLOGY COURSE OUTCOME SEMESTER 2**

Semester	Topic	Sub Topics	Course Outcome
CC2TH / GEN 2TH	Blood and Body Fluids	Blood: composition and functions. Plasma proteins: origin and functions. Blood cells-- their morphology and functions. Erythropoiesis. Hemoglobin : different types of compounds and derivatives. Coagulation of blood: mechanism, procoagulants, anticoagulants.. Lymph and tissue fluids: composition, formation, and functions.	Basic idea about different body fluid compartments, components and their functions along with their clinical significance. Also the knowledge of coagulation and disorders.
	Cardiovascular System	Anatomy and histology of the heart. Properties of cardiac muscle. Origin and propagation of cardiac impulse. Cardiac cycle : Events. Heart sounds. Heart rate. Cardiac output: Determination by following Fick principle, factors affecting. Pulse - arterial and venous. Blood pressure and factors controlling. Baro- and chemoreceptors. Vasomotor reflexes. Peculiarities of regional circulations: coronary and cerebral.	<i>Explanation of structure, function and common cardiovascular conditions, including diagnostic tests and therapeutic approaches. Analysis of factors leading to hypertension, as well as approaches useful in preventing and treating the condition.</i>

	Respiratory System	<p>Anatomy and histology of the respiratory passage and organs. Role of respiratory muscles in breathing. Lung volumes and capacities. Exchange of respiratory gases between lung and blood and between blood and tissues. Transport of oxygen and carbon dioxide in blood. Regulation of respiration - neural and chemical. Hypoxia.</p>	<p>Description and illustration of the main anatomical structures of respiratory system and the mechanics of inspiration and expiration. Basic idea about the factors affecting pulmonary ventilation and mechanisms of O<sub>2</sub> and CO<sub>2</sub> transport in the blood.</p>
CC2P GEN 2P		<p>Preparation and staining of human blood film with Leishman's stain and identification of different types of blood cells. Preparation of hemin crystals. Demonstration- kymographic recording of the unperfused heart of toad and effects of warm and cold saline. 5 Measurement of systolic and diastolic pressure by sphygmomanometer and determination of pulse and mean pressure. Measurement of peak expiratory flow rate. Pneumographic recording of normal respiratory movements and effects of hyperventilation and breath-holding.</p>	<p>Basic knowledge and practice of histological experiments, measurement of blood pressure and pneumographic recordings.</p>

**PHYSIOLOGY COURSE OUTCOME SEMESTER 3**

Semester/Paper	Topic	Sub Topic	Course outcome
3 GE3/CC3 TH	Nerve-muscle Physiology	Structure of neurons. Origin and propagation of nerve impulse. Velocity of impulse in different types of nerve fiber. Properties of nerve fibers: all or none law, rheobase and chronaxie, refractory period. indefatigability. Synapses: structure, mechanism of synaptic transmission. Motor unit. Myoneural junction: structure, mechanism of impulse transmission. Degeneration and regeneration in nerve fibers. Different types of muscle and their structure. Red and white muscle. Muscular contraction: structural, mechanical and chemical changes in skeletal muscle during contraction and relaxation. Isotonic and isometric contractions. Properties of muscle: all or none law, beneficial effect, summation, refractory period, tetanus, fatigue.	Idea about types of nerve fibres, muscle fibres, their properties and mechanism of action in our body. Basic idea and working principle of myoneural junction.

	Nervous System	<p>A brief outline of organization and basic functions (sensory, motor and association) of the nervous system, central and peripheral nervous system.</p> <p>Ascending tracts carrying touch, kinaesthetic, temperature and pain sensations.</p> <p>Descending tracts: pyramidal tract and brief outline of the extra-pyramidal tracts.</p> <p>Reflex action - definition, reflex arc, classification, properties. Functions of the spinal cord. Outline of functions of brain stem.</p> <p>A brief idea of the structure, connections and functions of cerebellum. Different nuclei and functions of thalamus and hypothalamus. Cerebral cortex: histological structure and localization of functions. CSF : composition, formation, circulation and functions.</p> <p>A brief description of the organization of the autonomic (sympathetic and parasympathetic) nervous system.</p> <p>Functions of sympathetic and parasympathetic nervous system. A brief idea of speech, aphasia, conditioning, learning and memory.</p>	<p>Brief idea of the somatic nervous system, peripheral and central nervous system, their anatomical properties, working mechanisms and functions. Knowledge of special abilities like learning and memory.</p>
	Special Senses	<p>Olfaction and Gustation: Structure of sensory organ, neural pathway of olfactory and gustatory sensation. Mechanism of olfactory and gustatory sensation. Olfactory and gustatory adaptation. After-taste.</p> <p>Audition: Structure of ear, auditory pathway, mechanism of hearing.</p> <p>Vision: Structure of the eye. Histology of retina. Visual pathway. Light reflex. Chemical changes in retina on exposure to light. Accommodation - mechanism. Errors of refraction.. Light and dark adaptation. Elementary idea of colour vision and colour blindness.</p>	<p>Introduction to the special neuro sensations of our body like vision, audition, gustation and olfaction. Detailed learning about their anatomical and historical structure and mechanism of action with reference to clinical conditions.</p>

<p>3 GE3/CC3 P</p>		<p>Silver Nitrate preparation of nodes of Ranvier. Silver nitrate preparation of corneal cell space. Examination and staining of skeletal and cardiac muscles by Methylene Blue stain. Demonstration : Use of kymograph, induction coil and mercury key. Recording of simple muscle curve with sciatic-gastrocnemius muscle preparation of toad. Determination of visual acuity by Snellen's chart / Landolt's C chart. Determination of colour blindness by Ishihara chart. Exploration of conductive and perceptive deafness by tuning fork method.</p>	<p>Practical idea of histological preparation of nerve and muscles. Basic idea of physiological instruments such as kymograph and it's working of principle. Elementary idea about clinical diagnostic methods of vision and hearing.</p>
<p>SEC A1</p>	<p>Microbiology &amp; Immunology</p>	<p>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.</p>	<p>Brief idea about microorganisms such as viruses and bacteria-their types, basic characteristics, beneficial and harmful effects.</p>

SEC A2	Clinical Biochemistry	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.	Pathological and biochemical knowledge about different blood constituents.
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**PHYSIOLOGY COURSE OUTCOME SEMESTER 4**

Semester/Paper	Topic	Sub Topic	Course outcome
CC4TH / GEN 4 <sup>TH</sup>	Endocrinology	<p>Hormones classification. Elementary idea of mechanism of hormone action.</p> <p>Hypothalamus: Basic concept of neurohormone. Hypothalamo-hypophyseal tract and portal system. Pituitary: Histological structure, hormones, functions. Hypo and hyper active states of pituitary gland. Thyroid: Histological structure. Functions of thyroid hormones (T4T3). Thyrocalcitonin. Hypo and hyper-active states of thyroid. Parathyroid: Histological structure, functions of parathyroid hormone. Tetany. Adrenal Cortex: Histological structure and functions of different hormones. Hypo and hyper-active states of adrenal cortex. Adrenal Medulla: Histological structure and functions of medullary hormones. The relation of adrenal medulla with the sympathetic nervous system. Pancreas: Histology of islets of Langerhans. Origin and functions of pancreatic hormones. Diabetes mellitus. 7 Brief idea of the origin and functions of renin-angiotensin, prostaglandins. erythropoietin and melatonin. Elementary idea of gastrointestinal hormone.</p>	<p>Introduction to the human endocrine system along with their effects on growth, metabolism, musculo-skeletal development. Elementary idea of hypo and hyper effects of each hormones and remedies.</p>

	Reproductive Physiology	Primary and accessory sex organs and secondary sex characters. Testis: histology, spermatogenesis, testicular hormones and their functions. Ovary: histology, oogenesis, ovarian hormones and their functions. Menstrual cycle and its hormonal control. Maintenance of pregnancy – role of hormones. Development of mammary gland and lactation - role of hormones.	Basic knowledge of the human reproductive system , functions and effects of endocrine secretions of reproductive organs on bodily functions. Detailed learning about Menstrual cycle, pregnancy.
	Excretory Physiology	Structure and function relationship of kidney. Mechanism of formation of urine. Normal and abnormal constituents of urine. Physiology of micturition. Renal regulation of acid-base balance. Non-excretory functions of kidney. Structure and functions of skin. Insensible and sensible perspiration Regulation of body temperature -- physical and physiological processes involved in it. Physiology of sweat secretion and its regulation.	Elementary idea of Structure,function and disturbances of human excretory system. Basic idea of physical and physiological processes involved in regulation of body temperature.
CC4P / GEN 4P		Study and Identification of Stained Sections of Different Mammalian Tissues and Organs: Esophagus, Stomach, Small Intestine, Large Intestine, Liver, Lung,Trachea, Spinal cord, Cerebral cortex, Cerebellum, Thyroid Gland, Adrenal Gland, Pancreas, Spleen,Testes, Ovary, Kidney, Artery and Vein. Identification of : Normal constituents of urine : Chloride, Sulphate, Phosphate, Creatinine and Urea; Abnormal constituents of urine: Glucose, Protein, Acetone, Bile pigment and Bile Salt.	Practical idea of identification of stained sections of different mammalian tissues and organs. Assessment of normal and abnormal constituents of urine.

Skill Enhancement Course (SEC)- SEC B1	Detection of Food Additives / Adulterants & Xenobiotics	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.	Basic idea of toxic food adulterants and their inverse effects on human systems. Introduction to the basic concepts of xenobiotics.
SEC B2	Community and Public Health	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 formulation of diet chart of growing children, pregnant & lactating women and diabetic patients.	Basic idea of principles, concepts, evidence-based knowledge and skills in public health nutrition to complex public health nutrition problems.

**PHYSIOLOGY COURSE OUTCOME SEMESTER 5**

Semester/period	Topic	Sub-topic	Course outcome
5 DSE A1 TH	Biological Statistics	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	Basic concepts of methods of statistics used in biological analysis and calculations.
DSE A1 P		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.	Presentation of biological statistical methods.

<p>5 DSE A2 TH</p>	<p>Haematology</p>	<p>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 .Foetal haemoglobin. Abnormal haemoglobins - thalassaemia and sickle-cell anaemia. Definition, determination and significance of TC, DC, ESR, Arneht 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.</p>	<p>Elementary idea of blood group, transfusion and different haematological factors, diseases.</p>
<p>DSE A2 P</p>		<p>DC of WBC, Estimation of haemoglobin , Blood group determination, Bleeding time and Clotting time.</p>	<p>Basic knowledge and practice of some common haematological experiments.</p>

**PHYSIOLOGY COURSE OUTCOME SEMESTER 6**

Semester/Par per	Topic	Sub Topic	Course outcome
Discipline Specific Electives- DSE B1TH	Work & Exercise Physiology and Ergonomics	<p>Concept of physical work and physiological work. Classification of work loads. Energetics of muscular work. Measurement of energy cost.</p> <p>Cardiovascular and respiratory responses to graded exercise. Maximal oxygen consumption and post-exercise oxygen consumption – definition, factors affecting, measurement and significance.</p> <p>Muscle fatigue and recovery. Physical fitness and its assessment by modified Harvard Step Test. Ergonomics.</p> <p>Importance of ergonomics in occupational health and well being. Definition of anthropometry. Different body dimensions measured in anthropometry and their significance.</p>	<p>Necessary knowledge of work and exercise physiology.</p> <p>Introduction to ergonomics and its uses in occupational health.</p> <p>Basic idea of anthropometric data and their significance in daily life.</p>
	DSE B1P	<p>Measurement of resting and working heart rate using thirty beats and ten beats methods respectively. Measurement of blood pressure before and after exercise.</p> <p>Determination of Physical Fitness Index by modified Harvard Step Test.</p> <p>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.</p> <p>Calculation of BSA and BMI from anthropometric data.</p>	<p>Practice and skill development of basic cardiovascular, pulmonary assessments and Anthropometric parameters.</p>

DSE B2TH	Human nutrition and dietetics	<p>10 Basic constituents of food and their nutritional significance. Vitamins- Classification, functions, deficiency symptoms and daily requirements. Hypervitaminosis. Mineral metabolism – Ca, P, Fe. BMR: definition, factors affecting. Respiratory quotient: definition, factors affecting and significance. Biological value of proteins. Essential and non-essential amino acids. Nitrogen balance. SDA : definition and importance. Body calorie requirements – adult consumption unit. Dietary requirements of carbohydrate, protein, lipid and other nutrients. Dietary fibres. Principles of diet survey. Composition and nutritional value of common food stuffs.</p>	Utilization of knowledge from the physical and biological sciences as a basis for understanding the role of food and nutrients in health and disease processes.
	DSE B2P	Diet survey report (hand-written) of a family (as per ICMR specification): Each student has to submit a report on his/her own family.	Preparation of proper diet plans and culturally competent nutrition services for individuals and communities.

## **PROGRAMME OUTCOME**

Human Physiology is the science deals with, how the human body functions in health and disease. Students examine human physiological systems from the molecular and cellular levels to the human body as a whole. Human physiology seeks to understand the mechanisms that work to keep the human body alive and functioning, The principal level of focus of physiology is at the level of organs and systems within systems. The endocrine and nervous systems play major roles in the reception and transmission of signals that integrate function in animals. Homeostasis is a major aspect with regard to such interactions within plants as well as animals. The biological basis of the study of physiology, integration refers to the overlap of many functions of the systems of the human body. After studying the Human Physiology, the students have the opportunity to do the future study Molecular Biology, Biotechnology, Biochemistry, Cell-Biology, Microbiology, Details of Endocrinology, Sports Physiology, Ergonomics and Occupational Health and above all the students do their future research on this domain and do their carer academically strong. After qualifying the B.Sc. General subjects the students may apply for the nursing, hospital administration, paramedical courses, physician assistant, WBCS officer, School teacher, Nurses etc.