

Course Curriculum For Physiology Honours Under Choice Based Credit System



University of North Bengal
Framework of CBCS in Physiology Honours (B.Sc., Hons. In Physiology)

	Core course (14)	Ability Enhancement Compulsory Course (AECC) (2)	Skill Enhancement Course (SEC) (2)	Elective: Discipline Specific (DSE) (4)	Elective: Generic (GE) (4)
I	C1	Environmental Sciences/(English Communication/MIL)			GE-1(paper-1)
	C2				
II	C3	Environmental Science/ (English/ MIL Communication)			GE-1(paper-2)
	C4				
III	C5		SEC-1		GE-2(paper-1)
	C6				
	C7				
IV	C8		SEC-2		GE-2(paper-1)
	C9				
	C10				
V	C11			DSE-1	
	C12			DSE-2	
VI	C13			DSE-3	
	C14			DSE-4	

Implementation

An undergraduate degree with honours in Physiology may be awarded if a student completes 14 Core Courses (CC) or Core Papers in Physiology, 2 Ability Enhancement Compulsory Courses (AECC), minimum 2 Skill Enhancement Courses (SEC) and 4 Courses each from a list of Discipline Specific Elective (DSE) and Generic Elective (GE) Courses, respectively.

Courses of B.Sc. Honours Physiology under CBCS

<p>Core Courses</p>	<ol style="list-style-type: none"> 1. Cellular Basis of Physiology 2. Biological Physics and Enzymes 3. Physiology of Nerve and Muscle Cells 4. Chemistry of Bio-molecules 5. Circulating Body Fluids 6. Circulation 7. Functions of Nervous system 8. Energy Balance, Metabolism and Nutrition 9. Gastrointestinal Function 10. Respiration 11. Special Senses 12. Endocrinology 13. Reproductive Function 14. Formation and Excretion of Urine
<p>Discipline Specific Electives (DSE)(Any Four)</p>	<ol style="list-style-type: none"> 1. Biological Statistics 2. Microbiology and immunology 3. Sports and Exercise Physiology 4. Environmental Physiology 5. Genetics and Molecular Biology 6. Nano-biotechnology and Bioinformatics 7. 8. Human Nutrition and Dietetics
<p>Ability Enhancement Course (AEC) (Compulsory)</p>	<ol style="list-style-type: none"> 1. Environmental Science 2. English/MIL Communication
<p>Skilled Enhancement Courses(any two)</p>	<ol style="list-style-type: none"> 1. Clinical Biochemistry 2. Diet Survey and formulation of Diet Chart 3. Hematological Techniques 4. Detection of Food Additives /Adulterants 5. Histopathological Techniques 6. PathologicalMicrobiology/Bio-Medical Technology

Summary of the Syllabus

Semester 1

(A) Core Courses (CC)

Theoretical (T)	Practical (P)
CC1T. Cellular Basis of Physiology (4)	CC1P. Cellular Basis of Physiology (2)
CC2T. Biological Physics and Enzymes (4)	CC2P. Biological Physics and Enzymes (2)

(B) Ability Enhancement Courses (AEC)

AEC1A. Environmental Science (1)
AEC 2A. English/MIL Communication (1)

(C) Generic Elective (GE)

Theoretical (T)	Practical (P)
GE1T(4)	GE1P..... (2)

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1. Each semester will consist of 15-18 weeks of academic work equivalent to 90 actual teaching days.
2. One Credit is equivalent to one (1) hour of teaching (lecture) or two hours of Practical work per week.
Total credits in Semester I: $[(4 \times 2)] + (2 \times 2) + (2 \times 1) + (4 + 2) = [8 + 4] + 2 + 6 = 20$
3. Numbers in parentheses indicate value of credit.

Semester II

(A) Core Courses (CC)

Theoretical (T)	Practical (P)
CC3T. Physiology of Nerve and Muscle Cells (4)	CC3P. Physiology of Nerve and Muscle Cells (2)
CC4T. Chemistry of Bio-molecules (4)	CC4P. Chemistry of Bio-molecules (2)

(B) Ability Enhancement Courses (AEC)

AEC1B. Environmental Science (1)
AEC 2B. English/MIL Communication (1)

(C) Generic Elective (GE)

Theoretical (T)	Practical (P)
GE2T..... (4)	GE2P..... (2)
Total credits: $[(4 \times 2)] + (2 \times 2) + (2 \times 1) + (4 + 2) = [8 + 4] + 2 + 6 = 20$	

Semester III

(A) Core Courses (CC)

Theoretical (T)	Practical (P)
CC5T. Circulating Body Fluids (4)	CC5P. Circulating Body Fluids (2)
CC6T. Circulation (4)	CC6P. Circulation (2)
CC7T. Functions of Nervous System (4)	CC7P. Functions of Nervous System (2)

(B) Skill Enhancement Courses (SEC)

SEC1T. (1)
SEC 1P.....(1)

(C) Generic Elective (GE)

Theoretical (T)	Practical (P)
GE3T..... (4)	GE3P..... (2)
Total credits: $[12 + 6] + 2 + (4 + 2) = 26$	

Semester IV

(A) Core Courses (CC)

Theoretical (T)	Practical (P)
CC8T. Energy Balance, Metabolism and Nutrition (4)	CC8P. Energy Balance, Metabolism and Nutrition (2)
CC9T. Gastrointestinal Function (4)	CC9P. Gastrointestinal Function (2)
CC10T. Respiration (4)	CC10P. Respiration (2)

(B) Skill Enhancement Courses (SEC)

SEC2T..... (1)
SEC 2P.....(1)

(C) Generic Elective (GE)

Theoretical (T)	Practical (P)
GE4T..... (4)	GE4P..... (2)
Total credits:[12+6]+2+(4+2) =26	

Semester V

(A) Core Courses (CC)

Theoretical (T)	Practical (P)
CC11T. Special Senses (4)	CC11P. Special Senses (2)
CC12T. Endocrinology (4)	CC12P. Endocrinology (2)

(B) (B)Discipline Specific Electives(DSE)

Theoretical (T)	Practical (P)
DSE1T..... (4)	DSE 1P..... (2)
DSE2T..... (4)	DSE 2P..... (2)

*Optional Dissertation/ Project Work in place of one DSE paper (6 Credits) may be adopted.

Total credits:[8+4]+(6X2) =24

Semester VI

(A) Core Courses (CC)

Theoretical (T)	Practical (P)
CC13T. Reproductive Function (4)	CC13P. Reproductive Function (2)
CC14T. Formation and Excretion of Urine (4)	CC14P. Formation and Excretion of Urine (2)

(B) (B)Discipline Specific Electives(DSE)

Theoretical (T)	Practical (P)
DSE3T..... (4)	DSE 3P..... (2)
DSE4T..... (4)	DSE 4P..... (2)

. Total credits:[8+4]+(6X2) =24

3. Credit Distribution Across Courses

COURSE TYPE	TOTAL PAPERS	CREDITS
		THEORY+ PRACTICAL
Core Courses	14	14X4=56 14X2=28
Discipline Specific Electives	4	4X4=16 4X2=8
Generic Electives	4	4X4=16 4X2=8
Ability Enhancement Language Courses	2	2X2=4
Skill Enhancement Courses	2	2X2=4
TOTAL	26	140

4.

Details of Courses and Components Core Courses

CC1T: Cellular Basis of Physiology

Introduction, Body Fluid Components, Organs, Systems, Tissues, Cells and Cell Organelles- Types, Distribution, Histology and Functions. Functional Morphology of Cell, Cell theory, Microtubules, Cell Junctions, Cell Signalling-Signalling molecules, types and actions of Second Messengers, Transport Across cell Membranes, Capillary Wall, Glands, Intercellular Communication, Cell Cycle, Apoptosis, Necrosis, Hyperplasia, Neoplasia, Hypertrophy, Cellular Aging. Cell Division- Mitosis, Meiosis, Homeostasis- Control System, Feed Back Mechanisms.

CC2T: Biological Physics and Enzymes

Units for Measuring Concentration of solutes: Moles, Equivalent, Osmoles; Principles of dilution, pH, Buffers, Bonds and Forces in Biomolecules, Colloids: Properties, Importance. Surface tension, Specific Gravity, Viscosity and Resistance, Acids, Bases, Buffers, and pH, Dialysis and Ultracentrifugation, Chromatography, Electrophoresis, Autoradiography, Cell Fractionation and Tracer Techniques, Nanoparticles and its application in Physiology, Laminar and Streamline flow, Poiseuille-Hagen Formula, Laws of Laplace, Osmosis and Diffusion, hemodynamics : Laws , Application in Physiology, Enzymes : Structure, coenzymes, Prosthetic Groups, Mechanism of enzyme action, Kinetics, Michaelis constant, Enzyme Inhibition Modulation of Enzymes Activities, Factors regulating enzyme activities, Isoenzymes, Allosteric enzymes, Pro-enzymes, Ribozymes, Abzymes, Concept of Rate limiting enzymes, Micelle, Liposome

CC1P: Cellular Basis of Physiology

Histology: Study on compound microscope. Study and identification of stained sections of different mammalian tissues and organs:

Bone, Cartilage, Trachea, Lungs, Spleen, Lymph gland, Esophagus, Stomach, Duodenum, Ileum, Jejunum, large Intestine, Liver, Kidney, Ureter, Salivary glands, Pancreas, Adrenal gland, Thyroid gland, Testes, Ovary, Spinal Cord, Cerebral cortex, Cerebellum, Skin, Cardiac muscle, Skeletal muscle, Smooth muscle, Artery, Vein, Tongue, Uterus.

(Ten slides to be identified 10 x 1¹/₂ =15 marks)
(Viva voce -2 marks + Lab Note Book -3 Marks)

CC2P: Biological Physics and Enzymes

- i. Determination of Systolic, Diastolic, Pulse and Mean Blood Pressure by non-invasive methods (Auscultatory Method) in resting condition.
- ii. Determination of enzyme activities (e.g., SOD, CAT, Amylase, Transaminase etc.).
- iii. Preparation of Buffer and pH measurement.
- iv. Determination of pulse rate and heart rate under resting condition and the effect of exercise on it.

(Two experiments to be set 8+7=15)
(Viva voce -2 marks + Lab Note Book -3 Marks)

CC3T: Physiology of Nerve & Muscle Cells

1. Excitable Tissue: Nerve

Introduction, Nerve cells- Excitation & Conduction, Ionic Basis of Excitation & Conduction, Properties of Nerves, Nerve Fiber Types & Function, Neurotrophins, Glia.

2. Excitable Tissue: Muscle :Introduction, Muscle proteins, Skeletal Muscle Morphology, Electrical Phenomena & Ionic Fluxes, Contractile Responses, Changes during muscular contraction, Energy Sources & Metabolism, Properties of Muscle in the Intact Organism, Cardiac Muscle Morphology, Properties, Metabolism, Pacemaker Tissue, Smooth Muscle Morphology, Mechanism of contraction, Multi-Unit Smooth Muscle. Sarcotubular system, Red and white muscle,

3. Synaptic & Junctional Transmission

Introduction, Synaptic Transmission: Functional Anatomy, Electrical Events at Synapses, Inhibition & Facilitation at Synapses, Chemical Transmission of Synaptic Activity, Principal Neurotransmitter Systems, Neuromuscular Transmission, Neuromuscular Junction.

4. Initiation of Impulses in Sense Organs: Introduction, Sense Organs & Receptors The Senses, Biological Transducer, Electrical & Ionic Events in Receptors, "Coding" of Sensory Information.

CC4T: Chemistry of Biomolecules

Classification, structure, Properties and Functions of Carbohydrates, Proteins and lipids. Structure, types and Functions of DNAs and RNAs.

Metabolic Pathways, energetic and Regulations- glycogenesis, Glycogenolysis, Glycolysis, TCA cycle, HMP pathway, Neoglucogenesis, Cori Cycle, Glucose Alanine cycle, Beta Oxidation, Alpha Oxidation, Omega Oxidation, Ketogenesis, Fatty acid Synthesis, Cholesterol Biosynthesis, Urea cycle. TCA cycle- the final common Pathway, Deamination, Transamination, Glucogenic and Ketogenic amino acid, Inborn error of metabolism.

CC3P: Physiology of Nerve & Muscle Cells

Histological Study: Experiment of Nerve and Muscle: Isolation and Staining of Nerve fibres with node(s) of Ranvier (AgNO₃).

Preparation & Staining of Squamous & Cornified epithelium, Skeletal & Cardiac muscle
(7 marks)

Study of Kymograph, Induction coil, key and other instruments used to study mechanical responses of skeletal muscle. Preparation of Amphibian Ringer solution. Preparation of sciatic nerve innervated gastrocnemius muscle of toad. Kymographic recording of mechanical responses of gastrocnemius muscle to a single stimulus. Kymographic recording of the movements of unperfused heart beats of toad. Determination of nerve conduction velocity.

Human experiments:

Phenomenon of Human Fatigue by Mosso's Ergograph and Hand grip spring dynamometer
Calculation of work done by the muscle.

(8 marks)
(Viva voce-2 marks+ Lab Note Book-3 marks)

CC4P: Chemistry of Biomolecules

Biological Chemistry:

Qualitative tests for the identification of physiologically important substances: Hydrochloric acid, lactic Acid, Uric Acid, Glucose, Galactose, Fructose, Sucrose, Lactose, Albumin, Gelatin, Peptone, Starch, Dextrin, Urea, Glycerol, Bile salts, Acetone, Cholesterol.

(8 marks)

Principles & methods of diet survey. Survey report (hand-written) on disease susceptibility of a community and identification of causative factors Or Survey report (hand-written) on nutritional assessment of college students.
(7 marks)

(Viva voce - 2 marks + Lab Note Book - 3 marks)

CC5T: Circulating Body Fluids

Introduction, Blood-properties & composition, Bone Marrow-Classification & Functions, White Blood Cells-Types, Characters, Shape & size, Functions, Immune activities of blood, Platelets, Red Blood Cells-Biosynthesis, Factors affecting, Hemoglobin- Synthesis, Estimation, Compounds & derivatives, Fate, abnormal Hemoglobins. Blood Types-ABO, Rh & MN, Cross matching, Agglutinin & Agglutinins, Plasma proteins-Classification, Values & Functions, Plasmapheresis. Hemostasis-Coagulation factors, Mechanisms, Factors Hastening, Hemophilia, Role of Platelets in Coagulation, Blood Volume- Values, Physiological Variations, Measurements and Regulations, Lymph-Lymphatic system, Source, Composition, circulation and functions. TC, DC, ESR, MCH, MCHC, PCV, Leukemia, Leukocytosis, Leukopenia, Purpura, Arneht count, Erythroblastosis foetalis. Transfusion-Hazards, Precautions, Procedure of transfusion. Edema, Spleen-structure & function.

CC6T: Circulation

1. Origin of the Heartbeat & the Electrical Activity of the heart

Introduction, Properties of heart muscle, Special Junctional tissues, Origin & Spread of Cardiac Excitation, The Electrocardiogram, Cardiac Arrhythmias, Electrocardiographic Findings in Other Cardiac & Systemic Diseases, hypertrophy and cardiac myopathy.

2. The Heart as a Pump : Introduction, Mechanical Events of the Cardiac Cycle, Cardiac Output, Heart sound, Heart rate.

3. Dynamics of Blood & Lymph Flow

Introduction, Anatomic Considerations, Biophysical Considerations, Arterial & Arteriolar Circulation, Capillary Circulation, Lymphatic Circulation & Interstitial Fluid Volume, Venous Circulation.

4. Cardiovascular regulatory Mechanisms

Introduction, Local Regulatory Mechanisms, Substances Secreted by the Endothelium, Systemic Regulation by Hormones, Systemic Regulation by the Nervous System. Blood pressure-Types, Measurement & Regulation

5. Circulation Through special Regions

Introduction, Cerebral Circulation, Anatomic Considerations Cerebrospinal fluid, The Blood-Brain barrier, Cerebral Blood Flow, Regulation of Cerebral Circulation, Coronary Circulation, Splanchnic Circulation, Circulation of the skin.

6. Cardiovascular Homeostasis in Health & Disease

Introduction, Compensation for Gravitational Effects, Exercise, Inflammation & Wound Healing, Shock, Hypertension, Heart Failure, stroke.

CC7T: Functions of the Nervous System

1. **Reflexes** : Introduction, Monosynaptic Reflexes: The Stretch Reflex, Polysynaptic Reflexes: The Withdrawal Reflex, General Properties of Reflexes, Reflex arc.
2. **Cutaneous, Deep & Visceral Sensation**: Introduction, Pathways Touch, Proprioception, Temperature, Pain, Other Sensations.
3. **Arousal Mechanisms, Sleep, & the Electrical Activity of the Brain** : Introduction, The Reticular Formation & the Reticular Activating System, The Thalamus & the Cerebral Cortex, Evoked Cortical Potentials, The Electroencephalogram, Physiological Basis of the EEG, Consciousness, & Sleep, Interpretation of abnormal EEG pattern.
4. **Control of Posture & Movement** : Introduction, General Principles, Ascending & Descending Tracts- Goll, Burdach, Spinothalamic, Pyramidal Extrapyramidal, Posture and its regulation, Basal Ganglia, Cerebellum, Movement disorders.
5. **The Autonomic Nervous System**: Introduction, Anatomic Organization of Autonomic Outflow, Chemical Transmission at autonomic Junctions, Responses of Effector Organs to Autonomic Nerve Impulses, Cholinergic and Adrenergic Discharge.
6. **Central Regulation of Visceral Function** : Introduction, Medulla Oblongata, thalamus, Hypothalamus & Cerebellum- Anatomic Considerations, Nucleus, connections and functions
7. **Neural Basis of Instinctual Behavior & Emotions**: Introduction, Anatomic Considerations, Limbic Functions, Sexual Behavior, Fear & Rage, Motivation,
8. **Higher Functions of the Nervous System: Conditioned Reflexes , Learning, & Related Phenomena** : Introduction, Methods, Learning & Memory, Functions of the Neocortex, Disorders relating learning and memory.

CC5P: Circulating Body Fluids

Haematological Experiments :

- I. Preparation and staining of blood film with *Leishman's* stain.
- II. Identification of the blood corpuscles.
- III. Differential count of WBC, Arneith count, Bleeding time and Clotting time and Haemoglobin estimation
- IV. Preparation of Haemin crystal.

*(Two experiments to be set 8+7=15)
(Viva voce - 2 marks + Lab Note Book - 3 Marks)*

CC6P: Circulation

Cardiovascular Experiments:

- I. Determination of blood pressure at different body postures.
- II. Measurement of blood pressure before and after exercise with graphical presentation.
- III. Study of the effects of changes in perfusion fluid pressure, changes in temperature, excess calcium and potassium ion concentration, acetylcholine, adrenaline on the movement of heart from supplied graph - Interpretation.
- IV. Measurement of electrocardiographic recordings (ECG)
- V. Computation of HR, PQ interval, QRS complex, PR interval from supplied ECG recording graph.

(One experiment to be set 15)

(Viva voce - 2 marks + Lab Note Book - 3 Marks)

Demonstration:

- i. Kymographic recording of the movements of perfused heartbeats of toad
- ii. Kymographic recording of changes in perfusion fluid pressure, changes in temperature, excess calcium and potassium ion concentration, acetylcholine and adrenaline on perfused heart beats of toad.

CC7P: Functions of the Nervous System

Neurological Experiments:

Experiments on superficial (plantar) and deep (knee jerk) reflex
Measurement of grip strength
Reaction time by stick drop test
Short term memory test (shape, picture word)
Two point discrimination test
Mapping of the peripheral field of vision with perimeter (Perimetry)

(One experiment to be set 15)

(Viva voce - 2 marks + Lab Note Book - 3 Marks)

Demonstration :

Basic concepts of brain imaging. Identification of different structures of human brain using CT scan and MRI images.

CC8T: Nutrition

Introduction. Fuel value, Composition and nutritional value of common Indian foodstuffs, rice, wheat, pulses, egg, meat, fish and milk, vegetables & fruits.

Importances of carbohydrate, protein and fat. Balance diet, Balanced diet chart, . Concept of ACU. Principles of formulation of balanced diets for growing child, adult man and woman, pregnant and lactating woman.

Caloric requirement, Dietary fibre, Protein energy malnutrition, Food groups, Malnutrition, BMR, RQ, RDA, SDA, NPU, Biological value of proteins, vitamins- A,D,E,K, Bcomplex, C, - Sources, Daily requirements, actions, deficiency symptoms, Hypervitaminosis and Hypovitaminosis and minerals- Sources, functions & Deficiency symptoms. Clinical implications .

Diet management of obese, diabetic, hypertensive person and athlete. Basic idea on PCM, marasmus, kwashiorkor and their prevention. Iron and iodine deficiency.

CC9T: Gastrointestinal system

1. Anatomy & Histology: Organs- Mouth; tongue, oesophagus liver, stomach, intestine , Deglutition, Defecation.

2. Digestion & Absorption

Introduction, Carbohydrates, Proteins & Nucleic Acids, Lipids, Digestion & Absorption, Absorption of Vitamins & Minerals

3. Regulation of Gastrointestinal Function

Introduction, General Considerations, Gastrointestinal hormones, & Exocrine Portion of the Pancreas, Liver & Biliary System, Small Intestine, Colon. Digestive Juices- Secretion, function & regulation of Saliva, Bile, Gastric juice, Pancreatic juice and Intestinal juice. Black & white bile, Pancreatitis, Jaundice, Cholecystitis. Endoscopy. Malabsorption. HCL secretion & regulation.

CC10T: Respiration

1. **Pulmonary Function:** Introduction, Properties of Gases, Anatomy of the Lungs, Mechanics of breathing, Gas Exchange in the lungs, Pulmonary Circulation, Other Functions of the Respiratory System.

2. **Gas Transport Between the Lungs & the Tissues:** Introduction, Oxygen Transport, Carbon Dioxide Transport, Oxygen dissociation curve, Respiratory acidosis and alkalosis.

3. **Regulation of Respiration:** Introduction, Neural control of Breathing, Chemical Control of Breathing,

Nonchemical Influences on Respiration.

4. **Respiratory Adjustments in Health & Disease :** Introduction, Effects of Exercise, Hypoxia, Cyanosis, Kayssons disease, Oxygen Treatment, Hypercapnia & Hypocapnia, Other Respiratory Abnormalities,

Effects of Increased Barometric Pressure, Artificial Respiration.

CC8P: Energy Balance, Metabolism, and Nutrition

Biochemical Estimation: Quantitative estimation of glucose and sucrose by Benedict's method. Quantitative estimation of amino nitrogen [Sorensen's formol titration method (percentage as well as total quantity to be done)]. Estimation of percentage quantity of lactose in milk by Benedict's method.

(One experiment to be set 15)

(Viva voce - 2 marks + Lab Note Book - 3 Marks)

CC9P: Gastrointestinal Function

Introduction on Dale's Apparatus and preparation of Ringer Lock solution.

Kymographic recording of normal movements of rat's intestine in Dale's Apparatus.

Effects of hypoxia on normal intestinal movements.

Preparation & staining of Adipose tissue

(One experiment to be set 15)

(Viva voce - 2 marks + Lab Note Book - 3 Marks)

CC10P: Respiration

Measurement of peak expiratory flow rate

Measurement of oxygen saturation by pulse oxymeter before and after exercise

Measurement of forced expiratory volume (FEV) in first second and first 10 second.

Pneumographic recording of effects of hyperventilation, breath-holding and talking on respiratory movements.

Measurement of Pulse respiratory ratio under resting condition and under different grades of exercise.

(One experiment to be set 15)

(Viva voce - 2 marks + Lab Note Book - 3 Marks)

Demonstration :

Lung function tests using Spirometry (Digital) and analysis of the results.

CC11T: Special Senses

- 1. Vision:** Introduction, Anatomic Considerations, Retina Structure, The Image-Forming Mechanism (accommodation and visual acuity), The Photoreceptor Mechanism: Genesis of Electrical Responses, Visual Pathways and effects of lesions of these pathways, Color Vision, Other Aspects of Visual Function, Eye Movements, Errors in visual process.
- 2. Hearing & Equilibrium :** Introduction, Anatomic considerations, Hair cells, Mechanism of hearing, Vestibular function, Loss of hearing. Auditory Pathway.
- 3. Smell & Taste :** Introduction, Smell, Receptors & Pathways, Physiology of Olfaction, Taste, Receptor Organs & Pathways, Physiology of Taste.

CC12T: Endocrinology

- 1. The Thyroid Gland :**Introduction, Anatomic Considerations, Formation & Secretion of Thyroid Hormones, Transport of Thyroid Hormones, Effects of Thyroid Hormones,Regulation of Thyroid Secretion,Clinical Correlates.
- 2. Endocrine Functions of the Pancreas & the Regulation of Carbohydrate Metabolism:** Introduction, Islet Cell Structure, Structure, Biosynthesis, & Secretion of Insulin, Effects of Insulin, Mechanism of action, Insulin Excess, Regulation of Insulin Secretion, Glucagon, Other Islet Cell Hormones, Hypoglycemia & Diabetes Mellitus in Humans.
- 3. The Adrenal Medulla & Adrenal Cortex :** Introduction, Adrenal Morphology, Adrenal Medulla, Structure & Function of Medullary Hormones, Regulation of Adrenal Medullary Secretion, Adrenal Cortex, Structure & Biosynthesis of Adrenocortical Hormones, Effects of Adrenal Androgens & Estrogens, Physiologic Effects of Glucocorticoids, Pharmacologic & Pathologic Effects of Glucocorticoids, Regulation of Glucocorticoid Secretion, Effects of Mineralocorticoids, Regulation of Aldosterone Secretion, Summary of the effects of Adrenocortical Hyper & Hypofunction in Humans.
- 4. Hormonal Control of Calcium Metabolism & the Physiology of Bone:** Introduction, Calcium & Phosphate Metabolism, Bone Physiology, Vitamin D & the Hydroxycholecalciferols, The Parathyroid Glands, Calcitonin, Effects of Other Hormones & Humoral Agents on Calcium Metabolism.
- 5. The Pituitary Gland :**Introduction, Morphology, Posterior pituitary hormones, Growth Hormone, Physiology of Growth, Pituitary Insufficiency, Pituitary Hyperfunction in Humans.
- 6. Endocrine Functions of the Kidneys, Heart, & Pineal Gland:** Introduction, The Renin-Angiotensin System, Erythropoietin, The Endocrine Function of the Heart: Atrial Natriuretic Peptide, Pineal Gland.
- 7. Human chronobiology :** Biological rhythms; basic concepts and implications. Temperature &Hormonal Biorhythm, Zeitgebers, Master Clock.

CC11P: Special Senses

Principles of fixation and staining,
Staining and identification of fixed nervous tissues,Lung, tongue and skin.

(8 Marks)

Silver nitrate preparation of corneal cell space.
Determination of visual acuity by Snellen's chart chart.
Determination of colour blindness by Ishihara chart.
Audiometry.

(7 Marks)

(Two experiments to be set 8+7=15)
(Viva voce - 2 marks + Lab Note Book - 3 Marks)

CC12P: Endocrinology

Endocrinological assay / Experiments related to experimental Physiology:

Study of the effects of adrenaline on uterine contraction of albino rat

Growth chart of school and college students & interpretation.

Study of the effects of adrenaline/ acetylcholine on intestinal movements of albino rat

Staining and identification of different mammalian tissues : Salivary glands, Liver, Lymph gland, Pancreas, Adrenal gland and Thyroid gland.

(One experiment to be set 15)

(Viva voce - 2 marks + Lab Note Book - 3 Marks)

Demonstration :

Estimation of plasma level of any hormone using ELISA

CC13T: Reproductive Function

Introduction, Sex Differentiation & Development, Embryology of the Human Reproductive System, Aberrant Sexual Differentiation, Puberty, Precocious & Delayed Puberty, Menopause, Pituitary Gonadotropins & Prolactin, The male reproductive System: Structure, Gametogenesis & Ejaculation, Endocrine Function of the Testes, Control of Testicular Function,

Abnormalities of Testicular Function, Sperm structure, Prostate gland. The Female Reproductive system: The Menstrual Cycle, Ovarian Hormones, Control of Ovarian Function, Abnormalities of Ovarian Function, Pregnancy, Breast Structure & development, Lactation, Physiological concepts for a planned family. Testosterone, Oestrogen and Progesterone, Placenta-Structure & Functions. Hypothalamic control of ovarian functions, oogenesis, Corpus Luteum, ART, IVF, oocyte donation, Infertility,

CC14T: Formation and Excretion of Urine

Introduction, Structure & Function of Malpighian corpuscles and renal tubule, GFR, counter-current mechanism, Water Excretion, Urine formation, Absorption in renal tubule- mechanism, Acidification of the Urine & Bicarbonate Excretion, Regulation of Na^+ & Cl^- Excretion, Renal Circulation, Diuretics-classification & functions, Disorders of Renal Functions, Filling of the Bladder, Emptying of the Bladder, Non-excretory function of kidney. Normal & abnormal constituents of Urine, Hormones of kidney- Renin, Erythropoietin and aldosterone, Renal clearance test- Inulin, PAH, Radiographic and biochemical tests for kidney function, Kidney transplantation, Kidney stone-causes, symptoms and prevention, Kidney failure, Proteinuria, glycosuria, Diabetes insipidus, Diabetes mellitus, Ketonuria.

CC13P: Reproductive Function

Reproductive Histology and Biochemistry:

Study of estrous cycle

Staining and identification of different mammalian tissues : Ovary, Testis, Uterus and Pituitary gland

Estimation of estrogen by spectrophotometric method

(8 Marks)

Pregnancy test by immunological method from human urine using KIT method

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

(7 Marks)

(Two experiments to be set 8+7=15)

(Viva voce - 2 marks + Lab Note Book - 3 Marks)

CC14P: Formation and Excretion of Urine

Renal Biochemistry:

Identification of normal and abnormal constituents of urine

Microscopic observation of RBC, Pus Cell and Castin urine

Serum Creatinine test

Kidney function tests

Assessment of nutritional status of infant (birth to 36month) from the standard growth curve and determination of stage of malnutrition

Estimation of albumin in urine

Detection of specific gravity of urine

Quantitative estimation of Urea in Urine

(One experiment to be set 15)

(Viva voce - 2 marks + Lab Note Book - 3 Marks)

Discipline Specific Electives (DSE)(Any Four)

1. Biological Statistics
2. Microbiology and Immunology
3. Sports Exercise and Ergonomics and Occupational Physiology
4. Environmental Physiology
5. Genetics and Molecular Biology
6. Nano-biotechnology and Bioinformatics

DSE1T : Biological Statistics

Scope of statistics – Principles of statistical analysis of biological data. Basic concepts – variable, parameter, statistics. Sampling. Presentation of data-frequency distribution, frequency polygon, histogram, bar diagram and pie diagram, Parameters. Different classes of statistics- mean, median, mode, mean deviation, variance, standard deviation, standard error of mean. Standard score. Degrees of freedom. Probability. Normal distribution. Student's t-distribution. Testing of hypothesis - Null hypothesis, errors of inference, levels of significance, Students' 't' test and z score for significance of difference. Distribution-free test - Chi-square test. Correlation coefficients

DSE 1P : Biological Statistics

Computation of mean, median, mode, standard deviation and standard error of the mean with physiological data like body temperature, pulse rate, respiratory rate, height and weight of human subjects. Graphical representation of data in frequency polygon and histogram. Student's 't' test for significance of difference between means. Demonstration: Statistical analysis and graphical representation of biological data with computer using One way ANOVA.

DSE 2T : Microbiology and Immunology

Bacteria - structure & morphological classification. Gram positive, gram negative, pathogenic & nonpathogenic bacteria. Sterilization, pasteurization, brief idea about antibiotics. Bacterial growth curve. Elementary idea of bacteriostatic and bacteriocidal agents. Bacterial genetics. Viruses - Structure and types, Lytic and lysogenic cycle. Prions – basic ideas and prion diseases.

Overview of immune system. Idea about innate and acquired immunity. Immuno-competent cells. Humoral and cell mediated immunity. Antigen-antibody interaction. Immunoglobulin - classification, basic structure and function. Antigen presentation. Major Histocompatibility Complex (MHC). Cytokines. Complement system. Vaccination - principles and importance of immunization. Basic principles of immunological detection of pregnancy.

Immunization programme - immunization against Polio, Hepatitis-B, Tetanus, Measles, Whooping cough, Tuberculosis, Rabies through vaccine, AIDS- causative virus, mode of transmission, effects on human body, preventive measures, and principles of diagnostic test for AIDS (ELISA).

Immunopathology - basic principles of autoimmune disease and transplantation immunology.

DSE 2P : Microbiology and Immunology

Types of culture media, Principles and description of Laminar flow, Preparation of Culture media, Sterilisation procedure, Pasteurisation procedure, Gram staining of bacteria and identification of Gram positive and Gram negative bacteria Demonstration: Spore Staining, Radial immuno-diffusion.

DSE 3T : Sports, Exercise, Ergonomics and Occupational Physiology

Importance of regular exercise in health and wellbeing, Basic concept of Bioenergetics, Energy sources during exercise (Phosphagen, Anaerobic system and Aerobic system). Cardio-respiratory responses during different grades of exercise. Concept of excess post exercise oxygen consumption (EPOC), physiological fatigue and recovery. Aerobic work Capacity: Measurement, physiological factors and applications.

Training: Principles of physical training, Training to improve aerobic and anaerobic power. Effect of overtraining and detraining. Nutritional supplements and ergogenic aids. Sports injury and its' management.

Basic idea sports rehabilitation and sports medicine. Genesis and concept of ergonomics. Importance of ergonomics in occupational health and well being. Classification of Physiological work load. Concept of work rest cycle. Occupational deafness, Ergonomic principles of control of Physical hazards.

Static anthropometry, Application of anthropometric data in design. User interface and control display compatibility. Prevention of accidents, concept of Industrial safety. Occupational Diseases: pneumoconiosis, asbestosis, silicosis and work-related musculoskeletal disorders.

DSE 3P : Work, sports, Ergonomics and Occupational Physiology

. Recording of recovery heart-rate after standard exercise. Determination of Physical Fitness Index by Harvard Step Test (Modified). Determination of VO₂max by queen college step test. Measurement of body fat percentage. Six minute walk test. Determination of endurance time by hand grip dynamometer. Measurement of working heart rate by ten beats methods. Determine cardiac cost of specific work. Measurement of Some common anthropometric parameters – Stature, eye, chin, shoulder, elbow, Naval, knee, sitting height (all), Head circumference, chest circumference, waist circumference, Arm reach from wall, Shoulder elbow length, Knee to Knee Breadth, Shoulder to shoulder breadth, Elbow to elbow breadth.

Calculation of BSA and BMI from anthropometric data. Measurement of WBGT indices. Measurement of noise level by noise level meter.

DSE 4T : Environmental Physiology

Toxicology

Toxins and Toxicology. Factors Affecting toxicity. LD 50, LOD50, ED50, NOEL, LOEL. Concept of Acute and Chronic Effects. Birth defects and Teratogens. Concepts of Biomagnification and Bioconcentration. Prevention of Food Adulteration Act, 1954. Other Food Toxicants: BPA, BPS, Pesticides, PAH, Dioxin, PCB, Heavy Metals: Pb, Hg, Cd, As etc.

Environmental Pollutions and Health Hazards

Definition: hygiene, health and public health. Air, Water, Food Borne Diseases: causes, symptoms and control. Food Additives and Adulterants: definition, examples and human health hazards. Vector Borne Epidemic Diseases: Malaria and Plague-etiology and control.

Environmental Pollution and Human Health Hazards

Air Pollution: definition, sources, air pollutants, effects of air pollution on human health, concept of ozone hole, green house effects and global warming.

Water Pollution: definition, types, health hazards, water pollutants, biochemical oxygen demand (BOD), thermal pollution, concept of safe drinking water standards.

Soil Pollution: causes, health hazards, solid waste managements- bioremediation, phytoremediation.

Sound Pollution: definition, concept of noise, source of sound pollution, effects of sound pollution on human health, noise index (noise standards).

Radionuclide Pollution: ionizing radiations, effects of ionizing radiation on human health, permissible doses.

Arsenic Pollution: sources, sources of arsenic in ground water, drinking water standard for arsenic (WHO, USEPA), health effects of chronic arsenic poisoning.

DSE 4P : Environmental Physiology

Determination of sound levels by sound level meter and noise index. Determination of dissolved oxygen in the supplied water samples-supplied water, ground water extracted by shallow and deep tube wells, stream waters, pond water etc. Detection of food additives in different food samples.

Kymographic recording of the effects of food additives on the movement of perfused heart of toad and intestinal movements of rat in Dale's bath. Biochemical estimation of serum glucose, total proteins, SGPT and SGOT in chronically exposed rats.

DSE 5T: Genetics and Molecular Biology

Genetics: Basic principles of Mendelian genetics - monohybrid and dihybrid, test and back crosses, Bacterial genetics-transformation, transduction, conjugation. Extension of Mendelism - Epistasis and its different types present in plants and animals. Penetrance, expressivity, pleiotropism. Crossing over and Gene mapping. Numerical and Structural variations in chromosome - basic concepts of aneuploids and polyploids. Human Cytogenetics - human karyotype, banding technique, use of human cytogenetics in medical science, inborn errors of metabolism, aneuploidy in humans. Sex determination and sex linkage.

Molecular Biology:

Genes - definition. DNA- structure, DNA replication, transcription of RNA in prokaryotes, Genetic code- properties and wobble hypothesis, translation in prokaryotes, regulation of gene expression - operon concept: lac operon, gene mutation, DNA repairing processes. Basic idea of Recombinant DNA technology and its applications, Polymerase chain reaction (PCR) - basic concepts.

DSE 5P: Genetics and Molecular Biology

DNA gel electrophoresis (agarose gel).

DSE 6T : Nanobiothechnology and Bioinformatics

Introduction to nanoscience and nanobiotechnology. Definition of a Nano system. Types of Nanostructures; Types of Nanocrystals-One Dimensional (1D)-Two Dimensional (2D) - Three Dimensional (3D) nanostructured materials - Quantum dots - Quantum wire; Core/Shell structures.

Synthesis of Nanomaterials. Characterization techniques for Nanomaterials: X-ray diffraction; Scanning Electron Microscope (SEM); Atomic force microscopy (AFM); scanning tunnelling microscopy (STM), scanning near field optical microscopy (SNOM); Transmission Electron Microscopy (TEM); Infrared spectroscopy (IR).

Properties of Nanomaterials: Size dependent properties - Mechanical, Physical and Chemical properties. Types of Nanomaterials: Carbon Nanotubes (CNT) - Metals (Au, Ag) - Metal oxides (TiO₂, CeO₂, ZnO) - Semiconductors (Si, Ge, CdS, ZnSe) - Ceramics and Composites. Applications of Nanomaterials in Biology: Biochemical sensors; Imaging; Cancer treatment etc. Toxicity of nanomaterials in the environment - Health threats.

DSE 6P : Nanobiothechnology and Bioinformatics

To be decided by respective universities board of studies based on the availability of infrastructure.

Skill Enhancement Course (SEC) (Any two)

1. Clinical Biochemistry
2. Diet Survey
3. Hematological Techniques
4. Detection of Food Additives /Adulterants
5. Histopathological Techniques
6. Pathological Microbiology/Bio-Medical Technology.

SEC 1T : Clinical Biochemistry

40 Marks

- 1.
2. Disorders of Carbohydrate Metabolism – Diabetes mellitus, glucose and galactose tolerance tests, sugar levels in blood, renal threshold for glucose, factors influencing blood glucose level, glycogen storage diseases, pentosuria, galactosemia.
3. Disorders of Lipids – Plasma lipoproteins, cholesterol, triglycerides & phospholipids in health and disease, hyperlipidemia, hyperlipoproteinemia, Gaucher's disease, Tay-Sach's and Niemann-Pick disease, ketone bodies, Abetalipoproteinemia
4. Inborn Errors of Metabolism – Phenylketonuria, alkaptonuria, albinism, tyrosinosis, maple syrup urine disease, Lesch-Nyhan syndrome, sickle cell anemia, Histidinemia.
5. Digestive diseases – Maldigestion, malabsorption, creatorrhoea, diarrhoea and steatorrhoea.
- 6.
7. Disorders of liver and kidney – Jaundice, fatty liver, normal and abnormal functions of liver and kidney. Inulin and urea clearance.
8. Electrolytes and acid-base balance – Regulation of electrolyte content of body fluids and maintenance of pH, reabsorption of electrolytes.
9. Diagnostic Enzymes – Enzymes in health and diseases. Biochemical diagnosis of diseases by enzyme assays – SGOT, SGPT, CPK, cholinesterase, LDH, Acid and aAlkaline phosphatase.
10. Abnormalities in Nitrogen Metabolism – Uremia, hyperuricemia, porphyria and factors affecting nitrogen balance.
11. Blood Clotting – Disturbances in blood clotting mechanisms – haemorrhagic disorders – haemophilia, von Willebrand's disease, purpura, Rendu-Osler-Werber disease, thrombotic thrombocytopenic purpura, disseminated intravascular coagulation, acquired prothrombin complex disorders, circulating anticoagulants.
12. Cancer – Cellular differentiation, carcinogens and cancer therapy.
13. ORGAN FUNCTION TEST: Liver, Renal and Pancreatic funcic function test. Analysis of CSF.Isotopes, Autoanalyser.

1.

SEC 1P: Clinical Biochemistry

List of Practicals

Photo-colorimetric estimation of blood constituents.
Measurement of blood glucose by Nelson-Somogyi method
Measurement of blood inorganic phosphate by Fiske – Subbarow method
Determination albumin globulin ratio, Determination of serum amylase by iodometric method.

Measurement of serum total protein by Biuret method

Measurement of pH of an unknown solution

(One experiment

to be set-15 Marks)

(Viva-voce – 2 marks, Lab note book – 3 marks)

SEC 2T :Clinical Dietetics : Human Nutrition & Diet Survey

40 Marks

Diet, concepts & principles of diet survey. Diet prescription, acid & alkaline foods.

Dietary fibre & nutrition, calorie concepts of ACU. Nutritional importance of carbohydrates, fat& proteins. Dietary requirements of carbohydrate, fat, protein and other nutrients.

Principles of balanced diet formulation of individuals --infants, growing children, students , aged persons, adult men & women, pregnant and lactating women.

Principles of diet therapy, therapeutic diet, RDA & nutraceuticals. Dietary managements of obese, diabetic persons, hypertensive persons & athelets.

Malnutrition and its causes. PEM : Marasmus & Kwashiorkor – causes & prevention. Iron &Iodine deficiency diseases - causes, symptoms & prevention. Diet prescription for Peptic ulcer, liver diseases, Gout and high fever patients.

SEC 2P: Excursion cum survey on diet & Preparation of project report

A complete project report (hand written) has to be prepared on the basis of survey work of a locality (20 families each) by the students- Report should have Introduction, Review of literature, Materials& Methods, Results, Discussion and Conclusion covering BMI, Dietary intake, Nutritional intake, Nutritional requirement, Energy deficiency/excess, vitamin deficiency/excess, mineral deficiency/excess, malnutrition, disease susceptibility and Formulation of balanced diet chart for the school going children, college students, pregnant woman & Lactating women based on the availability in the study area.

presented in Powerpoint presentation of 5-7 minutes)

20Marks(report-10, Presentation-8,

Viva-2)

SEC 3P: Hematological Techniques

Preparation of blood smear and identification of blood cells. Determination of haematocrit, MCV, MCH, MCHC. Preparation of serum, Estimation of SGOT and SGPT.

40 Marks

SEC 4P: Detection of Food Additives / Adulterants

Qualitative tests for identifying Food Adulterants in some food samples: Metanil yellow, Rhodamin- B, Saccharin, Monosodium glutamate, Aluminum foil, Chicory, Bisphenol A and Bisphenol S, Chocolate Brown HT, Margarine, Pb, Hg, As, PCB, Dioxin etc. in turmeric powder, besan, laddoo, noodles, chocolate and amriti.

40 Marks

SEC 5P: Histopathological Techniques

Preparation of tissue sections, H&E staining of tissue sections, Preparation and staining of bone marrow smear, measurement of diameter of megakaryocyte, reticulocyte staining, staining of collagen in tissue sections.

40 Marks

SEC 6P : Pathological Microbiology / Bio-Medical Technology

Staining of gram positive and gram negative bacteria. Identification of tubercular bacteria in sputum (demonstration: with utmost precautionary measure taken before students handle the samples). Demonstration of an ECG machine at work.

Handling of Doctor's centrifuge. Handling of colorimeter / spectrophotometer.

40 Marks

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Generic Elective:

Components of Core Courses

GE1T: Paper-1(T) CELL & ITS BIOPHYSICAL & BIOCHEMICAL PRINCIPLES	4 Credits
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Introduction, Body Fluid Components Organ Systems, Tissues, and Cells, Functional Morphology of Cell, Transport Across cell Membranes, Cell Signaling Capillary Wall, Intercellular Communication, Homeostasis, Aging.

Osmosis and Diffusion, pH, Buffers, Colloids: Properties, Importance, Surface tension, Specific Gravity, Viscosity and Resistance, Acids, Bases, Enzymes : Structure, coenzymes, Prosthetic Groups, Mechanism of enzyme action, Enzyme Inhibition, Factors regulating enzyme activities, Isoenzymes, Allosteric enzymes, Pro- enzymes, Ribozymes, Abzymes, Concept of Rate limiting enzymes.

Classification, structure, Properties and Functions of Carbohydrates, Proteins and lipids. Structure, types and Function of DNAs and RNAs. Metabolic pathways- Glycogenesis, Glycogenolysis, Glycolysis, TCA cycle, Beta oxidation, Ketogenesis & Urea cycle, Deamination, Transamination.

Introduction, Glands- secretion, function, regulation of secretion, Digestion & Absorption: Carbohydrates, Proteins & Nucleic Acids, Lipids, Water & Electrolytes, Intestinal movements.

GE1P: Paper 1 (p) CELL & ITS BIOPHYSICAL & BIOCHEMICAL PRINCIPLES	2 Credits
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Histology: Study and Identification of Stained Sections of Different Mammalian Tissues and Organs: Trachea, Lungs, Lymph gland, Tongue, Esophagus, Stomach, Duodenum, , Liver, Kidney , Spinal Cord, Cerebral cortex, Cerebellum, Staining & Identification of squamous & cornified epithelium.

Biological Chemistry: Qualitative tests for the identification of physiologically important substances: Hydrochloric acid, lactic Acid, Glucose, Fructose, Lactose, Albumin, Peptone, Starch, Dextrin, Urea.

GE 2: Paper-2 (T) SYSTEM PHYSIOLOGY	4 Credits
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Blood: RBC-Development, Factors, WBC: Types, functions, Platelets, Blood Volume: Factors, Measurement & Regulation, Coagulation Processes, Hemoglobin: compounds, Derivatives, Estimation, Blood Groups: Agglutinin, Agglutinogens, ABO system, Rh factor. Lymph: Composition & function. Cardiovascular system: Properties, Special junctional tissues, Cardiac cycle, Cardiac output, Blood Pressure: Measurement, Regulation, Heart rate, heart sound Respiratory system: Process of Respiration, Neural control, Chemical control, Anoxia, Oxygen

transport, Carbon-di-oxide transport, Oxygen dissociation curve.
Renal system: Nephron, Juxtaglomerular apparatus, Countercurrent mechanism, Micturation,
Normal & Abnormal constituents of urine.

GE 2: Paper-2(p) SYSTEM PHYSIOLOGY

2 Credits

Preparation and staining of blood film with Leishman's stain., Identification of the blood corpuscles. Differential count of WBC. Bleeding time and clotting time. Hemoglobin estimation. Preparation of haemin crystal. Measurement of Systolic and diastolic blood pressure in resting & exercise condition. Measurement of pulse rate, respiratory rate and pulse-respiratory ratio during rest & exercise. Pneumographic recording of respiratory movement along with the effect of hyperventilation, breath holding, talking & drinking. Measure the following anthropometric parameters- Stature, Eye height, Shoulder height, Elbow height, Knee height, Sitting height(all), arm reach from wall. Demonstration- 1. Kymographic recording of heart beats of toad.

Ability Enhancement Course (AEC) (Compulsory)

1. Environmental Science
2. English/MIL Communication

AEC 1T: Environmental Science

AEC 2T: English / MIL Communication

Recommended Text and Reference Books for Physiology (Honours)

1. Best and Taylor's Physiological basis of Medical Practices, by B.K. Brobecks. The William and Wilkins Co.
2. Review of Medical Physiology, by W.F. Ganong, Lange Medical Book. Pretices- Hall International. Mc Graw Hill.
3. Harper's illustrated Biochemistry, by R.K. Murray and others. Lange Medical Book, International edition, Mc Graw Hill.
4. Text book of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
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. Biochemistry, by D Das. Academic Publishers.
8. Biophysics and Biophysical Chemistry, by D.Das. Academic Publishers.
9. Physiology, by R.M. Berne and M.N. Levy, C.V Mosby Co.
10. Essential Immunology, by I.M. Roitt, Blackwell Scientific Publications.
11. Cellular and Molecular Biology, by E.D.P. De Robertis and E.M.F. De Robertis; Lea and Febiger.
12. Molecular Biology of gene, by J.D. Watson; H.N. Nancy and other; Benjamin-Cummings.
13. Human Physiology, by Rhoades and Pflanger, Saunder College Publishing.
14. Neurobiology, by G.M.Shepherd. Oxford University Press.
15. Biochemistry, by L. Stryer, W.H. Freeman and Co.
16. The Physiological Basis of Physical Education and Athletics, by W.D. McArdle, F. Katch and V.L Katch. Williams and Wilkins.
17. The Text Book of Environmental Physiology, by C. Edger Folk Jr. Lea and Febiger.

18. The Text Book of Work Physiology by P.O. Astrand and K. Rodhal. McGraw-Hill Books Co.
19. Human factors in Engineering and Design, by E.O. McCormick and M. Sanders. Tata McGraw Hill.
20. Sports Physiology, by E.L. Fox, Saunders College Publishing Holt-Saunders.
21. The Physiology of Reproduction, Volumes I and II, by, E. knobil and J.D. Neil. Raven Press.
22. Practice Biochemistry in Medicine, by Srinivas Rao, Academic Publishers.
23. Ross and Wilson Anatomy and Physiology in Health and Illness, by A. Waugh and A. Grant. International Edition, Churchill Livigstone Elesvier.
24. Human Physiology, by Stuart Ira Fox, McGraw Hill International edition.

SYLLABUS
FOR
BACHELOR OF SCIENCE
IN
PHYSIOLOGY GENERAL
UNDER
CHOICE BASED CREDIT SYSTEM



UNIVERSITY OF NORTH BENGAL

: EFFECTIVE FROM ACADEMIC SESSION - 2018 - 19:

Scheme for CBCS Curriculum for Physiology General Course

		Credits for Physiology		Credits for total General Courses
Course type		Total papers	Theory +Practical	Theory +Practical
Core courses(12)	4 papers from Physiology discipline	4	4X4=16 4X2=8	16x3=48 8x3=24
Elective Courses(6)	2 papers from Physiology discipline of choice out of 6 electives (discipline specific Electives)	2	2X4=8 2X2=4	8x3=24 4x3=12
Ability Enhancement Courses	Bengali/English and Environmental Science	2	2X2=4 (common)	4
Skill Enhancement Courses(4)	2 papers from the Physiology discipline out of 6 skill enhancement courses given	2	2X2=4 (for Physiology)	4 x2=8
Total		12	44(4+0/4)=40/36 credits for physiology	120

- All general courses will have 3 subjects/disciplines of interest. Students will select 4 core courses each from discipline of choice including Physiology as one of the disciplines.
- Students will select 2 elective courses each from discipline of choice including Physiology as one of the disciplines.
- Student may also choose 2 skill enhancement courses in Physiology.

Framework of CBCS in Physiology General (B.Sc. General in Physiology)

Semester	Core Course (04)	Ability Enhancement Compulsory Course (AECC) (2)	Skill Enhancement (SEC) (2)	Discipline Specific Elective (2)
I	C1	Environmental Science/ (English Communication/MIL/Bengali)		
II	C2	Environmental Science/ (English/ MIL Communication/Bengali)		
III	C3		SEC-1	
IV	C4		SEC-2	
V			Or SEC-1	DSE—1
VI			SEC-2	DSE-2

Courses of B.Sc. General Physiology under CBCS

Core Courses	
<ul style="list-style-type: none"> Cellular Basis of Physiology, Bio-Physics, Biochemistry, Gastrointestinal Physiology. Circulating Body Fluids, Circulation, Respiration, Formation and Excretion of Urine Nerve and Muscle, Nervous system, Nutrition Special Senses, Endocrinology, Reproductive Function 	
Ability Enhancement Course (AEC) (Compulsory)	
<ul style="list-style-type: none"> Environmental Science English/MIL Communication/Bengali 	
Elective Course (DSE) (any two)	
<ul style="list-style-type: none"> Discipline Specific Electives (DSE)(Any two) 	<ul style="list-style-type: none"> Biological Statistics Microbiology and immunology Sports and Exercise Physiology Environmental Physiology
Skill Enhancement Course (SEC) (Any two)	
<ul style="list-style-type: none"> Clinical Biochemistry Diet Survey Hematological Techniques Detection of Food Additives /Adulterants Histopathological Techniques Pathological Microbiology/Bio-Medical Technology. 	

Summary of the Syllabus

Semester 1

- Each semester will consist of 15-18 weeks of academic work equivalent to 90 actual teaching days.
- One Credit is equivalent to one (1) hour of teaching (lecture) or two hours of Practical work per week.
- Numbers in parentheses indicate value of credit.

<ul style="list-style-type: none"> Core Courses (CC) 	
Theoretical (T)	Practical (P)
CCT1. (4)	CCP1. (2)
<ul style="list-style-type: none"> Ability Enhancement Courses (AEC) 	
AECA1. Environmental Science (1), AEC A2.English/MIL Communication/Bengali (1)	
Total credits in Semester I: 6 (for Physiology)+ 2 (Compulsory)=(6+2)=8.	

Semester II

<ul style="list-style-type: none"> Core Courses (CC) 	
Theoretical (T)	Practical (P)
CCT2. (4)	CCP2. (2)
<ul style="list-style-type: none"> Ability Enhancement Courses (AEC) 	
AECB1. Environmental Science (1), AEC B2.English/MIL Communication/Bengali (1)	
Total credits in Semester II: 6 (for Physiology)+ 2 (Compulsory)= (6+2)=8.	

Semester III

• Core Courses (CC)	
Theoretical (T)	Practical (P)
CCT3. (4)	CCP3. (2)
• Skill Enhancement Courses (SEC)	
SEC 1. (2)	
Total credits in Semester III: 6+2or (6+0)=8 or 6 (for Physiology)	

Semester IV

• Core Courses (CC)	
Theoretical (T)	Practical (P)
CCT4. (4)	CCP4. (2)
• Skill Enhancement Courses (SEC)	
SEC 2. (2)	
Total credits in Semester IV: 6+2or (6+0)=8 or 6 (for Physiology)	

Semester V

• Skill Enhancement Courses (SEC)	
Or SEC 1. (2)	
• Elective Courses (EC)	
Theoretical (T)	Practical (P)
DSE 1T. (4)	DSE 1P(2)
Total credits in Semester IV: 6+2or (6+0)=8 or 6 (for Physiology)	

Semester VI

• Skill Enhancement Courses (SEC)	
Or SEC 2. (2)	
• Elective Courses (EC)	
Theoretical (T)	Practical (P)
DSE 2T. (4)	DSE 2P (2)
Total credits in Semester IV: 6+2or (6+0)=8 or 6 (for Physiology)	

Credit Distribution Across Courses in Physiology

COURSE TYPE	TOTAL PAPERS	CREDITS
		THEORY+ PRACTICAL
Core Courses	4	4X4=16 & 4X2=08
Ability Enhancement Language Courses	2	2X2=04
Elective Courses	2	4x2=08 2x2=04
Skill Enhancement Courses	2	2X2=04
TOTAL	12	44 – (4+0/4)=40/36

-----**DETAILS OF COURSE**-----
Components of Core Courses

• CCT1: Cellular Basis of Physiology, Bio-Physics, Biochemistry, Digestive Physiology.	4 Credits
<p>Cell: Introduction, Body Fluid Components Organ Systems, Tissues, and Cells, Functional Morphology of Cell, Transport Across cell Membranes, Cell Signaling Capillary Wall, Intercellular Communication, Homeostasis, Aging.</p> <p>Biophysics: Osmosis and Diffusion, pH, Buffers, Colloids: Properties, Importance, Surface tension, Specific Gravity, Viscosity and Resistance, Acids, Bases, Enzymes : Structure, coenzymes, Prosthetic Groups, Mechanism of enzyme action, Enzyme Inhibition, Factors regulating enzyme activities, Isoenzymes, Allosteric enzymes, Pro-enzymes, Ribozymes, Abzymes, Concept of Rate limiting enzymes.</p> <p>Biochemistry: Classification, structure, Properties and Functions of Carbohydrates, Proteins and lipids. Structure, types and Function of DNAs and RNAs. Metabolic pathways- Glycogenesis, Glycogenolysis, Glycolysis, TCA cycle, Beta oxidation, Ketogenesis & Urea cycle, Deamination, Transamination.</p> <p>GI System: Introduction, Glands- secretion, function, regulation of secretion, Digestion & Absorption: Carbohydrates, Proteins & Nucleic Acids, Lipids, Water & Electrolytes, Intestinal movements</p>	
CCP1: Histology & Biochemistry	2 Credits
<p>Study on different parts& functions of simple & compound microscope</p> <p>Histology: Study and Identification of Stained Sections of Different Mammalian Tissues and Organs: Trachea, Lungs, Lymph gland, Tongue, Esophagus, Stomach, Duodenum, , Liver, Kidney , Spinal Cord, Cerebral cortex, Cerebellum, Staining & Identification of squamous & cornified epithelium. (8 marks)</p> <p>Biological Chemistry: Qualitative tests for the identification of physiologically important substances: Hydrochloric acid, lactic Acid, Glucose, Fructose, Lactose, Albumin, Peptone, Starch, Dextrin, Urea. (7 marks) (Viva voce-2marks, Lab note book-3 marks)</p>	
CCT2: Blood, Cardio-vascular, Respiration&Renal	4 Credits
<p>Blood: RBC-Development, Factors, WBC: Types, functions, Platelets, Blood Volume: Factors, Measurement& Regulation, Coagulation Processes, Hemoglobin: compounds, Derivatives, Estimation, Blood Groups: Agglutinin, Agglutinogens, ABO system, Rh factor. Lymph: Composition &function.</p> <p>Cardiovascular system: Properties, Special junctional tissues, Cardiac cycle, Cardiac output, Blood Pressure:Measurement, Regulation, Heart rate, heart sound</p> <p>Respiratory system: Process of Respiration, Neural control, Chemical control, Anoxia, Oxygen transport, Carbon-di-oxide transport, Oxygen dissociation curve.</p> <p>Renal system: Nephron, Juxtaglomerular apparatus, Countercurrent mechanism, Micturation, Normal &Abnormal constituents of urine.</p>	

CCP2: Haematology & Experimental Physiology	2 Credits
<p>Haematology: Preparation and staining of blood film with Leishman's stain. Identification of the blood corpuscles. Bleeding time and clotting time. Preparation of haemin crystal. (7 marks)</p> <p>Experimental: Measurement of Systolic and diastolic blood pressure in resting & exercise condition. Measurement of pulse rate, respiratory rate and pulse-respiratory ratio during rest & exercise. Pneumographic recording of respiratory movement along with the effect of hyperventilation, breath holding, talking & drinking. (8 marks) (Viva-2+ LNB-3)</p>	
CCT3: Nerve Muscle Physiology, Nervous system & Nutrition	4 Credits
<p>Nerve Muscle Physiology: Excitable Tissue: Nerve- Introduction, Nerve Cells, Excitation & Conduction, Ionic Basis of Excitation & Neurotrophins, Glia. Excitable Tissue: Muscle-Introduction, Skeletal Muscle Morphology, Electrical Phenomena & Ionic Fluxes, Contractile Responses, Cardiac Muscle Morphology, Properties, Pacemaker Tissue, Smooth Muscle Morphology, Multi-Unit Smooth Muscle. Synaptic & Junctional Transmission- Introduction, Transmission: Functional Anatomy, Nervous system: Reflex-Introduction, Monosynaptic Reflexes: The Stretch Reflex, Polysynaptic Reflexes: Properties. Pathways- Touch, Temperature, Pain, Corticospinal & Corticobulbar System, Medulla Oblongata, The Reticular Formation & the Reticular Activating System, The Thalamus & the Cerebral Cortex, Hypothalamus, Hypothalamic Function, Cerebellum, The Electroencephalogram, Learning & Memory, Nutrition: Importances of Carbohydrate, Protein, Fat, BMR, RQ, RDA, SDA, Nitrogen balance, essential amino acids, biological value of proteins. Supplementary value of protein. Protein efficiency ratio and net protein utilization of dietary proteins. Dietary fibres. . Composition and nutritional value of common food stuffs. vitamins- Sources, functions, deficiency signs of A,D,E,K,B complex & C. mineral- Sources & functions of Na,K,Ca,Mg,S,P,Fe,Mn,Zn.</p>	
CCP3: Histology & Experiments of Nerve and Muscle	2 Credits
<p>Histology-: Isolation and Staining-Node(s) of Ranvier (AgNO_3), Adipose tissue, Cornea. (5 marks)</p> <p>Experiment of Nerve and Muscle: Study of Kymograph, Induction coil, Key and other instruments used to study mechanical responses of skeletal muscle. Kymographic recording of mechanical responses of gastrocnemius muscle to a single stimulus and two successive stimuli. Preparation of Amphibian Ringer solution. Kymographic recording of the movements of unperfused heart of toad. Study of the effects of changes in temperature and adrenaline on the movement of heart. Measure the following anthropometric parameters-Stature, Eye height, Shoulder height, Elbow height, Knee height, suprasternal height, Iliac crest height, Sitting height(all), arm reach from wall, Measurement of girth- Neck, Upper arm, chest, waist hip & thigh. (10 marks) (Viva-2+ LNB -3)</p>	

CCT4: Special Sense, Endocrinology & Reproductive system	• Credits
<p>Special Sense: Vision: The Photoreceptor Mechanism: Visual Pathways Color Vision, Hearing- Anatomic considerations, Hair cells, Mechanism of hearing, Smell & Taste- Smell- Receptors & Pathways, Physiology of Olfaction, Taste- Receptor Organs & Pathways, Physiology of Taste.</p> <p>Endocrinology: The Pituitary Gland- Introduction ,Morphology, Posterior pituitary hormones, Growth Hormone, Thyroid Gland- Anatomic Considerations, Effects of Thyroid Hormones, Regulation of Thyroid Secretion, Pancreas- Islet Cell Structure, Secretion of Insulin, Effects of Insulin, Regulation, Glucagon-Function &regulation of secretion, Hypoglycemia & Diabetes Mellitus, The Parathyroid Glands- Calcium & Phosphate Metabolism, , Vitamin D, Calcitonin, Atrial Natriuretic Peptide, Pineal Gland,Angiotensin,Erythropoietin.</p> <p>Reproductive system: Introduction, Puberty, Precocious & Delayed Puberty, Menopause, Pituitary Gonadotropins & Prolactin, The male reproductive System- Structure, Spermatogenesis, Endocrine Function of the Testes. The Female Reproductive system- The Menstrual Cycle, Ovarian Hormones, Control of Ovarian Function, Pregnancy,Placenta, Breast development and Lactation, Physiological concepts for a planned family</p>	
CCP4: Biochemical Estimation & Experiments on Special Sense & Reproductive system	2 Credits
<p>Biochemical Estimation: Quantitative estimation of gram percentage & total quantity of glucose and sucrose by Benedict's method. Quantitative estimation of gram percentage & total quantity of amino nitrogen [Sorensen's formol titration method.</p> <p>Experiments on Special Sense & Reproductive system Determination of visual acuity by Snellen's chart / Landolt's C chart. Determination of colour blindness by Ishihara chart, Perimeter. Study of estrous cycle. Staining and identification of kidney and ureters. Pregnancy test from human urine by kit method. One experiment to be set-15 marks) (Viva-2marks+LNB -3 marks)</p>	

Ability Enhancement Compulsory Course (AECC)

- Environmental science
- English/MIL communication

ASCCT1: Environmental Science
ASCCT2: English/MIL Communication

Elective Courses (any two)

- **Discipline Specific Electives (DSE)** (Courses of Serial no-1 &2 will be selected)
- Biological Statistics
- Microbiology and Immunology
- Sports and Exercise Physiology
- Environmental Physiology

DSET1 : Biological Statistics	4 Credits
<p>Scope of statistics – Principles of statistical analysis of biological data. Basic concepts – variable, parameter, statistics. Sampling. Presentation of data-frequency distribution, frequency polygon, histogram, bar diagram and pie diagram. Different classes of statistics-mean median, mode, mean deviation, variance, standard deviation, standard error of mean. Standard score. Degrees of freedom. Probability. Normal distribution. Student’s t-distribution Testing of hypothesis - Null hypothesis, errors of inference, levels of significance, Students’ ‘t’ test and z score for significance of difference. Distribution-free test - Chi-square test.</p>	
DSE P1 : Biological Statistics Lab	2 Credits
<p>Computation of mean, median, mode, standard deviation and standard error of the mean with physiological data like body temperature, pulse rate, respiratory rate, height and weight of human subjects. Graphical representation of data in frequency polygon and histogram. Student’s ‘t’ test for significance of difference between means. Demonstration: Statistical analysis and graphical representation of biological data with computer using One way ANOVA etc. (One experiment to be set-15 marks) (Viva-2marks+LNB -3 marks)</p>	
DSE T2 : Microbiology and Immunology	4 Credits
<p>Bacteria- structure & morphological classification. Gram positive, gram negative, pathogenic & nonpathogenic bacteria. Sterilization, pasteurization, brief idea about antibiotics. Bacterial growth curve. Elementary idea of bacteriostatic and bacteriocidal agents. Viruses - Structure and types, Lytic and lysogenic cycle. Immune system- Innate and acquired immunity. Humoral and cell mediated immunity. Antigen-antibody interaction, Immunoglobulin - classification, basic structure and function. Antigen presentation. Major Histocompatibility Complex (MHC). Cytokines. Hypersensitivity, Complement system. Vaccination - principles and importance of immunization. Basic principles of immunological detection of pregnancy. Immunization program - immunization against Polio, Hepatitis-B, Tetanus, Measles, Whooping cough, Tuberculosis, Rabies through vaccine, AIDS- causative virus, mode of transmission, effects on human body, preventive measures, and principles of diagnostic test for AIDS (ELISA).</p>	

DSE P2 : Microbiology and Immunology Lab	2 Credits
<p>Instruments components & functions- Study on Laminar flow, Autoclave, Study on different classes of bacteria, Study on disinfection of glasswares, Study on types of culture media, Preparation of Culture media, Gram staining of bacteria and identification of Gram positive and Gram negative bacteria, Spore Staining, Radial immuno-diffusion. Identification of tubercular bacteria in sputum (demonstration: with utmost precautionary). One experiment to be set-15 marks) (Viva-2marks+LNB -3 marks)</p>	
DSE T3 : Sports and Exercise Physiology	4 Credits
<p>Importance of regular exercise in health and wellbeing. Basic concept of Bioenergetics, Energy sources during exercise (Phosphagen, Anaerobic system and Aerobic system). Cardio-respiratory responses during different grades of exercise. Concept of excess post exercise oxygen consumption (EPOC), physiological fatigue and recovery. Aerobic work Capacity: Measurement, factors and applications. Training: Principles&Applications. Effect of overtraining and detraining. Nutritional supplements and ergogenic aids. Sports injury and its' management. Basic idea sports rehabilitation and sports medicine. Application of anthropometric data in design. Concept of Industrial safety. Occupational Diseases: pneumoconiosis, asbestosis, silicosis and work-related musculoskeletal disorders.</p>	
DSE P3 : Sports and Exercise Physiology Lab	2 Credits
<p>Measurement of blood pressure before and after different grades of exercise. Recording of recovery heart-rate after standard exercise. Determination of Physical Fitness Index by Harvard Step Test (Modified). Determination of vital capacity and calculation of different volumes of lung Measurement of working heart rate by ten beats methods. Determine cardiac cost of specific work. Calculation of BSA and BMI from anthropometric data. Measurement of WBGT indices. Measurement of noise level by noise level meter. Determination of VO_{2max} by queen college step test. Measurement of body fat percentage. Six minute walk test. Determination of endurance time by hand grip dynamometer. (Two experiments to be set 7+8=15) (Viva-2 marks, LNB -3 marks)</p>	
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DSE T4 : Environmental Physiology	4 Credits
<p>Toxicology:Toxins and Toxicology. Factors Affecting toxicity. LD₅₀, LOD₅₀, ED₅₀, Concept of Acute and Chronic Effects. Teratogens. Concepts of Biomagnification and Bioconcentration. Other Food Toxicants: Pesticides, PAH, Dioxin, PCB, Heavy Metals: Pb, Hg, Cd, As etc.</p> <p>Environmental Pollutions and Health Hazards</p> <p>Definition: hygiene, health and public health., Food Borne Diseases: causes, symptoms and control. Vector Borne Epidemic Diseases: Malaria and Plague-etiology and control.</p> <p>Air Pollution: definition, sources, air pollutants, effects of air pollution on human health, concept of ozone hole, green house effects and global warming.</p> <p>Water Pollution: definition, types, health hazards, water pollutants, biochemical oxygen demand (BOD), thermal pollution, concept of safe drinking water standards.</p> <p>Sound Pollution: definition, concept of noise, source of sound pollution, effects of sound pollution on human health, noise index (noise standards).</p> <p>Radionuclide Pollution: ionizing radiations, effects of ionizing radiation on human health, permissible doses.</p>	

Arsenic Pollution: sources, sources of arsenic in ground water, health effects of chronic arsenic poisoning.

DSE 4P : Environmental Physiology Lab

2 Credits

Determination of sound levels by sound level meter and noise index.

Determination of dissolve oxygen in the supplied water samples-supplied water, ground water extracted by shallow and deep tube wells, stream waters, pond water etc.

Detection of food additives in different food samples.

Kymographic recording of the effects of food additives on the movement of perfused heart of toad and intestinal movements of rat in Dale's bath.

Biochemical estimation of serum glucose, total proteins, SGPT and SGOT in chronically exposed rats.

(Two experiments to be set 7+8=15) (Viva-2 marks, LNB -3 marks)

Skill Enhancement Course (SEC) (Any two)
(Courses of Serial no-1 &2 will be selected)

Skill Enhancement Course (SEC) (Any two)

- Clinical Biochemistry
- Diet Survey
- Hematological Techniques
- Detection of Food Additives /Adulterants
- Histopathological Techniques
- Pathological Microbiology/Bio-Medical Technology.

SEC 1T : Clinical Biochemistry

40 Marks

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- Disorders of Carbohydrate Metabolism – Diabetes mellitus, glucose and galactose tolerance tests, sugar levels in blood, renal threshold for glucose, factors influencing blood glucose level, glycogen storage diseases, pentosuria, galactosemia.
- Disorders of Lipids – Plasma lipoproteins, cholesterol, triglycerides & phospholipids in health and disease, hyperlipidemia, hyperlipoproteinemia, Gaucher's disease, Tay-Sach's and Niemann-Pick disease, ketone bodies, Abetalipoproteinemia
- Inborn Errors of Metabolism – Phenylketonuria, alkaptonuria, albinism, tyrosinosis, maple syrup urine disease, Lesch-Nyhan syndrome, sickle cell anemia, Histidinemia.
- Digestive diseases – Maldigestion, malabsorption, creatorrhoea, diarrhoea and steatorrhoea.
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- Disorders of liver and kidney – Jaundice, fatty liver, normal and abnormal functions of liver and kidney. Inulin and urea clearance.
- Electrolytes and acid-base balance – Regulation of electrolyte content of body fluids and maintenance of pH, reabsorption of electrolytes.
- Diagnostic Enzymes – Enzymes in health and diseases. Biochemical diagnosis of diseases by enzyme assays – SGOT, SGPT, CPK, cholinesterase, LDH.
- Abnormalities in Nitrogen Metabolism – Uremia, hyperuricemia, porphyria and factors affecting nitrogen balance.
- Blood Clotting – Disturbances in blood clotting mechanisms – haemorrhagic disorders – haemophilia, von Willebrand's disease, purpura, Rendu-Osler-Werber disease, thrombotic thrombocytopenic purpura, disseminated intravascular coagulation, acquired prothrombin complex disorders, circulating anticoagulants.
- Cancer – Cellular differentiation, carcinogens and cancer therapy.

SEC 1P: Clinical Biochemistry

List of Practicals

Photo-colorimetric estimation of blood constituents.

Measurement of blood glucose by Nelson-Somogyi method

Measurement of blood inorganic phosphate by Fiske – Subbarow method

Determination albumin globulin ratio, Determination of serum amylase by iodometric method.

(15 Marks)

Measurement of serum total protein by Biuret method

Measurement of pH of an unknown solution

(15 Marks)

(Two experiments to be set – 30 marks)

(Viva-voce – 2 marks, Lab note book – 3 marks)

SEC 2T :Clinical Dietatics : Human Nutrition & Diet Survey

40 Marks

Diet, concepts & principles of diet survey. Diet prescription, acid & alkaline foods. Composition & nutritional value of common Indian food stuffs: Rice, wheat,pulses,egg,meat,fish and milk.

Dietary fibre & nutrition, calorie concepts of ACU. Nutritional importance of carbohydrates, fat& proteins. Dietary requirements of carbohydrate, fat, protein and other nutrients.

Principles of balanced diet formulation of individuals --infants, growing children, students , aged persons, adult men & women, pregnant and lactating women.

Principles of diet therapy, therapeutic diet, RDA & nutraceuticals. Dietary managements of obese, diabetic persons, hypertensive persons & athelets.

Malnutrition and its causes. PEM : Marasmus & Kwashiorkor – causes & prevention. Iron &Iodine deficiency diseases - causes, symptoms & prevention. Diet prescription for Peptic ulcer, liver diseases, Gout and high fever patients.

SEC 2P: Excursion cum survey on diet & Preparation of project report

A complete project report (hand written) has to be prepared on the basis of survey work of a locality (20 families each) by the students- Report should have Introduction, Review of literature, Materials& Methods, Results, Discussion and Conclusion covering BMI, Dietary intake, Nutritional intake, Nutritional requirement, Energy deficiency/excess, vitamin deficiency/excess, mineral deficiency/excess, malnutrition, disease susceptibility and Formulation of balanced diet chart for the school going children, college students, pregnant woman & Lactating women based on the availability in the study area.

(Report should also be presented in Powerpoint presentation of 5-7 minutes) 20 Marks(report-10, Presentation -8, Viva-2)

SEC 3P: Hematological Techniques

Preparation of blood smear and identification of blood cells. Determination of haematocrit, MCV, MCH, MCHC. Preparation of serum, Estimation of SGOT and SGPT.

40 Marks

SEC 4P: Detection of Food Additives / Adulterants

Qualitative tests for identifying Food Adulterants in some food samples: Metanil yellow, Rhodamin- B, Saccharin, Monosodium glutamate, Aluminum foil, Chicory, Bisphenol A and Bisphenol S, Chocolate Brown HT, Margarine, Pb, Hg, As, PCB, Dioxin etc. in turmeric powder, besan, laddoo, noodles, chocolate and amriti.

40 Marks

SEC 5P: Histopathological Techniques

Preparation of tissue sections, H&E staining of tissue sections, Preparation and staining of bone marrow smear, measurement of diameter of megakaryocyte, reticulocyte staining, staining of collagen in tissue sections.

40 Marks

SEC

6P : Pathological Microbiology / Bio-Medical Technology

Staining of gram positive and gram negative bacteria. Identification of tubercular bacteria in sputum (demonstration: with utmost precautionary measure taken before students handle the samples). Demonstration of an ECG machine at work.

Handling of Doctor's centrifuge. Handling of colorimeter / spectrophotometer.

40 Marks

Recommended Text and Reference Books for Physiology (General)

- Best and Taylor's Physiological basis of Medical Practices, by B.K. Brobecks. The William and Wilkins Co.
- Review of Medical Physiology, by W.F. Ganong, Lange Medical Book. Pretices- Hall International. Mc Graw Hill.
- Harper's illustrated Biochemistry, by R.K. Murray and others. Lange Medical Book, International edition, Mc Graw Hill.
- Text book of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
- Lehninger's Principles of Biochemistry, by D.L. Nelson and M.M. Cox, Worth Publishers Inc.
- Text book of Biochemistry, by E.S. West; W.R.Todd; H.S. Mason; J.T Van Bruggen. The Macmillan Company.
- Biochemistry, by D Das. Academic Publishers.
- Biophysics and Biophysical Chemistry, by D.Das. Academic Publishers.
- Physiology, by R.M. Berne and M.N. Levy, C.V Mosby Co.
- Essential Immunology, by I.M. Roitt, Blackwell Scientific Publications.
- Cellular and Molecular Biology, by E.D.P. De Robertis and E.M.F. De Robertis; Lea and Febiger.
- Molecular Biology of gene, by J.D. Watson; H.N. Nancy and other; Benjamin-Cummings.
- Human Physiology, by Rhoades and Pflanger, Saunder College Publishing.
- Neurobiology, by G.M.Shepherd. Oxford University Press.
- Biochemistry, by L. Stryer, W.H. Freeman and Co.
- The Physiological Basis of Physical Education and Athletics, by W.D. McArdle, F. Katch and V.L Katch. Williams and Wilkins.
- The Text Book of Environmental Physiology, by C. Edger Folk Jr. Lea and Febiger.
- The Text Book of Work Physiology by P.O. Astrand and K. Rodhal. McGraw-Hill Books Co.
- Human factors in Engineering and Design, by E.O. McCormick and M. Sanders. Tata McGraw Hill.
- Sports Physiology, by E.L. Fox, Saunders College Publishing Holt-Saunders.
- The Physiology of Reproduction, Volumes I and II, by, E. knobil and J.D. Neil. Raven Press.
- Practice Biochemistry in Medicine, by Srinivas Rao, Academic Publishers.
- Ross and Wilson Anatomy and Physiology in Health and Illness, by A. Waugh and A. Grant. International Edition, Churchill Livigstone Elesvier.
- Human Physiology, by Stuart Ira Fox, McGraw Hill International edition.
- Sharirvigyan, by J. Debnath.