
TRIPURA UNIVERSITY

SURYAMANINAGAR-799022



DEPARTMENT OF HUMAN PHYSIOLOGY

Under Graduate
COURSE AND CURRICULUM

Under NEP 2020

MAJOR DISCIPLINE SPECIFIC COURSE

Basic Structural Framework of the Syllabus

CORE COURSES :{[MAJOR]}

Course Code	Subject Name of the Course
YEAR 1 1ST SEMESTER	
Course I (4 Th)	History of Physiology & Medicine; Contribution of Indian scientists in the field of Physiology and allied health sciences; Structural and functional basis of Human Body.
Course 2 (2 Th)	Biophysics and Physicochemical Principles; Chemistry of Bio molecules, structure and classification of macromolecules, protein separation
Course 2 (2P)	Lab work I
2ND SEMESTER	
Course 3 (4 Th)	Cardiovascular System; Respiratory System.
Course 4 (2 Th)	Physiology of Blood and body fluids
Course 4 (2 P)	Lab work II
YEAR 2 3RD SEMESTER	
Course 5 (4 Th)	Enzyme classification and kinetics, Digestion & absorption
Course 6 (2 Th)	Excretory physiology; Skin and body temperature regulation.
Course 6 (2 P)	Lab work III
4TH SEMESTER	
Course 7 (4 Th)	Endocrinology; Reproductive Physiology
Course 8 (2 Th)	Nerve muscle physiology.
Course 8 (2 P)	Lab work IV
YEAR 3 5TH SEMESTER	
Course 9 (4 Th)	Molecular Biology and Human Genetics
Course 10 (2Th)	Cell Signaling, cell cycle and apoptosis
Course 10 (2 P)	Lab work V
Course 11 (4 Th)	Immunology
Course 12 (2 Th)	Molecular physiological basis of Cancer
Course 12 (2 P)	Lab work VI

6th SEMESTER	
Course 13 (4 Th)	Nervous System
Course 14 (2 Th)	Special senses
Course 14 (2P)	Lab work VII
Course 15 (4 Th)	Exercise & Sports Physiology and Yoga,
Course 16 (2 TH)	Work Physiology, Ergonomics and Occupational Health.
Course 16 (2P)	Lab work VIII
YEAR 4	
7th SEMESTER	
Course 17 (4 Th)	Metabolic pathways and integration, oxidative phosphorylation
Course 18 (2 Th)	Nutrition and Dietetics
Course 18 (2P)	Lab work IX
Course 19 (4Th)	Embryology & Developmental Biology, Stress Physiology.
Course 20 (2Th)	Neurochemistry, Behavioral physiology & Higher brain functions, chronobiology
Course 20 (2P)	Lab work X
8th Semester	
Course 21 (4 Th)	Medical Microbiology
Course 22 (2 Th)	Environmental Physiology and Public Health issues
Course 22 (2P)	Lab work XI
Course 23 (4 Th)	Molecular Biological, Cell Biological and Immunological Techniques
Course 24 (2Th)	Biostatistics, Research Methodology & Ethical issues in Biomedical Research
Course 24 (2P)	Lab work XII

DETAIL COURSE CONTENTS: (CORE COURSES):

YEAR – 1

Semester–I:

Course I (4 Th)	History of Physiology & Medicine; Contribution of Indian scientists in the field of Physiology and allied health sciences; Structural and functional basis of Human Body.
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History of Physiology & Medicine; Contribution of Indian scientists in the field of Physiology and allied health sciences; Structural and functional basis of Human Body.

Course objective: Objective of the course is to give learners fundamental knowledge of human body and different principle governing its function.

Learning outcome: At the end of the course, learners will be able to:

Describe the structural framework of human body and organ systems.

Analyze the importance of different biophysical and physiochemical principles.

Summarize the chemistry of different biomolecules.

Demonstrate the skill to explain the basis of normal function of human body Interpret the importance of Human physiology as a basic science subject.

History of Physiology and medicine and contribution of Indian Scientists in the field of Physiology and allied health sciences:

Charaka

Sushruta

Patanjal

U.NBrahmachari

S.CMahalanobis

J.B.S. Haldane

A.SPainal

Structural and Functional basis of Human Body:

Cell theory- General concept of structure and function of cell organelles of Eukaryotic cell: Endoplasmic reticulum, Golgi body, Mitochondria, Nucleus, Lysosomes, Peroxisomes, Ribosomes.

Cytoskeletal system, Cell junction, Cell inclusions.

Structural and functional basis of different human body organ and organ systems.

Musculoskeletal system.

Homeostasis and its control systems

Anthropometric landmarks.

Course 2 (2 Th)	Biophysics and Physicochemical Principles; Chemistry of Bio molecules, structure and classification of macromolecules, protein separation methods
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Biophysics and Physicochemical Principles:

Diffusion, osmosis, surface tension & viscosity - definition and physiological applications.
 Properties of water, pH and Buffer - definition, weak chemical bonds, biological significance;
 Henderson-Hasselbalch equation, mathematical problems on pH and buffer.
 Gibbs-Donnan membrane equilibrium - its biological application and relation with osmotic pressure and pH.
 Colloids - Classification, properties - optical and electrical, Physiological importance of Colloids.

Chemistry of Biomolecules:

Carbohydrates - Definition and Classification.
 Monosaccharides - classification, structure, stereoisomerism, optical isomerism, optical activity, epimerism.
 Cyclic structure - pyranose and furanose forms, anomerism, mutarotation and its mechanism. Chemical reactions of monosaccharides (Glucose and Fructose).
 Reactions with acid and alkali and their biochemical importance. Polysaccharides - Starch, glycogen, dextrin.
 Lipids - Definition and Classification. Fatty acids - Classification, and structure. Phospholipids and glycolipids - classification and physiological significance.
 Mono and polyunsaturated fatty acids and their physiological significance.
 Sterols - Chemical nature, structure, classification and physiological importance.
 Amino acids - Classifications. Peptide and Protein: Zwitterion, isoelectric pH, isoionic form
 Primary, secondary (alpha helix, beta sheet and globular structure), tertiary, quaternary structure of proteins.
 Protein purification and separation methods.

Course 2 (2P)	Lab work I
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Course objective: Objective of the course is to train learners on skills for performing different anthropometric and biochemical measurements.

Learning outcome: At the end of the course, learners will be able to:

Demonstrate the skill to measure different anthropometric parameters. Become equipped to do different biochemical analysis.

Describe the models and charts on human body and organ systems.

Analyze the importance of different anthropometric and biochemical parameters.

Interpret the results in light of knowledge on normal values in human systems.

Study of Models/Charts of different body organ systems & organs – Anatomical position, Structure & Functions.

Study of Body Anthropometry - Stature, weight, sitting height, shoulder height (standing), Elbow height (standing), Hip height (standing), hand length, shoulder elbow length, leg length, shoulder breadth (biacromial), Arm reach from wall (Arm span) Knee to Knee Breadth, Elbow to elbow breadth, Head circumference, Shoulder circumference, Chest circumference, waist circumference, hip circumference. Calculation of BMI, BSA, WHR, Head and Chest circumference ratio.

Qualitative identification of physiologically important substances – HCL, Lactic acid, Uric acid, Albumin, Peptone, Starch, Dextrin, Glucose, Fructose, Lactose, Maltose, Sucrose, Bile salt, Acetone, Glycerol, urea.

Preparation of buffer solution and determination of pH.

Semester –II:

Course 3 (4 Th)	Cardiovascular System; Respiratory System.
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Cardiovascular System; Respiratory System.

Course objective: Objective of the course is to provide knowledge on functions of blood, body fluid, respiratory and cardiovascular system, their regulation and application of the knowledge.

Learning outcome: At the end of the course, learners will be able to:

Describe different formed elements of blood, their formation and function.

Explain the structural framework of human cardiovascular and respiratory system.

Summarize the mechanism of cardiovascular and respiratory homeostasis.

Demonstrate the skill to explain the causes of hematological, cardiovascular and respiratory abnormalities. Express opinion on correction of different diseases associated with these systems.

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 - Principles of Electrocardiography, Normal electrocardiogram, different waves, intervals and segments; different electrocardiographic leads systems. Cardiac Arrhythmias. The pulse - Arterial and venous. Hemodynamics of blood flow.

Innervation of the heart and blood vessels, cardiac and vasomotor reflexes.

Coronary Circulation. Coronary artery disease - Atherosclerosis.

Blood vessels - types, structure. Hemodynamics: velocity of blood flow, nature of blood flow, Flow-Pressure-Resistance relationship.

Blood pressure - regulation with special reference to sino-aortic mechanism. Its controlling factors.

Immediate and delayed effects of hemorrhage.

Respiratory System:

Anatomy and histology of the lung and airways.

Mechanics of breathing: Role of respiratory muscles, Compliance of lungs and chest wall, pressure-volume relationships, alveolar surface tension and surfactant. Spirometry: Lung volumes and capacities. Dead space.

Pulmonary Circulation.

Ventilation-perfusion ratio, Transport of gases (O_2 and CO_2) in body: Partial pressure and composition of normal atmospheric gases in inspired, expired, alveolar air and blood.

Oxygen dissociation curve of hemoglobin – 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, Cyanosis, Periodic breathing, Apnoea, Asthma, Emphysema.

High altitude pulmonary edema (HAPO). Oxygen therapy. Decompression sickness, caisson's disease

Course 4 (2 Th)	Physiology of Blood and body fluids
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Physiology of Blood and body fluids.

Bone marrow: Formed elements of blood – origin, formation, functions and fate.

Plasma proteins: Origin and functions.

Erythropoiesis – factors affecting and leucopoiesis.

Haemoglobin - Structure, types. Anemia.

Blood volume - factors affecting.

Hemostasis-Factors,mechanism,anticoagulants,procoagulants.Disordersofhemostasis-Hemophilia.
 Bloodgroup-ABO,Rhsystemandotherminorbloodgroupsystems.Bloodtransfusionandits hazards.
 Lymphandtissuefluids-Formation,circulation,functionsandfate.
 Lymphaticorgans-Histologicalstructuresandfunctionsoflymphglandandspleen.Splenomegalycases and effects.

Course 4 (2 P)	Lab work II
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Courseobjective:Objectiveofthecourseistotrainthestudentsthe techniquesformeasurmentdifferent hematological , cardiovascular and respiratory parameters.

Learningoutcome:Attheendofthecourse,learners willbeable to:

Analysisofdifferenthematologicalparameters.

Record the blood pressure and associated cardiovascular parameters.

Performlungfunctiontestsusingspirometerandotherrelated equipments.

Demonstrate ability to do such techniques individually.

Developskillstoexplainthecausesofhematological,cardiovascularandrespiratoryabnormalities

Haematologicalexperiments : PreparationandstainingofbloodfilmwithLeishman's stain.Identification ofbloodcells.TotalcountofW.B.CandR.B.C.DifferentialcountofW.B.C.Haemoglobinestimationby Sahli's hemoglobinometer. Preparation of haemin crystals.

CardiovascularPhysiologyExperiments:DeterminationofBloodpressureindifferentbodyposture.

Determination of pulse rate.

InterpretationofKymographicrecordingofthemovementsofperfusedheartoftoadandtheeffectsof Excess Calcium, acetylcholine and adrenaline on the contraction of heart.

Respiratory Human Experiments: Pneumographic recording / demonstration of effects of hyperventilation, breath-holding and talking. Interpretation of lung function tests using Spirometry (Digital) and analysis of the results.

Determination of Peak Expiratory Flow Rate

YEAR -2

Course 5 (4 Th)	Enzyme classification and kinetics, Digestion & absorption
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Courseobjective:Objectiveofthecourseistoexplaintheprocessofdigestion,absorption,metabolism,excretion and body temperature regulation.

Learningoutcome:Attheendofthecourse,learners willbeable to:

Explain the mechanism of digestion , absorption and metabolism in the body.

Describethestructuralandfunctionalsignificanceofhumanexcretorysystem.

Summarize the mechanism of body temperature regulation.

Demonstratetheskilltoexplainthecausesofdigestive,metabolicandexcretoryabnormalities.

Express opinion on correction of different diseases associated with these systems .

Enzyme classification and Kinetics:

Classification of enzymes

Co enzymes and co factors

Models of enzyme action, Multi-enzyme system-example

Enzyme kinetics: Factors affecting enzyme activity.Michaelis-Menten constant (Km); Lineweaver-Burk plot.

Enzyme Inhibition: Types, Feedback and allostericregulation of enzymes.

Digestion&Absorption:

Anatomyandhistologyofalimentarytract&digestive glands.
 Mastication,De-glutitionandmovementssofalimentary canal.
 Composition,function and regulation ofsecretion of salivary,gastric,pancreaticandintestinaljuiceandbile.
 Formation,secretionandregulation of HCL,conceptofhyperacidity, achlorhydria
 Gastro-intestinal hormones.
 Entero-hepatic circulation of bilesalt-role of bileindigestion.
 Digestion and absorptionof carbohydrates, proteins and fats.
 Defecation-mechanism, constipation
 Basic conceptofpeptic ulcer, gallstone,
 Vomiting center and mechanism

Course 6 (2 Th)	Excretory physiology; Skin and body temperature regulation.
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Excretorysystem :

Histology,StructuralandAnatomyofkidneyandnephron.Renalcirculation–peculiaritiesandauto regulation.
 Glomerular filtration, GFR, measurements, regulation.Juxta-glomerular apparatus.
 Tubularreabsorptionandsecretion,diuretics
 Formationofhypotonicandhypertonicurine-counter-currentmechanism.
 Renalregulationofosmolarityandblood volume.
 Renalregulationofacid-base balance,acidificationofurine.
 Physiologyofurinarybladderandmicturition.Abnormalities ofmicturition.
 Normalandabnormalconstituentsofurine,andpathophysiologicalsignificance.
 Renalfunctiontests.Disorders ofrenalfunctions.

Skinand Body TemperatureRegulation:

Histology and functions of skin.
 Skinwounds,classification and phases and mechanismsofwoundhealing.
 Sweatglands–structure and composition of sweat.
 Mechanism of sweatformation, secretionanditsregulation.Insensible perspiration.
 Regulation of bodytemperatureinhomeotherms –itsphysicalandphysiologicalprocesses,rolesofneural and hormonal processes.
 Heat Stress, Pyrexia,hyperthermiaandhypothermia

Course 6 (2 P)	Lab work III
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Courseobjective:Objectiveofthecourseis totrainthestudents thehistologicalandurineanalysis techniques.

Learningoutcome:Attheendofthecoursethelearnerswillbeableto; Identify of different histological slides of the systems in study.
 Performbiochemicalanalysisofurinesamples.
 Study different physiological models .
 Demonstrateabilitytoperformsuchtechniquesindividually.
 Developskillstoexplainthecauses ofabnormalities involvingthese systems ofthebody.

Studyandidentificationofhistologicalslides ofdigestivesystemandexcretorysystem.

Study of Models for anatomical position and functions of organs of digestive system and excretory system and skin.

Urinary analysis: Identification of abnormal constituents of urine (albumin, ketone, glucose, bile salt).

Assessment of nutritional status by recall method and Diet survey.

Semester –IV:

Course 7 (4 Th)	Endocrinology; Reproductive Physiology
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Endocrinology; Reproductive Physiology

Course objective: The course aims to impart the learner's knowledge on nerve and muscle function, endocrine system and reproduction in human

Learning outcome: After completion of the course, learners will be able to:

Know how nerve and muscle coordinate to work in human.

Comprehend a variety of functions of endocrine glands.

Describe the effects of hypo and hypersecretion of different hormones in human system. Explain the basic structural framework of human reproductive system.

Use the knowledge to understand the difficulties associated with achieving human reproductive goal.

Endocrinology:

Concept of autocrine, paracrine and endocrine system. Anatomical organization of endocrine glands. Mode of action of hormones, signal transduction and concept of second messenger system. Feedback regulation of hormone action.

Hypothalamus and Pituitary-Hypothalamus as a neuroendocrine organ. Hypothalamic releasing factors. Hypothalamo-hypophyseal portal system, Anterior and posterior pituitary -- histological structure of the gland. Pituitary hormones, functions and regulation of secretion of hormones.

Thyroid and Parathyroid -- Histological structure of the glands. Thyroid and parathyroid hormones, chemical nature, mechanism of action, functions and regulation of secretion of the hormones. Calcium-phosphate homeostasis.

Adrenal gland -- Histological structure of the gland. Adrenal cortical and medullary hormones, mechanism of action, functions and regulation of secretion of these hormones.

Endocrine Pancreas -- Histological structure. Hormones of Islet of Langerhans, Insulin, glucagon and other hormones, mechanism of action, functions and regulation of secretion of the hormones. Hormonal control of blood sugar. Diabetes mellitus-types.

Gastro-intestinal hormones -- Gastrin, Secretin, CCK, somatostatin, ghrelin and GRP -- functions of these hormones.

Effect of hypo and hypersecretion of hormones of different endocrine glands.

Reproductive Physiology:

Anatomical organization of male and female reproductive organs. Primary and accessory sex organs and secondary sex characters.

Histology of testis. Blood testis barrier, Endocrine functions of testis. Spermatogenesis. Hypothalamic control of testicular functions. Cryptorchidism.

Histology of ovary. Ovarian hormones and their functions. Oogenesis and ovulation. Formation and functions of corpus luteum.

Physiology of puberty. Menstrual cycle- ovarian and uterine changes and its hormonal regulation. Onset of menopause and postmenopausal changes. Abnormalities in menstrual cycle.

Course 8 (2 Th)	Nerve muscle physiology.
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Nerve-Muscle Physiology:

Structure, properties and classification of Neurons and Neuroglia.

Nerve fibers structure and types. Properties of nerve fibers, modern concept of generation of resting membrane potential, graded potential.
 Action potential, ionic basis, characteristics of AP, propagation in different types of nerve fibers. Rheobase and chronaxae.
 Nerve injury - Degeneration and regeneration of nerve fibers, Factors affect Nerve growth
 Synapse, structure, classification, properties, Transmission of nerve impulse through synapse, EPSP, IPSP.
 Neuromuscular Junction, structure, motor unit, motor point, propagation of nerve impulse through the neuro-muscular junction, MEPP, EPP.
 Receptors, classification, types, properties, mechanism of transduction of stimuli from sensory receptors.
 Reflex, arc, classification, properties.
 Muscle: Structural properties of skeletal and smooth muscles,
 Sarco-tubular system, Mechanism of skeletal and smooth muscle contraction, EC coupling, Rigor mortis.
 Properties of skeletal muscle.

Course 8 (2 P)	Lab work IV
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Course objective: Objective of the course is to train the students the histological and urine analysis techniques.

Learning outcome: At the end of the course the learners will be able to; Identify of different histological slides of the systems in study.

Perform staining procedure for staining the skeletal and cardiac muscle. Study different physiological models .

Demonstrate ability to perform such techniques individually.

Develop skills to explain the causes of abnormalities involving these systems of the body.

Study and identification of histological slides of endocrine glands and reproductive system.

Study of Models for anatomical position and functions of organs of endocrine glands and reproductive system

Staining of skeletal and cardiac muscle by methylene blue.

Demonstration on the nerve-muscle preparation and interpretation of kymographic recording of isotonic muscle twitch, effects of temperature, load and two successive stimuli on muscle twitch.

Study of Charts on—Spermatogenesis and oogenesis.

Study of Charts for identification of—Primary, secondary and mature Graafian follicles.

Determination of onset of puberty from the velocity growth curve of stature of school children.

YEAR 3

5th semester

Course 9 (4 Th)	Molecular Biology and Human Genetics
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ular Biology :

Nucleic acid: Chemical composition of DNA, RNA and DNA structure, detailed account of double stranded DNA, B-DNA, Z-DNA.

DNA the genetic material (Experimental proof-Griffith and Hershey and Chase Experiments).

Replication: Semi-conservative model of DNA replication.

Prokaryotic DNA replication, replication origin, DNA polymerases, composition and features, replication factors and the mechanism of replication, leading strand and lagging strand synthesis. DNA polymerases-I, II and III their composition,

Telomere, telomerase and mode of action.

Transcription: Coding region and noncoding region of genes, RNA polymerase structure, subunits and their function: mechanism of transcription, initiation, elongation and termination (rho dependent and rho independent mechanism).

Post-transcriptional processing of mRNA.

Translation: Genetic code, Genetic codons, initiating codon, termination codons, degeneracy of genetic code, Wobble hypothesis.

Mechanism of translation.

Translocation of proteins and protein modifications

Epigenetic modifications – DNA and chromosomal proteins.

Regulation genes expression and operon concept, regulation of Lac operon and Tryptophan operon.

Human Genetics

Chromosomal organization

Concept of gene and genome sizes. Gene structure: structural organization of prokaryotic and eukaryotic genes,

Regulatory elements of genes, (proximal or internal including promoter, operator, activator and enhancers).

DNA binding proteins, concise account of helix turn helix proteins, helix loop helix proteins, helix turn beta, zinc finger proteins, and mode of action in regulation of gene expression.

Mendelian genetics- Mendel's experiments, monohybrid crosses, principles of dominance, dihybrid crosses, incomplete dominance, co-dominance. Gene polymorphism, SNPs, Multiple alleles,

Linkage and Genetic Mapping.

Pedigree analysis,

Karyotyping. Human Genetical Disorders – gene incompatibility (ABO blood group), autosomal (Phenylketonuria, albinism), sex-linked (haemophilia, red green colour blindness), diseases with abnormal chromosome number examples.

Hardy Wein-berg principle and population genetics.

Course 10 (2Th)	Cell Signaling, cell cycle and apoptosis
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Biomembrane, organization and composition of bio membrane, fluidity & asymmetry of lipid bilayer.

Transport across the membrane pump, channels, ion channels, voltage and transmitter gated ion channels, protein sorting within the cells, Transport vesicle and Intra cellular Membrane Traffic, Role of Clathrin

Signaling and receptors

Properties of cell signaling.

Signalling through G-Protein Coupled Receptors, cAMP & phospholipid, Calcium Ion Signals, electrical signaling.

Different signal pathways viz. tyrosine kinase, Pi3K AKT, Hagde Hog, Wnt, Notch , TGF beta, Jak stat etc.

Nuclear receptors & steroid Hormones.

Mammalian cell cycle, phases, regulation

Apoptosis, autophagy and necrosis

Course 10 (2 P)	Lab work V
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- Analysis of pedigree chart
- Gram staining of bacteria
- Different sterilization methods
- Single colony isolation
- Cell signaling chart study

Course 11 (4 Th)	Immunology
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Immune system, Innate and acquired immunity - their components
 Primary and secondary lymphoid organs, T cell, B cell, Macrophage, neutrophil, dendritic cells their functions.
 Antigen, Immunogen, Epitope, Hapten, Paratope, Class I & II MHC molecules, CD - 4 and CD - 8 markers - general idea.
 Humoral immunity –Structure, Classification of antibodies. General structure of IgG antibody, monoclonal and polyclonal antibody, Primary and secondary immune responses, Clonal selection theory of antibody production, generation of effector and memory T cell, T and B cell cooperation in antibody production.
 Cell mediated immunity - role of CTL and T_H in Cell mediated immunity.
 Complement components of classical and alternative pathways, their activation, and physiological function of complement system, complement deficiencies.
 Antigen antibody interaction.
 Types of HLA, polymorphism of HLA
 T cell, B cell ontogeny and activation
 Inflammation, mediators and signaling
 Hypersensitivity Type-I and Type-II.
 Antigen presentation, Clonal selection theory of antibody production.
 Role of T-helper cell in activation of T-cytotoxic cell, Role of cytotoxic T cell in cell mediated immunity.
 Complement components of classical and alternative pathways, their activation, and physiological function of complement system, complement deficiencies.
 Vaccination :Passive and active immunization, types and uses of vaccine.

Course 12 (2 Th)	Molecular physiological basis of cancer
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Properties of cancer cells, concept of oncogenes and proto-oncogenes, suppressor gene.
Genetic and epigenetic causes of cancer
Classification of cancer on the basis of origin
Altered metabolic and physiological changes in cancer cells.
 Molecular and chromosomal changes in cancer: Mutation : Spontaneous and induced mutation, mechanism of transition and transversion, chemical and physical agents inducing mutation, Ames' test, Types- DNA: Structural - Point mutation-deletion, insertion, Frame shift; Functional - Non-sense, mis-sense, silent, null mutation; Chromosomal : i)Structural-Inversion, translocation, deletion, duplication. ii)Number - Euploidy, aneuploidy, Polyploidy.
 Repair mechanism of Mutation : direct repair, excision repair, transcriptional excision repair, mismatch repair, UVr A, B and C mechanism, and SOS repair system.
 Factors inducing cancer,
 Concept of cancer metastasis.
 Abnormal cell proliferation and cancer specific abnormalities in different cell signaling pathways.
 Modern approach of cancer treatment, Nano drugs and immunotherapy

Course 12 (2 P)	Lab Work VI
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Measurement of height
 Measurement of weight
 Determination of BMI

Study of different classifications of BMI (chart based)
 Anthropometric Nutritional assessment
 Ouchterlony double diffusion assay

6th semester

Course 13 (4 Th)	Nervous System
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Nervous system :

Structural organization of different parts of brain and spinal cord. Nerve roots.
 Brain Ventricle concept, CSF composition, formation, circulation and functions. Blood Brain Barrier, Lumber puncture, Cerebral circulation-course, factors affecting.. cranial nerves-functions
 Somato-sensory system: Ascending (sensory) tracts-carrying touch, pain, temperature sensation. Referred pain. Pain inhibiting system, opioids.
 Motor system: Descending tracts (pyramidal and extra pyramidal systems), Upper motor and lower motor neurons and their lesions, Babinski sign.
 Functions of spinal cord with special reference to functional changes following hemi section and complete section at different levels of spinal cord. Brown sequard syndrome. Tabes Dorsalis.
 Cerebellum: Histology, nuclei, connections and functions. Cerebellar diseases.
 Basal ganglia: structure connections and functions, Parkinson's Disease.
 Components and functions of Pons Medulla Reticular formation.
 Stretch reflex: muscle spindle-structure, connections, and function- special reference to muscle tone. Role of different parts of brain in muscle tone maintenance. Spasticity, Rigidity.
 Maintenance of posture & equilibrium: vestibular apparatus, different postural reflexes-righting reflex. Romberg's sign.
 Cerebral cortex: Histology, different lobes, areas and their functions Method of Localization of the functions of cerebral cortex.
 Thalamus: Nuclei, functions. Thalamic animal. Thalamic syndrome.
 Hypothalamus: Nuclei, functions: Feeding & satiety, Thermoregulation etc.
 Autonomic Nervous system (ANS): Classification, structural and functional organizations. Neurotransmitter in ANS.

Course 14 (2 Th)	Special senses
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Vision: anatomy and structure of eye ball, Histology of retina, photochemical changes of retina on exposure to light, light and dark adaptation, visual pathway, reflexes of eyes, accommodation, Argyll Robertson pupil, refractive errors and their corrections, visual field-scotopic and photopic vision, visual acuity, perception and depth, positive and negative after image, theories of color vision, color blindness, cataract, glaucoma and retinal detachment.
 Audition: Structure and function of auditory apparatus, organ of corti. Auditory pathways & centers. Mechanism of hearing. Perception of sound frequency and loudness. Deafness, audiometry, hearing tests.
 Olfaction and gustation: Structure and functions of receptor organs, nerve pathways, centers. Taste and smell adaptation, abnormalities of olfactory and taste sensation.

Course 14 (2P)	Lab work VII
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Determination of heart rate and blood pressure at rest and after exercise.
 Determination of PFI and graphical representation of recovery heart rate.
 Determinations of VO₂ max indirectly by Queens's college step test.
 ECG demonstration

Course 15 (4 Th)	Exercise & Sports Physiology and Yoga,
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Exercise & Sports Physiology and Yoga:

Introduction to exercise & sports physiology- scope, Importance. Skeletal muscle types and their response to exercise. Types of exercise: isotonic, isometric etc.

Energy for exercise: source of energy in exercise, Nutrients used during exercise, energy stores.

Energy system for exercise and recovery--Aerobic and anaerobic energy system-anaerobic power, OBLA, Lactate threshold. Aerobic energy system-Aerobic power-VO₂ max; measurements, factors controlling. EPOC or O₂debt -lactacid & alactacid. Fatigue causes.

Physiological responses in exercise; Effects of exercise on cardio-vascular & respiratory system. Physiological responses to exercise in the heat and cold environment. Heat cramps, heat stroke, frostbite.

Women in sports: Sex difference in physiological responses in exercise. Pregnancy and menstruation in relation to exercise and Sports.

Exercise Training: Training principles; aerobic & anaerobic training, resistance training; effects of training on respiratory, cardio-vascular and muscular system. Concept of Overtraining, detraining. High altitude training.

Nutrition and ergogenic aids in sports: Role of nutrients in sports, pregame meal; carbohydrate loading, spacing of meals, glycogen loading, fluid replacement. Ergogenic aids- effects of creatine, carnitine, erythropoietin, alkalizers, anabolic steroids, amphetamines, caffeine etc. Concept of Doping in sports.

Yoga and Human performance: Introduction to Yoga, traditional yogic practices-Asanas, Pranayamas, meditations. Physiological applications.

Course 16 (2 TH)	Work Physiology, Ergonomics and Occupational Health.
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Work Physiology –definition and nature – isotonic, isometric and isokinetic, positive and negative work.

Concept of physiological work, static and dynamic work. Power and work capacity relation.

Classification of Work-load – light, moderate and heavy work-depending on intensity and duration of work.

Different methods of assessment of energy cost for various physical work-- direct and indirect methods with their limitations. Assessment of energy cost by using bicycle ergometer and treadmill.

Ergonomics—definition, basic concept of ergonomics and its application. Work Study, time study and motion study-basic concept and application.

Concept of system design; Effect of Man, Machine and Environment in System Design; Failure of System – accident.

Static and Dynamic Anthropometry—concept and application in design and development.

Application of Ergonomics for the development of safety.

Occupational health—definition and basic concept, contribution of Bernardino Ramazzini.

Occupational hazards – Physical, chemical and biological hazards. Occupational diseases – silicosis, asbestosis and work-related musculoskeletal disorders.

Course 16 (2 p)	Lab work VIII
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Determination of body fat percentage by indirect method- using skinfold caliper

Determination of somatotyping (endomorph, mesomorph & ectomorph) of the body

Determination/demonstration of muscular efficiency and fatigue by Mosso's ergograph

Determination grip strength by Grip dynamometer

Effect of exercise on respiratory pattern. Effect of hyperventilation on breath holding.

Measurement of wet bulb globe temperature (WBGT) indices.

Measurement of environmental temperature – dry bulb and wet bulb, relative humidity, air velocity.

Determination of sound levels by sound level meter and noise index

Suggested Readings :

1. Text book of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
2. Best & Taylor's Physiological Basis of Medical Practice, O.P.Tandon & Y.Tripathi, Lippincott Williams & Wilkins
3. Ganong's Review of Medical Physiology. Barrett et.al, McGraw Hill Lange
4. Harper's Illustrated Biochemistry, V.W. Rodwell and others, Lange
5. Lehninger's Principles of Biochemistry. By D.L. Nelson and M. M. Cox, Worth Publishers Inc.
6. Text Book of Biochemistry, by E.S. West. W.R. Todd. H.S. Mason. J.T. Van Bruggen. The Macmillan Company.
7. Biophysics and Biophysical Chemistry, D.Das. Academic Publishers.
8. Samson Wright's Applied Physiology, C.A. Keele. E Neil & N. Toels. Oxford University Press.
9. Physiology, R.M. Berne & M.N. Levy, C.V. Mosby Co.
10. Basic Histology, L.C. Junqueira & J Carneiro, McGraw- Hill .
11. diFiore's Atlas of Histology, V.P. Eroschenko, Wolters-Kluwer
12. The Cell – A Molecular Approach, G.M. Cooper & R.E.Hausman, ASM Press SINAUER.
13. Cell Biology, G.Karp, John Wiley & Sons, Inc.
14. Core Text Book of Neuro-Anatomy, by M.B. Carpenter; the Williams and Wilkins Company.
15. The Human Nervous System, by Charles Nobach, Mc Graw Hill Book Co.
16. The Human Nervous System. By M.L. Barr & J.A. Kierman, Harper & Row.
17. Essential Food and Nutrition, by M. Swaminathan. The Bangalore Printing & Publishing Co.
18. Cell & Molecular Biology, EDP De Robertis & EMF De Robertis; Lea & Febiger
19. Molecular Biology of the Gene, by J.D. Watson, H.H. Nancy & others; Benjamin Cummings.
20. Molecular Biology of the Cell, B. Alberts and others, Garland.
21. Textbook of Medical Physiology, Indu Khurana, Elsevier
22. Biochemistry, J.M.Berg, J.L
23. Tymoczko & L. Stryer, W.H. Freeman
24. William's Text Book of Endocrinology Larsen et. al An Imprint of Elsevier.
25. Endocrinology, Mac E. Hadley, Pearson Education.
26. Vander's Human Physiology, E.P. Widmaier et al., McGraw-Hill, Higher Education.
27. Endocrinology. Vols.I, II and III by L.O. DeGroot. W.B. Saunders Co.
28. Langman's Medical Embryology by J.W. Sadler, Lippincott Williams and Wilkins.\
29. Human Embryology by I. Singh & G.P.Pal, McMillan.
30. Statistics in Biology and Psychology by D.Das and A.Das Academic Publishers.
31. An Introduction to Biostatistics, N. Gurumani, M.J.P. Publishers, Chennai.
32. Microbiology, Pelczar Tata McGrawhill.
33. General Microbiology By Stanier et.al, Prentice Hall.
34. Kuby Immunology by T.J Kindt et.al, W.H Freeman.
35. Cellular and Molecular Immunology, A.K. Abbas et.al, Elsevier.
36. Ergonomics Man in His working Environment. Murrell K. 3rd Ed. Springer.
37. Introduction to Ergonomics,R.S. Bridger, Routledge : Taylor & Francis group.
38. Park's Textbook of Preventive and Social Medicine, K.Park, M/s. Banarasidas Bhanot, 2015.
39. Communicable Disease Control Handbook, Jeremy Hawker et.al, Blackwell Publishing.
40. Physiology of Sport and Exercise. J. H. Wilmore, D. L. Costill, W. Larry Kenney. Human Kinetics
41. Textbook of Work Physiology: Physiological Bases of Exercise. Per- Olof Åstrand, Kaare Rodahl, Hans A. Dahl, Sigmund B. Strømme . Human Kinetics
42. Fox's Physiological Basis for Exercise and Sport by M. L.Foss. S. J. Keteyian, E. L. Fox , William C Brown Pub
43. Essentials of Exercise Physiology, V.L. Katch, W.D. McArdle, F.I. Katch, Wolters Kluwer.
44. Chronobiology – The Biological Timekeeping, J.C. Dunlap, Sinauer Associati

MINOR COURSES TO BE OFFERED: Human Physiology

year	semester	Minor/Elective	Subject Name of the Course	Total Score	Total Marks
1	I	Course- 1 (3Th+1P)		4	
	II	Course-2 (4)(3Th+1P)		4	
2	III	Course- 3 (3Th+1P)		4	
	IV	Course- 4 (4)(3Th+1P)		4	
3	V	Course- 5 (3Th+1P)		4	
	VI	Course- 6 (4)(3Th+1P)		4	
4	VII	Course- 7 (3Th+1P)		4	
	VIII	Course- 8 (4)(3Th+1P)		4	

DETAIL COURSE CONTENTS:

MINOR COURSES :

Semester –I:

Total credit – 04 (Theory-03, Practical-01)

Total marks :

Course- 1 : HP Minor Theory (Credit-3)

General Physiology and basic concepts

Course objective : Objective of the course is to give learners fundamental knowledge of human body and different principle governing its function.

Learning outcome : At the end of the course, learners will be able to :

Describe the structural framework of human body and organ systems.

Analyze the importance of different biophysical and physiochemical principles.

Summarize the chemistry of different biomolecules.

Demonstrate the skill to explain the basis of normal function of human body

Interpret the importance of Human physiology as a basic science subject.

Structural and Functional basis of Human Body:

- ☐ General structure and function of Human cell: cell membrane, Nucleus, Endoplasmic reticulum, Golgi body, Mitochondria, Lysosomes, Peroxisomes, Ribosomes, Cytoskeletal system, Inter cellular connections: Cell junction, Idea about different types of tissues-Functions.
- ☐ **Musculo-skeletal system:** Types of muscle-classification. Bones: structure and types. Cartilage & ligaments. Joints types-functions.
- ☐ General idea about functional aspect of human body organ and organ systems.
- ☐ Homeostasis and its control systems-Negative & positive feedback -examples.

Biophysics and Physicochemical Principles:

- ☐ Movement of substances within the body: Diffusion, Osmosis, Osmotic pressure. Tonicity-isotonic, hypertonic, hypotonic. Basic idea about cell membrane transport: Passive transport-ligand and voltage gated ion channel transport, facilitated diffusion. Active transport, secondary active transport.
- ☐ Gibbs-Donnan membrane equilibrium- its biological application.
- ☐ Colloids- Classification, Physiological importance of Colloids.
- ☐ Acids, bases, pH and Buffers: Definition, biological significance. Henderson-Hasselbalch equation. Important Buffers in the Body. Acidosis, alkalosis-origin.
- ☐

Chemistry of Bio molecules:

- ☐ Chemistry, classification and physiological importance of carbohydrates. Reactions of monosaccharide's with acids and alkali. Reducing properties of carbohydrates. Benedict Test. Glycosides.
- ☐ Chemistry, classification and physiological importance of Proteins, amino acids. Zwitterion, isoelectric pH. Peptides.
- ☐ Chemistry, classification and physiological importance of Lipids & fatty acids. Mono and poly unsaturated fatty acids. Sterols- physiological importance.
- ☐ Enzyme: Nature, classification, and properties- Enzyme. Concept of apoenzyme, holoenzyme, coenzyme, cofactors, isoenzyme. Mechanism of enzyme action-models; activation energy; active site, regulatory site-Allosteric enzyme. Factors affecting enzyme activity-effect of substrate concentration, temperature, pH. Michaelis Menten constant-K_m.

Course 1: HP Minor Practical (Credit-01):

Course objective : Objective of the course is to train learners on skills for performing different anthropometric and biochemical measurements .

Learning outcome : At the end of the course, learners will be able to :

Demonstrate the skill to measure different anthropometric parameters.

Become equipped to do different biochemical analysis.

Describe the models and charts on human body and organ systems.

Analyze the importance of different anthropometric and biochemical parameters.

Interpret the results in light of knowledge on normal values in human systems.

- ☒ Study of Models / Charts of different body organ systems & organs – Anatomical position, Structure & Functions.
- ☒ Study of Human Skeleton
- ☒ Study of Body Anthropometry- Stature, weight, sitting height, shoulder height (standing), Elbow height (standing), Hip height (standing), hand length, shoulder elbow length, leg length, shoulder breadth (biacromial), Arm reach from wall (Arm span), Knee to Knee Breadth, Elbow to elbow breadth, Head circumference, Shoulder circumference, Chest circumference, waist circumference, hip circumference. Calculation of BMI, BSA, WHR, Head and Chest circumference ratio.

Semester –II:

Total credit – 04 (Theory-03, Practical-01)

Total marks:

Course – 2: Theory : HP Minor (Credit-03):

Physiology of Blood and body fluids

Course objective : Objective of the course is to provide knowledge on functions of blood, body fluid and application of the knowledge.

Learning outcome : At the end of the course, learners will be able to :

Describe different formed elements of blood , their formation and function.

Demonstrate the skill to explain the causes of hematological abnormalities.

Express opinion on correction of different diseases associated with blood.

- ☒ Composition and general functions of blood. **Blood volume. Plasma** - Plasma proteins-types and functions.
- ☒ **Haematopoiesis**-General idea. Haemopoetic stem cell. Site of Blood cells Formation. Erythropoiesis –factors effecting.
- ☒ **RBC**-morphology. Total RBC count. ESR-its importance. Haemoglobin-structure, types, synthesis. Haemoglobinopathies-sickle cell haemoglobin, thallemia.

Anaemia-types. PCV, Hb indices. Hemolysis-Fragility of RBC. Degradation of Hb-unconjugated & conjugated bilirubin.

- ☒ **WBC**-morphology, types. TLC, DLC, variation in WBC count. Functions of different types of WBC:

Immunity-- Innate and acquired immunity. Macrophage, T cell, B cell. Humoral immunity - classification, functions of antibodies. General structure of IgG antibody. Cell mediated immunity-cytotoxic T cell. Primary and secondary lymphoid organ. Antigen, Immunogen. Primary and secondary immune response and vaccination.

- ☒ **Haemostasis: Platelets** -morphology, platelets count, critical count. Role in haemostasis. Platelets plugging. Blood coagulation-Mechanism. Anticoagulants and their mode of action. Prevention of intravascular coagulation. Purpura, Hemophilia. BT, CT. PT.
- ☒ Blood group -ABO, Rh system . Blood transfusion and its hazards. Rh incompatibility-erythroblastosis foetalis.
- ☒ Body fluid compartments –types, features. Tissue fluid. Lymph –composition and functions.

Course – 2 : Practical : HP (Credit-0 1):

Course objective : Objective of the course is to train the students the techniques for measurement different hematological parameters.

Learning outcome : At the end of the course, learners will be able to :

Analysis of different hematological parameters.

Develop skills to explain the causes of hematological abnormalities.

- ☒ Introduction to compound microscope.
- ☒ Preparation and staining of blood film with Leishman's stain. Identification of blood cells. Haematological indices.
- ☒ Determination of differential leukocyte count (DLC).
- ☒ Hemoglobin estimation by Sahli's hemoglobinometer.
- ☒ Preparation of haemin crystals.
- ☒ Determination of bleeding time and clotting time., ESR
- ☒ Determination of Blood group.

Semester –III: Total credit – 04 (Theory-03, Practical-01)

Total marks:

Course – 3 : Theory : HP (Credit-03):

Cardiovascular System

Course objective : Objective of the course is to provide knowledge on functions cardiovascular system, their regulation and application of the knowledge.

Learning outcome : At the end of the course, learners will be able to :

Explain the structural framework of human cardiovascular system.

Summarize the mechanism of cardiovascular homeostasis.

Demonstrate the skill to explain the causes of cardiovascular abnormalities.

Express opinion on correction of different diseases associated with the systems .

- ☐ Anatomy of the heart. Properties of cardiac muscle. Origin and propagation of cardiac impulse-Junctional tissues. Heart Block.
- ☐ Electrocardiography- Principles of Electrocardiography, Normal electrocardiogram, different waves, intervals and segments; different electrocardiographic lead systems. Electrical axis of heart.
- ☐ Cardiac cycle -Pressure and volume changes. Heart sounds. Murmurs. Arterial pulse. Arrhythmia.
- ☐ Cardiac output - factors affecting, Starling's law of heart. Measurement by application of Fick's principle.
- ☐ Innervations of the heart and blood vessels, cardiac and vasomotor reflexes.
- ☐ Blood pressure- Normal value, Physiological variation. Regulation with special reference to sino-aortic mechanism. Hypertension-types.
- ☐ Blood vessels-types, structure. **Hemodynamics:** velocity of blood flow, nature of blood flow, Flow-Pressure-Resistance relationship.
- ☐ Coronary Circulation-course, peculiarities and control. Coronary artery disease (CAD)- Atherosclerosis.
- ☐ Effects of exercise on cardiovascular system. PFI-Harvard step test.
- ☐ Immediate and delayed effects of hemorrhage on cardiovascular system.

Course – 3 : Practical : HP (Credit-0 1):

Course objective : Objective of the course is to train the students the techniques for measurement of different cardiovascular parameters.

Learning outcome: At the end of the course, learners will be able to :

Record the blood pressure and associated cardiovascular parameters.

Demonstrate ability to do such techniques individually.

Develop skills to explain the causes of cardiovascular abnormalities

- ☐ Identification of different pulse-Radial, brachial, carotid.
- ☐ Determination of pulse rate in different posture.
- ☐ Determination of arterial Blood pressure by sphygmomanometer.
- ☐ Auscultation of the Heart sounds.
- ☐ Measurement of PFI by Harvard step test (modified) and graphical presentation of the recovery heart rate. Hand grip
- ☐ Determination of heart rate, PR interval, QT, QRS and ST segment from electrocardiogram.

- ☐ Determination of electrical axis by standard limb leads electrogram.
- ☐ Interpretation of Kymographic recording of the movements of perfused heart of toad and the effects of Excess Potassium, calcium, acetylcholine and adrenaline on the contraction of heart.

Semester –IV: **Total credit – 04 (Theory-03, Practical-01)** **Total marks:**

Course – 4 : Theory : HP (Credit-03):

Respiratory System

Course objective : Objective of the course is to provide knowledge on functions of respiratory system , their regulation and application of the knowledge.

Learning outcome : At the end of the course, learners will be able to :

Explain the structural framework of respiratory system.

Summarize the mechanism of respiratory homeostasis.

Demonstrate the skill to explain the causes of respiratory abnormalities.

Express opinion on correction of different diseases associated with the systems .

- ☐ Functional Anatomy and histology of the lung and airways. Pleural fluid.
- ☐ Pulmonary Circulation-course, peculiarities.
- ☐ Physical principles of gas exchange, Partial pressure and composition of normal atmospheric gases in inspired, expired, alveolar airs and blood, Respiratory membrane. Ventilation- perfusion ratio.
- ☐ **Transport of blood gases:** Oxygen transport-mechanism, oxygen-Hb dissociation curve – factors affecting, Bohr effect. Carbon- di-oxide transport, mechanism, Haldane effect.
- ☐ **Spirometry:** Lung volumes and capacities, VC, Timed vital capacity (FEV1), MVV, PEFr-measurements and importance. Dead space.
- ☐ **Mechanics of breathing:** Respiratory pressures, elastic recoil of the lung. Respiratory Muscles. Mechanism of respiration. Pressure changes during breathing cycle, pressure-volume relationships, alveolar surface tension and surfactant. Lung compliance. Air way resistance-Factors affecting.
- ☐ Regulation of respiration: Respiratory centers, Chemoreceptor’s. Neural control and chemical control of respiration.
- ☐ **Respiratory abnormalities: Hypoxia-** Types. High Altitude Sickness-Acclimatization. High altitude pulmonary edema (HAPO). Oxygen therapy.

Dysbarism (Decompression sickness, caisson’s disease)-cause, effect.

Hypercapnia, Asphyxia, Cyanosis. Apnea, Dyspnoea, Periodic breathing-brief idea.

Obstructive & Restrictive lung disease-Asthma, Emphysema.

- ☒ Effect of exercise on respiratory system. Maximal aerobic power- VO_2 max: definition, factors controlling & its measurement.

Course – 4 : Practical : HP (Credit-0 1):

Course objective : Objective of the course is to train the students the techniques for measurement different parameters to assess condition of respiratory system..

Learning outcome : At the end of the course, learners will be able to :

Perform lung function tests using spirometer and other related equipments.

Demonstrate ability to do such techniques individually.

Develop skills to explain the causes of respiratory abnormalities.

- ☒ Pneumographic recording of normal respiratory movement and Effect of talking, drinking, hyperventilation, breathe holding and exercise on respiratory pattern.
- ☒ Pneumographic recording of the effect of breath-holding before and after hyper ventilation.
- ☒ Measurement of VC, FEV_1 and $FVC/FEV_1\%$ by digital spirometer and interpretation of result.
- ☒ Determination of obstructive or restrictive lung diseases from the supplied chart of $FVC-FEV_1$ measurement.
- ☒ Determination of Peak Expiratory Flow Rate and interpretation of result.
- ☒ Determination of VO_2 max by Queens College step test.
- ☒ Cardio pulmonary resuscitation-Demonstartion (CPR)

Semester –V: **Total credit – 04 (Theory-03, Practical-01)**

Course – 5 : Theory : HP (Credit-03):

Digestive system and Nutrient metabolism

Course objective : Objective of the course is to explain the process of digestion, absorption, metabolism.

Learning outcome : At the end of the course, learners will be able to:

Explain the mechanism of digestion, absorption and metabolism in the body.

Demonstrate the skill to explain the causes of digestive, metabolic abnormalities.

Express opinion on correction of different diseases associated with these.

Digestive system:

- ☒ Anatomy and histology of alimentary tract & digestive glands. Enteric Nervous system (ENS)
- ☒ Mastication, Deglutition and movements of alimentary canal. Lower esophageal sphincter.

- ☐ Composition, function and regulation of secretion of salivary, gastric, pancreatic and intestinal juice and bile.
- ☐ Formation, secretion and regulation of HCL, concept of hyperacidity, achlorhydria.
- ☐ Gastro-intestinal hormones.
- ☐ Entero-hepatic circulation of bile salt. Role of bile in digestion.
- ☐ Digestion and absorption of carbohydrates, proteins and fats.
- ☐ Defecation-mechanism, constipation
- ☐ Basic concept of ulcer, gallstone,
- ☐ Vomiting center and mechanism. Motion and Morning sickness.
- ☐ Vitamins-water and fat soluble-source, functions, deficiency. Minerals-source, functions of Calcium, Iodine, Iron etc.
- ☐

Nutrient Metabolism:

- ☐ Glycolysis, TCA cycle, Cori cycle, Gluconeogenesis, Glycogenesis, Pentose phosphate pathway and Cori cycle.
- ☐ Energetic of glycolysis and TCA cycle
- ☐ Concept of Electron Transport Chain- Oxidative phosphorylation-ATP synthesis.
- ☐ β -oxidation and Ketone body metabolism.
- ☐ Amino acid pool, Transamination, Deamination, Disposal of ammonia-concept of ammoniotelic, uricotelic and ureotelic animals, Urea cycle.

Course- 5 : Practical : HP (Credit-01):

Course objective : Objective of the course is to train learners on skills for performing biochemical measurements .

Learning outcome : At the end of the course, learners will be able to :
Become equipped to do different biochemical analysis.

- ☐ Qualitative identification of physiologically important substances – HCL, Lactic acid, Uric acid, Albumin, Peptone, Starch, Dextrin, Glucose, Fructose, Lactose, Maltose, Sucrose, Bile salt, Acetone, Glycerol, urea.
- ☐ Estimation of percentage quantity of glucose by Benedict's method.
- ☐ Estimation of lactose content of milk.

Semester –VI:

Total credit – 04 (Theory-03, Practical-01)

Total marks:

Course – 6 : Theory : HP (Credit-03):

Excretory physiology and Body temperature regulation.

Course objective : Objective of the course is to explain the process excretion and body temperature regulation.

Learning outcome : At the end of the course, learners will be able to :

Describe the structural and functional significance of human excretory system.

Summarize the mechanism of body temperature regulation.

Demonstrate the skill to explain the causes excretory abnormalities.

Express opinion on correction of different diseases associated with the system.

Excretory system

- ☐ Histology, Structural and Anatomy of kidney and nephron. Renal circulation – peculiarities and auto regulation. Glomerular filtration, GFR, measurements, regulation. Juxta-glomerular apparatus.
- ☐ Tubular reabsorption and secretion, diuretics-types & mechanism of action.
- ☐ Formation of hypotonic and hypertonic urine formation Countercurrent mechanism.
- ☐ Regulation of osmolarity and blood volume-Role of kidney.
- ☐ Regulation of acid-base balance of the body- Role of kidney.
- ☐ Physiology of urinary bladder and micturition. Abnormalities of micturition.
- ☐ Normal and abnormal constituents of urine, and pathophysiological significance.
- ☐ Renal function tests. Disorders of renal functions.

Body Temperature Regulation:

- ☐ Histology and functions of skin.
- ☐ Skin wounds, classification and phases and mechanisms of wound healing.
- ☐ Sweat glands –structure and composition of sweat.
- ☐ Mechanism of sweat formation, secretion and its regulation. Insensible perspiration.
- ☐ Regulation of body temperature in homeotherms –its physical and physiological processes, roles of neural and hormonal processes.
- ☐ Heat Stress, Pyrexia, hyperthermia and hypothermia

Course- 6 : Practical : HP (Credit-01):

Course objective: Objective of the course is to train the students about anatomy-physiology of kidney and also urine analysis techniques.

Learning outcome : At the end of the course the learners will be able to ;

Identify of different histological slides of the systems in study.

Identify different physiological models.

Perform biochemical analysis of urine samples.

Demonstrate ability to perform such techniques individually.

Develop skills to explain the causes of abnormalities involving these systems of the body.

- ☒ Study of Models for anatomical position and functions of organs of digestive system and excretory system and skin.
- ☒ Study and identification of histological slides of digestive system and excretory system.
- ☒ Urine analysis: Identification of abnormal constituents of urine (albumin, ketone, glucose, bile salt).
- ☒ Preparation of buffer solution and determination of pH.