

Syllabus for Physiology Honours

Choice Based Credit System

(CBCS)



West Bengal State University

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 for Hons: Generic Course (GEC) (4)
I	PHYACOR01 PHYACOR02	Environmental Sciences			PHYHGEC01
II	PHYACOR03 PHYACOR04	(English /MIL)			PHYHGEC02
III	PHYACOR05 PHYACOR06 PHYACOR07		PHYSSEC01M		PHYHGEC03
IV	PHYACOR08 PHYACOR09 PHYACOR10		PHYSSEC02M		PHYHGEC04
V	PHYACOR11 PHYACOR12			PHYADSE01 PHYADSE02 PHYADSE03 (any two)	
VI	PHYACOR13 PHYACOR14			PHYADSE04 PHYADSE05 PHYADSE06 (any two)	

Courses of B.Sc. Honours Physiology under CBCS

Core Courses	<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 Biomolecules 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
Ability Enhancement Course (AEC) (Compulsory)	<ol style="list-style-type: none"> 1. Environmental Science 2. English/MIL Communication
Generic Elective Course (HGEC)	<ol style="list-style-type: none"> 1. Nutrition, Metabolism & Gastrointestinal Functions Circulation, Respiration, Excretion 2. Nervous system & Special senses 3. Endocrinology & Reproduction 4.

**Skill Enhancement Course (SEC)
(two)**

1. Hematological Techniques
2. Diet Survey and formulation of Diet Chart

**Discipline Specific Elective
Course (ADSEC)
(Any Four)**

1. Biological Statistics
2. Microbiology and Immunology
3. Sports and Exercise Physiology
4. Human Nutrition and Dietetics
5. Genetics and Molecular Biology
6. Environmental Physiology

Summary of the Syllabus

Semester 1

(A) Core Courses (COR)	
Theoretical (T)	Practical (P)
PHYACOR01T. Cellular Basis of Physiology (4)	PHYACOR01P Cellular Basis of Physiology (2) PHYACOR02P. Biological Physics and Enzymes (2)
PHYACOR02T. Biological Physics and Enzymes (4)	
(B) Ability Enhancement Courses (AEC)	
ENVSAEC01T Environmental Science (2)	
(C) Generic Elective Course for Hons (HGEC)	
From Related Discipline	

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 (COR)	
Theoretical (T)	Practical (P)
PHYACOR03T. Physiology of Nerve and Muscle Cells (4)	PHYACOR03P. Physiology of Nerve and Muscle Cells (2)
PHYACOR04T. Chemistry of Biomolecules (4)	PHYACOR04P. Chemistry of Biomolecules (2)
(B) Ability Enhancement Courses (AEC)	
ENGSaec02M English/MIL Communication (1)	
(C) Generic Elective Course for Hons (HGEC)	
From related discipline	
Total credits: $[(4 \times 2)] + (2 \times 2) + (2 \times 1) + (4 + 2) = [8 + 4] + 2 + 6 = 20$	

Semester III

(A) Core Courses (COR)	
Theoretical (T)	Practical (P)
PHYACOR05T Circulating Body Fluids (4)	PHYACOR05P. Circulating Body Fluids (2)
PHYACOR06T. Circulation (4)	PHYACOR06P. Circulation (2)
PHYACOR07T. Functions of Nervous System (4)	PHYACOR07P. Functions of Nervous System (2)
(B) Skill Enhancement Courses (SEC)	
PHYSSEC01M Haematological techniques (1)	

(C) Generic Elective Course for Hons (HGEC)

From related discipline
Total credits:[12+6]+2+(4+2) =26

Semester IV

(A) Core Courses (COR)	
Theoretical (T)	Practical (P)
PHYACOR08T. Energy Balance, Metabolism and Nutrition (4) PHYACOR09T. Gastrointestinal Function (4)	PHYACOR08P. Energy Balance, Metabolism and Nutrition (2) PHYACOR09P. Gastrointestinal Function (2)
PHYACOR10T. Respiration (4)	PHYACOR10P. Respiration (2)
(B) Skill Enhancement Courses (SEC)	
PHYSSEC002Diet Survey (1)	

(C) Generic Elective Course for Hons (HGEC)

From related discipline
Total credits:[12+6]+2+(4+2) =26

Semester V

(A) Core Courses (COR)	
Theoretical (T)	Practical (P)
PHYACOR11T. Special Senses (4) PHYACOR12T. Endocrinology (4)	PHYACOR11P. Special Senses (2) PHYACOR12P. Endocrinology (2)
(B) Discipline Specific Elective for Honours (ADSE) (any two)	
Theoretical (T)	Practical (P)
PHYADSE01T. Biological Statistics (4) PHYADSE02T Microbiology and Immunology (4) PHYADSE03T Sports and Exercise Physiology	PHYADSE01P Biological Statistics (2) PHYADSE02P Microbiology and Immunology (2) PHYADSE03P Sports and Exercise Physiology
Total credits:[8+4]+(6X2) =24	

Semester VI

(A) Core Courses (COR)	
Theoretical (T)	Practical (P)
PHYACOR13T. Reproductive Function (4) PHYACOR14T. Formation and Excretion of Urine (4)	PHYACOR13P. Reproductive Function (2) PHYACOR14P. Formation and Excretion of Urine (2)
(B) Discipline Specific Elective for Honours (ADSE) (Any two)	
Theoretical (T)	Practical (P)
PHYADSE04T Human Nutrition and Dietetics (4) PHYADSE05T Genetics and Molecular Biology (4) PHYADSE06T Environmental Physiology	PHYADSE04P Human Nutrition and Dietetics (2) PHYADSE05P Genetics and Molecular Biology (2) PHYADSE06P Environmental Physiology (2)
Total credits:[8+4]+(6X2) =24	

Summary of the Syllabus

Semester I

Courses/ Papers	Theoretical (T)	Credits	Practical (P)	Credits	Total Credits
Core Courses	PHYACOR01T Cellular Basis of Physiology	4	PHYACOR01P Cellular Basis of Physiology	2	6
	PHYACOR02T Biological Physics and Enzymes	4	PHYACOR02P. Biological Physics and Enzymes	2	6
Ability Enhancemen t Course	ENVSAEC01T Environmental Science	2			2
Generic Elective	From related discipline				6
					20

Semester II

Courses/ Papers	Theoretical (T)	Credit s	Practical (P)	Credit s	Total Credits
Core Courses	PHYACOR03T Physiology of Nerve and Muscle Cells	4	PHYACOR03P Physiology of Nerve and Muscle Cells	2	6
	PHYACOR04T Chemistry of Biomolecules	4	PHYACOR04P Chemistry of Biomolecules	2	6
Ability Enhancement Courses					
	ENGBAEC02M English/MIL Communication	2			2
Generic Elective	From related discipline				6
					20

Semester III

Courses/Papers	Theoretical (T)	Credits	Practical (P)	Credits	Total Credits
Core Courses	PHYACOR05T Circulating Body Fluids	4	PHYACOR05P Circulating Body Fluids	2	6
	PHYACOR06T Circulation	4	PHYACOR06P Circulation	2	6

	PHYACOR07T Functions of Nervous System	4	PHYACOR07P Functions of Nervous System	2	6
Skill Enhancement Courses	PHYSSEC01M Haematological techniques		PHYSSEC01M Haematological techniques		2
Generic Elective	From related discipline				6
					26

Semester IV

Courses/Papers	Theoretical (T)	Credits	Practical (P)	Credits	Total Credits
Core Courses	PHYACOR08T Energy Balance, Metabolism and Nutrition	4	PHYACOR08P Energy Balance, Metabolism and Nutrition	2	6
	PHYACOR09T Gastrointestinal Function	4	PHYACOR09P Gastrointestinal Function	2	6
	PHYACOR10T Respiration	4	PHYACOR10P Respiration	2	6
Skill Enhancement Courses	PHYSSEC002M Diet Survey		PHYSSEC002M Diet Survey		2
Generic Elective	From related discipline				6
					26

Semester V

Courses/Papers	Theoretical (T)	Credits	Practical (P)	Credits	Total Credits
Core Courses	PHYACOR11T Special Senses	4	PHYACOR11P Special Senses	2	6
	PHYACOR12T Endocrinology	4	PHYACOR12P Endocrinology	2	6
Discipline Specific Electives (Any two)	PHYADSE01T Biological Statistics	4	PHYADSE01P Biological Statistics	2	6
	PHYADSE02T Microbiology and Immunology	4	PHYADSE02P Microbiology and Immunology	2	6

	PHYADSE03T Sports and Exercise Physiology	4	PHYADSE03P Sports and Exercise Physiology	2	6
					24

Semester VI

Courses/Papers	Theoretical (T)	Credits	Practical (P)	Credits	Total Credits
Core Courses	PHYACOR13T Reproductive Function	4	PHYACOR13P Reproductive Function	2	6
	PHYACOR14T Formation and Excretion of Urine	4	PHYACOR14P Formation and Excretion of Urine	2	6
Discipline Specific Electives (Any two)	PHYADSE04T Human Nutrition and Dietetics	4	PHYADSE04P Human Nutrition and Dietetics	2	6
	PHYADSE05T Genetics and Molecular Biology	4	PHYADSE05P Genetics and Molecular Biology	2	6
	PHYADSE06T Environmental Physiology	4	PHYADSE06P Environmental Physiology	2	6
					24

Details of Courses :
Components of Core Courses

PHYACOR01T: Cellular Basis of Physiology	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,
 Cell Cycle,
 Cell Division- Mitosis,
 Meiosis
 Homeostasis,
 Aging.

PHYACOR01P: Cellular Basis of Physiology Lab	2 Credits
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Histology:
 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.

PHYACOR02T: Biological Physics and Enzymes	4 Credits
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A study of 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,
 Flow and Pressure,
 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,
 Thermodynamics :
 Laws ,
 Application in Physiology,
 Osmosis and Diffusion,
 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.

PHYACOR02P: Biological Physics and Enzymes Lab**2 Credits****Biological Physics and Enzymes :**

Determination of oncotic pressure of colloidal solutions; Determination of Systolic, Diastolic, Pulse and Mean Blood Pressure by non-invasive methods (Auscultatory Methods).

Determination of enzyme activities (e.g., SOD, CAT, Amylase, Transaminases etc.).

PHYACOR03T: Physiology of Nerve & Muscle Cells**4 Credits****1. Excitable Tissue: Nerve**

Introduction,

Nerve Cells,

Excitation & Conduction, Measurement

of Electrical Events, Ionic Basis of

Excitation & Conduction, Properties of

Mixed Nerves,

Nerve Fiber Types & Function,

Neurotrophins, Glia.

2. Excitable Tissue: Muscle

Introduction,

Skeletal Muscle

Morphology,

Electrical Phenomena & Ionic Fluxes,

Contractile Responses,

Energy Sources & Metabolism,

Properties of Muscle in the Intact Organism,

Cardiac Muscle

Morphology, Electrical

Properties, Mechanical

Properties, Metabolism,

Pacemaker Tissue,

Smooth Muscle

Morphology,

Visceral Smooth Muscle,

Multi-Unit Smooth 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,

Synaptic Plasticity & Learning,

Neuromuscular Transmission,

Neuromuscular Junction, Denervation Hypersensitivity.

4. Initiation of Impulses in Sense Organs

Introduction,

Sense Organs & Receptors,

The Senses,

Electrical & Ionic Events in Receptors,

"Coding" of Sensory Information.

5. Clinical Aspect of Nerve and Muscle Physiology**PHYACOR03P: Physiology of Nerves and Muscle Cells Lab****2 Credits****Histological Study, Experiment of Nerve and Muscle:**

Isolation and Staining of nerve fibres with node(s) of Ranvier (AgNO₃)

and muscle fibres

(H and E).

Preparation of sciatic nerve innervated gastrocnemius muscle of toad.

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.

Kymographic recording of the effects of variations of temperature and load (after-load) on single muscle twitch.

Calculation of work done by the muscle.

Determination of nerve conduction velocity.

PHYACOR04T: Chemistry of Biomolecules	4 Credits
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Classification, structure, Properties and Functions of Carbohydrates, Proteins and lipids. Structure, types and Function of DNAs and RNAs.

PHYACOR04 P: Chemistry of Biomolecules Lab	2 Credits
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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.

PHYACOR05T: Circulating Body Fluids	4 Credits
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Introduction, Blood, Bone Marrow, White Blood Cells, Immune Mechanisms, Platelets, Red Blood Cells, Blood Types, Plasma, Hemostasis, Lymph, Clinical Implications. Hemoglobin.

PHYACOR05P: Circulating Body Fluids Lab	2 Credits
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Hematological Experiments:

Preparation and staining of blood film with Leishman's stain.

Identification of the blood corpuscles.

Differential count of WBC.

Total count of RBC and WBC.

Bleeding time and clotting time.

Hemoglobin estimation.

Preparation of haemin crystal.

Preparation and staining of bone marrow.

Measurement of diameter of megakaryocyte.

Reticulocyte staining.

Blood group determination.

PHYACOR06T Circulation	4 Credits
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1. Origin of the Heartbeat & the Electrical Activity of the heart

Introduction,

Origin & Spread of Cardiac Excitation,

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.

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 Nervous System.

5. Circulation Through Special Regions

Introduction, Cerebral Circulation,
Anatomic Considerations, Cerebrospinal fluid,
The Blood-Brain barrier, Cerebral Blood Flow,
Regulation of Cerebral Circulation,
Brain Metabolism & Oxygen Requirements,
Coronary Circulation ,
Splanchnic Circulation,
Circulation of the skin, Placental & Fetal Circulation.

6. Cardiovascular Homeostasis in Health & Disease

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

PHYACOR06P: Circulation Lab	2 Credits
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Cardiovascular Experiments:

Preparation of Amphibian Ringer solution.

Kymographic recording of the movements of perfused heart of toad.

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.

PHYACOR07T: Functions of the Nervous System	4 Credits
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1. Reflexes

Introduction,
Monosynaptic Reflexes: The Stretch Reflex,
Polysynaptic Reflexes: The Withdrawal Reflex,
General Properties of Reflexes.

2. Cutaneous, Deep & Visceral Sensation

Introduction,
Pathways Touch,
Proprioception,
Temperature,

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- 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,
 Corticospinal & Corticobulbar System,
 Anatomy & Function,
 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,
 Hypothalamus,
 Anatomic Considerations,
 Hypothalamic Function, Relation
 to Autonomic Function, Relation
 to Sleep,
 Relation to Cyclic Phenomena,
 Hunger,
 Thirst,
 Control of Posterior Pituitary Secretion,
 Control of Anterior pituitary Secretion,
 Temperature Regulation, fever.
 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.
 9. **Clinical Aspect of Nervous System**

PHYACOR07P: Functions of the Nervous System Lab	2 Credits
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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.

PHYACOR08T: Energy Balance, Metabolism, and Nutrition

4 Credits

Introduction. Energy metabolism.
Carbohydrate metabolism.
Protein metabolism.
Fat and cholesterol metabolism.
Integration of carbohydrate, fat and protein metabolism.
Nutrition – BMR, RQ, RDA, SDA, NPU, Biological value of proteins, vitamins and minerals.

PHYACOR08P: Energy Balance, Metabolism, and Nutrition Lab

2 Credits

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.

PHYACOR09T: Gastrointestinal Function

4 Credits

1. Digestion & Absorption

Introduction,
Carbohydrates, Proteins
& Nucleic Acids, Lipids,

Absorption of Water & Electrolytes,
Absorption of Vitamins & Minerals

2. Regulation of Gastrointestinal Function

Introduction,
General Considerations,
Gastrointestinal hormones,
Mouth & Esophagus,
Stomach, Digestive Function of the Stomach.
Exocrine Portion of the Pancreas,
Liver & Biliary System,
Small Intestine, Colon.

3. Gastrointestinal Dysfunctions

PHYACOR09P: Gastrointestinal Function Lab

2 Credits

Dale's Experiments :

Kymographic recording of normal movements of rat's intestine in Dale's apparatus.
Effects of hypoxia, acetylcholine and adrenaline on normal intestinal movements.

PHYACOR10T: Respiration

4 Credits

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,
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,
Other Forms of Hypoxia,
Oxygen Treatment,
Hypercapnia & Hypocapnia,
Other Respiratory Abnormalities,
Effects of Increased Barometric Pressure,
Artificial Respiration.

PHYACOR10P: Respiration Lab	2 Credits
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Respiratory Human Experiments:

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.

PHYACOR11T: Special Senses	4 Credits
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1. Vision

Introduction,
Anatomic Considerations,
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.

3. Smell & Taste

Introduction,
Smell,
Receptors & Pathways,
Physiology of Olfaction,
Taste,
Receptor Organs & Pathways,
Physiology of Taste.

4. Clinical Aspect of Special Senses

PHYACOR11P: Special Senses Lab	2 Credits
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Histological and Human Experiments:

Principles of fixation and staining, Staining and identification of fixed endocrine glands and nervous tissue. Determination of visual acuity by Snellen's chart / Landolt's C chart.
Determination of colour blindness by Ishihara chart.

PHYACOR12T: Endocrinology**4 Credits**

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.

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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.

PHYACOR12P: Endocrinology Lab	2 Credits
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Endocrinological assay / Experiments related to experimental Physiology:

Study of the effects of oxytocin on uterine contraction.
Study of the effects of adrenaline on intestinal / uterine movements.

PHYACOR13T: Reproductive Function	4 Credits
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Introduction,
Sex Differentiation & Development,
Chromosomal Sex,
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,
The Female Reproductive system:
The Menstrual Cycle,
Ovarian Hormones,
Control of Ovarian Function,
Abnormalities of Ovarian Function,
Pregnancy, Placenta
Breast development and Lactation,
Physiological concepts for a planned family.

PHYACOR13P: Reproductive Function Lab	2 Credits
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Reproductive Histology and Biochemistry:

Study of estrous cycle.
Staining and identification of kidney and ureters. Estimation of estrogen by spectrophotometric method. Pregnancy test from human urine by kit method.

PHYACOR14T: Formation and Excretion of Urine	4 Credits
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1. **Renal Function & Micturition**
Introduction,
Juxta Glomerular Apparatus
Function of Malpighian corpuscles and renal tubule, counter-current mechanism,
Water Excretion,
Acidification of the Urine & Bicarbonate Excretion,
Regulation of Na⁺ & Cl⁻ Excretion,
Renal Circulation,
Diuretics,
Disorders of Renal Functions,
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Filling of the Bladder,
Emptying of the Bladder,
Non-excretory function of kidney.

PHYACOR14P: Formation and Excretion of Urine Lab

2 Credits

Renal Biochemistry:

Identification of normal and abnormal constituents of urine

Ability Enhancement Course (AEC)(Compulsory)

1. Environmental science
 2. English/MIL communication
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ENVSAEC01T: Environmental Science

ENGSaec01M: English/MIL Communication

Discipline Specific Electives (DSE)(Four)

1. Biological Statistics
2. Microbiology and Immunology
3. Sports and Exercise Physiology

4. Human Nutrition and Dietetics
5. Genetics and Molecular Biology
6. Environmental Physiology

PHYADSE01T : Biological Statistics

4 Credits

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.

PHYADSE01P: Biological Statistics Lab
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2 Credits

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.

PHYADSE02T: Microbiology and Immunology
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4 Credits

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. 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).
Immunopathology - basic principles of autoimmune disease and transplantation immunology.

PHYADSE02P: Microbiology and Immunology Lab	2 Credits
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Gram staining of bacteria and identification of Gram positive and Gram negative bacteria
 Demonstration: Spore Staining, Radial immuno-diffusion.

PHYADSE03T: Sports and Exercise Physiology	4 Credits
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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.

PHYADSE03P: Sports and Exercise Physiology Lab	2 Credits
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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 VO_{2max} by queen college step test.
 Measurement of body fat percentage. Six minute walk test.
 Determination of endurance time by hand grip dynamometer.
 Pneumographic recording of effect of talking, laughing, coughing, breath holding and hyperventilation.

PHYADSE04T: Human nutrition and dietetics	4 Credits
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Constituents of food and their significance.
 Basal metabolic rate -factors, determination by Benedict-Roth apparatus. Respiratory quotient
 Specific dynamic action.
 Basic concept of energy and units.
 Calorific value of foods.
 Body calorie requirements – adult consumption unit.
 Dietary requirements of carbohydrate, protein, lipid and other nutrients. Balanced diet and principles of formulation of balanced diets for growing child, adult man and woman, pregnant woman and lactating woman. 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.
 Vitamins.
 Principle of diet survey.
 Composition and nutritional value of common food stuffs.
 Physiology of starvation and obesity. Sources and physiological significances of vitamins and minerals.
 Space nutrition.

PHYADSE04P: Human nutrition and dietetics Lab	2 Credits
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Nutrition and Dietetics - Diet Survey (Field Study Record):

- a) Diet survey report (hand-written) of a family (as per ICMR specification): Each student has to submit a report.
- b) A report (hand-written) on the basis of field survey from ONE of the followings: (1) Physiological parameters of human (at least three parameters). (2) Anthropometric measurements on human (at

least three parameters). (3) Epidemiological studies on human.

PHYADSE05T: Genetics and Molecular Biology	4 Credits
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Genetics:

Basic principles of Mendelian genetics - monohybrid and dihybrid, test and back crosses, Bacterial genetics-transformation, transduction, conjugation (mention of F+ /F- , Hfr strain, function of pillus).

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.

PHYADSE05P: Genetics and Molecular Biology Lab	2 Credits
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DNA gel electrophoresis (agarose gel).

Paper chromatography and Thin Layer Chromatography

PHYADSE06T: Environmental Physiology	4 Credits
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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.

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 management, 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 forarsenic (WHO, USEPA), health effects of chronic arsenic poisoning.

Environmental management

Environmental ethics.

Conservation of topsoil, ground water and wild lives; rain water harvesting; sanctuary, national park, biosphere reserve, wildlife (conservation) Act, 1992.

PHYADSE06P: Environmental Physiology Lab	2 Credits
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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.

Demonstration of 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

Recommended Text and Reference Books for Physiology (Honours)

- 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.