PROPOSED SYLLABUS FOR UNDERGRADUATE THREE YEARS HONOURS COURSE IN  
HUMAN PHYSIOLOGY

1st Year

**SEMMESTER – I**

<table>
<thead>
<tr>
<th>Paper – I</th>
<th>Full Marks – 50</th>
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</thead>
<tbody>
<tr>
<td><strong>Topics</strong></td>
<td><strong>Number of Lectures</strong></td>
</tr>
<tr>
<td>a) Cell– The Unit of Human Body</td>
<td>8</td>
</tr>
<tr>
<td>b) Biophysical Phenomenon</td>
<td>10</td>
</tr>
<tr>
<td>c) Chemistry of Bio molecules (Carbohydrate, Lipid, Protein, Nucleic Acids, Lipids, Vitamins, Minerals)</td>
<td>34</td>
</tr>
<tr>
<td>d) Physiology of Nerve &amp; Muscle</td>
<td>12</td>
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<tr>
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<thead>
<tr>
<th>Paper – II</th>
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<tbody>
<tr>
<td><strong>Topics</strong></td>
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</tr>
<tr>
<td>a) Physiology of Respiration</td>
<td>22</td>
</tr>
<tr>
<td>b) Renal Physiology</td>
<td>24</td>
</tr>
<tr>
<td>c) Enzyme</td>
<td>08</td>
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<tr>
<td>d) Receptors &amp; Bio signalling</td>
<td>10</td>
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**SEMMESTER – II**

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<thead>
<tr>
<th>Paper – III</th>
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<tbody>
<tr>
<td><strong>Topics</strong></td>
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</tr>
<tr>
<td>a) Blood and Body Fluids</td>
<td>18</td>
</tr>
<tr>
<td>b) Physiology of Heart</td>
<td>12</td>
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<tr>
<td>c) Vascular Physiology</td>
<td>08</td>
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<tr>
<td>d) Regional Circulation</td>
<td>12</td>
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<td>e) Genetics</td>
<td>14</td>
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<th>Paper – IV</th>
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<tbody>
<tr>
<td><strong>Topics</strong></td>
<td><strong>Number of Lectures</strong></td>
</tr>
<tr>
<td>a) Metabolism of Carbohydrate</td>
<td>22</td>
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<tr>
<td>b) Metabolism of Vitamins &amp; Minerals</td>
<td>18</td>
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<tr>
<td>c) Digestive System</td>
<td>16</td>
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<tr>
<td>d) Nutrition &amp; Dietetics</td>
<td>08</td>
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<tr>
<td></td>
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<thead>
<tr>
<th>Paper – V</th>
<th>Full Marks – 50</th>
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<tbody>
<tr>
<td><strong>Practical</strong></td>
<td><strong>Number</strong></td>
</tr>
<tr>
<td>a) Biochemistry – Qualitative Analysis</td>
<td>15</td>
</tr>
<tr>
<td>b) Histology</td>
<td>15</td>
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<tr>
<td>c) Viva – voce</td>
<td>10</td>
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<tr>
<td>d) Clinical Physiology</td>
<td>10</td>
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### 2nd Year

#### SEMESTER – III

**Paper – VI**  
**Full Marks – 50**  
**Topics**  
| a) Organization & Functions of Nervous System | 08 |
| b) Neural Pathways | 10 |
| c) Control of Posture & Movement | 08 |
| d) Cognitive functions of brain | 08 |
| e) The Autonomic Nervous System | 30 |
| **Total** | 64 |

**Paper – VII**  
**Full Marks – 50**  
**Topics**  
| a) Metabolism of Lipids, Protein, Purine & Pyrimidin | 40 |
| b) Immunology | 12 |
| c) Molecular Biology | 12 |
| **Total** | 64 |

**Paper – VIII**  
**Full Marks – 50**  
**Practical**  
**Topics**  
| a) Histochemistry | 10 |
| b) Biochemistry – Quantitative Analysis | 10 |
| c) Viva – voce | 10 |
| d) Haematology | 10 |
| e) Excursion Report | 10 |
| **Total** | 50 |

#### SEMESTER – IV

**Paper – IX**  
**Full Marks – 50**  
**Topics**  
| a) Endocrinology | 32 |
| b) Circadian Rhythms | 08 |
| c) Reproductive Physiology | 24 |
| **Total** | 64 |

**Paper – X**  
**Full Marks – 50**  
**Topics**  
| a) Sensory Physiology & Pain Sensation | 08 |
| b) Physiology of Vision | 12 |
| c) Physiology of Hearing | 14 |
| d) Physiology of Olfaction & Gestation | 14 |
| e) Skin & Body Temperature | 16 |
| **Total** | 64 |

**Paper – XI**  
**Full Marks – 50**  
**Topics**  
| a) Experimental Physiology | 15 |
| b) Quantitative Analysis of Food Stuffs | 15 |
| c) Viva – voce | 10 |
| d) Staining of Microbes | 10 |
| **Total** | 50 |
### 3rd Year

#### SEMESTER – V

**Paper – XII**  
**Full Marks – 50**

<table>
<thead>
<tr>
<th>Topics</th>
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<tbody>
<tr>
<td>a) Work &amp; Sports Physiology</td>
<td>18</td>
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<tr>
<td>b) Physiology of Stress</td>
<td>06</td>
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<tr>
<td>c) Yoga &amp; Rehabilitation</td>
<td>08</td>
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<tr>
<td>d) Biology of Aging</td>
<td>08</td>
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<tr>
<td>e) Occupational Health</td>
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**Paper – XIII**  
**Full Marks – 50**

<table>
<thead>
<tr>
<th>Topics</th>
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<tbody>
<tr>
<td>a) Application of Statistics in Physiology</td>
<td>15</td>
</tr>
<tr>
<td>b) Application of Computer in Physiology</td>
<td>10</td>
</tr>
<tr>
<td>c) Physiological Applications &amp; Instrumentation</td>
<td>15</td>
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<tr>
<td>d) Bio Informatics</td>
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**Paper – XIV**  
**Full Marks – 50**

<table>
<thead>
<tr>
<th>Practical</th>
<th>Number of Lectures</th>
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<tbody>
<tr>
<td>a) Blood Biochemistry</td>
<td>15</td>
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<tr>
<td>b) Analytical Biochemistry</td>
<td>10</td>
</tr>
<tr>
<td>c) Chromatographic Study</td>
<td>10</td>
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<tr>
<td>d) Viva – voce</td>
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<tr>
<td>e) Human Experiment</td>
<td>10</td>
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#### SEMESTER – VI

**Paper – XV**  
**Full Marks – 50**

<table>
<thead>
<tr>
<th>Topics</th>
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<tbody>
<tr>
<td>a) Physiology of Microbes and Microbiology</td>
<td>8</td>
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<tr>
<td>b) Biotechnology and its application</td>
<td>05</td>
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<tr>
<td>c) Environmental Physiology</td>
<td>14</td>
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<tr>
<td>d) Social Physiology &amp; Community Health</td>
<td>13</td>
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<tr>
<td>e) Pharmacology – Basic Concept</td>
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<td><strong>Total</strong></td>
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**Paper – XVI**  
**Full Marks – 50**

<table>
<thead>
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<tbody>
<tr>
<td>a) Experimental Physiology</td>
<td>15</td>
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<tr>
<td>b) Biostatistics &amp; Computer Application</td>
<td>10</td>
</tr>
<tr>
<td>c) Environmental Physiology &amp; Clinical Physiology</td>
<td>10</td>
</tr>
<tr>
<td>d) Diet Survey Report as per ICMR Specification</td>
<td>10</td>
</tr>
<tr>
<td>e) Viva – voce</td>
<td>05</td>
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<tr>
<td><strong>Total</strong></td>
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THREE- YEAR HONOURS & GENERAL DEGREE SYLLABI
(1ST SEMESTAR)

DEPARTMENT OF PHYSIOLOGY
MIDNAPORE COLLEGE (AUTONOMOUS)
MIDNAPORE
1st SEMESTER (100 Marks)
PAPER-I - PHYH101
Theory-(40+10) Marks

I) Organization of Human body:
Structure, classification, distribution, functions of different tissues. Organization of different organs and systems of the human body, Planes of body, Orientation and directional terms.

ii) Cell biology:

iii) Biophysical and Biochemical Principles:
Stabilizing interactions: Covalent bonds, Ionic and hydrogen bonds, Van der Waals forces and hydrophobic interactions. Law of mass action and orders of reactions.

Biophysical phenomenon: Diffusion, surface tension and viscosity- their characteristics, factors influencing and biological applications. Osmosis: osmotic pressure-laws, determination -freezing point depression method and application.


Buffers: Definition, types and functions of buffers. Role of kidney, erythrocyte and lungs for maintaining body pH. Indicators and its applications.

Colloids: Classification and properties: Physical, Optical, Electrical and Electrokinetic, sol and gel, lyophilic and lyophobic sol. Isoelectric pH and isoelectric precipitation. Physiological importance of colloid. Dialysis and Ultrafiltration. Gibbs-Donnan membrane equilibrium,
Thermodynamics: Type of surroundings and system. Living body as a thermodynamic system. First and second laws of thermodynamics, Concepts of Internal energy, enthalpy and entropy, Maintenance of physiological steady state. Gibbs concept of free energy. Free energy change,

Radioactivity: Radioactive emissions, radioactive decays, radioisotopes and their importance in clinical and applied research.

iv) Blood and Body Fluids:


v) Chemistry of Bio molecules:

Carbohydrates: Definition and classification.
Disaccharides – Maltose, Lactose and Sucrose: Occurrence, Structure, bio-chemical properties and Physiological importance.
Polysaccharides – Starch, Glycogen, Dextrin, Cellulose, Glycosaminoglycans, Glycoproteins, Sialic acids, Lectins, Blood group polysaccharides.
Lipids: Definition and classification. Fatty acids- Classification, systemic nomenclature and structure. Mono-, Di- and Triglycerides. Properties of Fat and Fatty acids- Hydrolysis, Saponification, Saponification number, Iodine number, Acetylation - Acetyl number. Hydrogenation,


VI) Nerve-Muscle Physiology:


Staining and Examination of fresh tissues: Squamous, ciliated columnar epithelium (methylene blue), node of Ranvier (silver nitrate), adipose tissue (sudan III or IV), voluntary muscle (methylene blue), Cardiac muscle.

B. Hematology: 15 Marks

C. Biochemistry: 10 Marks
Qualitative analysis of biochemical molecules: Carbohydrates- Glucose, fructose, galactose (osazone test), maltose, lactose (osazone test), sucrose, starch, dextrin. Protein - Albumin, gelatin, peptone; Others - glycerol, cholesterol, bile salts and pigments, acetone, HCl, lactic acid, urea, uric acid, blood.

D. Laboratory Note Book (Internal) + Attendance (05 + 05 marks)

E. Viva-voce (05 marks)

2ND SEMESTER (150 Marks)

PAPER-III - PHYH103/201

(40+10) Marks - Theory

1. Cardiovascular Physiology:

Introductory ideas: Heart as a pump, cardiac output, and venous return. Frank-Starling’s law. Mode of circulation through heart, concept of valves, heart sounds and murmurs justification of differential thickness of the ventricles. Overview of the systemic circulation, Parallel and Series arrangements of vessels, basic importance of regional circulation and auto-regulation, measurement of cardiac output by Fick principle.

importance. Portal system and its physiological importance, Concept of venous valves and venous storage. Hemodynamics of blood flow - streamline flow, laminar flow and turbulent flow.

**Functional consideration of heart** - Properties of myocardium and special junctional tissues. Pace maker potential, Cardiac action potentials, their origin, pattern and propagation. Excitation-contraction coupling. Cardiac cycle.

**Electrocardiography (ECG):** Concept of standard limb leads, unipolar chest (V) leads, and normal ECG (standard names for individual waves, and segments), Determination of mean electrical axis of heart. Basic ECG abnormalities.

**Cardiovascular regulation and blood pressure:** Autonomic innervations of heart and blood vessels. Concept of baro- and chemo-receptors, their innervations and mechanism of function. Medullary and supramedullary centers for Sympathetic and Parasympathetic control, Concept of blood pressure- mean arterial blood pressure, pulse pressure and pressure pulse. Factors controlling BP.

**Short-term and long-term regulation of BP** - Short-term regulation by baro- and chemo-receptor reflex pathway, and long-term regulation by neuro-endocrine control (Role of renin-angiotensin system, ADH, atrial natriuretic factor, adrenal medulla and thirst).

2. **Regional circulation:**

**Cerebral circulation:** Organization, Peculiarities, Stroke. **Coronary circulation:** Organization, Peculiarities, myocardial infarction, **Renal circulation:** – Organization, Peculiarities. **Cutaneous circulation:** Organization, Peculiarities, triple response, axon reflex.

3. **Respiratory Physiology:**

**Functional organization of respiratory system:** component of respiratory system, histology of lungs, respiratory muscles and their innervation. **Ventilation and the Mechanics of Breathing:** muscles of respiration, mechanism of inspiration and expiration, pressure changes during breathing.

Lung Compliance: elasticity and elastic recoil of the lung, role of lung surfactants, intra-thoracic and intra-pleural pressures. Airway resistance. Lung Volumes and Capacities (tidal volume, inspiratory and expiratory reserve volumes, residual volume, vital capacity, functional residual capacity, maximum breathing capacity). Alveolar ventilation, dead space, work of breathing.

**Exchange of Gases in Alveoli and Tissues:** partial pressures of gases, alveolar gas pressures, gas exchange between alveoli and blood,
ventilation-perfusion ratio, gas exchange between tissues and blood. **Transport of Oxygen in Blood:** process of O2 transport, O2 dissociation curve factors affecting it (pCO2, H+ concentration, temperature, and 2,3 BPG Concentration). **Transport of Carbon Dioxide in Blood:** process of CO2 transport, CO2 dissociation curve and factors affecting it. **Control of Respiration:** neural control - respiratory centers and their functions, neural generation of rhythmical breathing, **chemical control** - central and peripheral chemoreceptors and control of Ventilation by pO2, pCO2, and H+ Concentration, non chemical control by reflexes from lungs and chest wall. **Hypoxia** – types and effects. Respiratory failure, artificial respiration (mouth to mouth, tank respirator method). Asphyxia, dyspnea, asthma, emphysema, cyanosis, dysbarism, coughing and sneezing. Non respiratory functions of lung – Airway defence, Immune system defence and biosynthetic functions.

**4. Renal Physiology:**

**Structure of the Kidneys:** Gross structure of kidney. Microanatomy (including electron microscopy) of a nephron and structural differences between cortical and juxtamedullary nephrons. **Juxtaglomerular apparatus:** structure and functions of rennin-angiotensin system. **Formation of urine:** Glomerular filtration – mechanism and factors affecting it. GFR: Definition, affecting factors and regulation. Tubular functions: Reabsorptions and secretions. **Concept of counter current system:** counter-current multiplier and exchanger. Formation of hypertonic urine. **Homeostatic functions:** renal regulation of osmolarity, volume of body fluids and acid-base balance. Diabetes insipidus. **Renal function tests:** inulin, and PAH clearance tests. Renal stone formation. dialysis and artificial kidney Non-excretory functions of kidney. Physiology of urinary bladder, micturation reflexes and their regulation.

PAPER-IV - PHYH104/202
(40+10) Marks -Theory

**1. Alimentary system:**

**Functional organization of GI Tract:** Parts of GI tract, structure of the wall of GI tract, innervation and reflexes of the GI tract, GI sphincter, **Mastication and deglutition:** Mechanism, functions and regulation. **Gastric juice:** Composition and functions, mechanism, phases and regulation of HCl secretion. **Intestinal juice:** Composition, functions and regulation. **GI**

2. Enzymology:


3. Metabolism:


Lipids: Beta oxidation and biosynthesis of saturated and unsaturated fatty acids. α and ω oxidation. Formation and fate of ketone bodies Metabolism of Triglycerides. Biosynthesis of Lecithin, Cephalin and Cholesterol. Role of lipoproteins in transport and storage of lipids.

Amino Acids Metabolism: Amino acids pool, glucogenic and ketogenic amino acids. Transamination, deamination. Catabolism of Phenylalanile,
tyrosine, tryptophan, glycine, and sulphur containing amino acids.
Synthesis of Urea and nitric oxide. Labile methyl group and transmethylation.

**Nucleic Acids:** Purines and pyrimidines-Biosynthesis: De Novo and salvage pathways and catabolism. Purine and pyrimidine.

**PAPER-V - PHYH105/203**

50Marks

**Practical**

1. **Histological Permanent Slide Identification:** (10 marks)

Study and identification of stained sections of different mammalian tissues and organs: Trachea, lung, spleen, lymph gland, tongue, esophagus, stomach, duodenum, ileum, jejunum, large intestine, liver, kidney, salivary glands (parotid, submadibular, sublingual), pancreas, adrenal gland, thyroid gland, testis, ovary, spinal cord, cerebral cortex, cerebellum, skin, cardiac muscle, skeletal muscle, smooth muscle, artery, vein.

2. **Quantitative Biochemistry:** (10 marks)

1) Determination of strength of NaOH, HCl and H$_2$SO$_4$ by titration.
2) Preparation of buffer (pH 4 to 10)
3) Quantitative estimation of chloride by Mohr’s method, amino nitrogen by Formol-titration method, glucose and ribose by Benedict’s method.
4) Estimation of free and total acidity in supplied gastric juice.

3. **Quantitative estimation of food stuff:** (15 marks)

1) Determination of pH of food material.
2) Estimation of lactose and calcium from milk.
3) Determination of total carbohydrate by phenol sulphuric acid method from cereals.
4) Estimation of free amino acids by ninhydrin method and total protein by quantitative biuret reagent method from pulses.
5) Determination of acid number, saponification of fat.
6) Estimation of Vit C from lemon juice.

4. **Laboratory Note Book (Internal) + Attendance** (5+5 marks)

5. **Viva - Voce** 05 marks
1. Units of Human System:
Electron microscopic structure and functions of Cell membrane, nucleus, mitochondria, endoplasmic reticulum (rough and smooth), Golgi apparatus, Lysosomes, Peroxisomes and cytoskeleton elements like microtubules and microfilaments. Structure, classification and functions of Epithelial, Connective, Muscular and Nervous tissue.

2. Biophysical and Biochemical principles involved in human system:

3. Alimentation:

4. Biochemistry & Metabolism:
Definition, classification and importance of Carbohydrates with examples, Chemical reaction of glucose and fructose with concentrated mineral acid and alkali and their importance, Definition and classification of lipid, classification of fatty acids and properties: Hydrolysis, Saponification number, Iodine number, Hydrogenation, Rancidity-Acid number, Phospholipids, Cholesterol and its esters- physiological importance. Classification of Amino acids and structure of the peptide bonds. Glycolysis, TCA cycle, Glycogenesis, Glycogenolysis, Hexose monophosphate shunt, gluconeogenesis. Beta oxidation of saturated fatty acids, ketone bodies- formation & significance, Deamination, Transamination. Amino acid pool- fate and functions of
amino acids in the body. Formation of urea & its importance. Elementary idea of electron transport chain, Oxidative phosphorylation.

5. Nutrition & Dietetics:

PHYSIOLOGY (General)
Semester II
Paper – PHYG102/201 (Theoretical)
(Written Examination - 40 marks, Internal Assessment 10 marks)

1. Blood & Body Fluids (10 lectures)

2. Cardio- Vascular System (25 lectures)
a) Heart: Anatomy & histology of heart, properties of cardiac muscle, origin & propagation of cardiac impulse, Events of cardiac cycle, Heart rate, Heart Sound, Heart rate control, Cardiac output: Methods (dye & Fick methods), factors affecting, regulation. ECG - normal waves, different intervals. Myocardial Infarction. Atherosclerosis, thrombosis, hypertension, heart block, cardiac myopathy- a brief idea.
b) Circulation: Structure of arteries, arterioles, capillaries, venules and veins. Pulse - arterial & venous. Blood pressure and its regulation, measurement of
3. Respiratory System (12 lectures)

4. Renal Physiology (8 lectures)

3RD SEMESTER (150 Marks)

PAPER-VI - PHYH106/301
(40+10) Marks -Theory

1. Essential Micronutrients:
   i) **Vitamins:** Thiamin, Riboflavin, Niacin, Pyridoxine, Pantothenic Acid, Biotin, Cyanocobalamin, Folic Acid, Ascorbic Acid, Inositol. Vitamins A, D, E and K. Chemistry, dietary sources, daily requirements, biochemical roles and functions and deficiency symptoms, Hypervitaminosis and Antivitamins. Pseudo vitamin. Vitamin as co-enzyme.
   ii) **Minerals:** Sources, biological functions, metabolism and regulation of sodium, potassium, calcium, phosphorus, iron, zinc, iodine, selenium and fluoride.

2. Nutrition & Dietetics:
   i) **Basic concept:** Nutrition, Nutrients, Nutraceutical, Cosmoceutical, Nutrogenomics.
   ii) **Nutritional Evaluation of Carbohydrates:** Glycemic Index (GI), Classification of dietary fibers with potential of health benefit, Resistance
starch as prebiotics: Fructo-oligosaccharide, Galacto-oligosaccharide, soy-oligosaccharide, Nutritive value of major carbohydrate like rice, wheat, roots, tubers, leafy vegetables, red-yellow vegetables and fruits.

iii) **Nutritional Evaluation of Proteins:** Essential and Non essential amino acids, Protein Efficiency ratio (PER), nitrogen balance, Net protein utilization (NPU), Biological value of protein, protein spares, Nutritive value of protein food stuffs like pulses, egg, fish, meat, milk, soybeans.

iv) **Nutritional Evaluation of Fats:** essential fatty acids, saturated and unsaturated fatty acids, Dietary requirement of fat, Non-glyceride edible oil, Nutritive value of fat food stuffs like egg, fish, milk, edible oils, nuts.

v) **Energy in Human Nutrition:** Basic concept of energy and units, calorific and physiological fuel value, respiratory quotient (RQ), Total energy expenditure (TEE), Basal metabolic rates (BMR) and Resting energy expenditure (REE), Specific dynamic action (SDA), physical activity ratio (PAR), Determination of BMR by Benedict Roth apparatus and WHO/ICMR prediction equation, Factors affecting BMR, Adult consumption unit (ACU), determination of energy requirements of Indians in different age groups by doubley labeled water (DL W) method and prediction equation method.

vi) **Formulation of Diet chart:** Basic principle of diet chart. ICMR specified food groups (Five Group Plans, Nine Group Plan and 11-Group Plan), Food guide pyramid. Formulation of balance diet chart for vegetarian and non-vegetarian, infant, growing child, sedentary adults, moderate working adults, college students, pregnant and lactating mother and athletes in low and moderate socio economic status.

3. **Genetics & Molecular Biology:**

i) **BASIC ORGANISATION:** Chromosome structure, Concept of nucleosome, molecular organization, chromosomal proteins, the different levels of chromatin organization, Organisation of Human genome, karyotyping. Concept of Oncogenes, Tumor suppressor gene, Properties of cancer cells.

ii) **DNA:** Structural Complexity, Basic concept of DNA replication: Meselson and Stahl Experiment, DNA Polymerases, Ligases and other regulatory proteins. Brief idea of DNA damage and repair, Gene mutation-agents and types.
iii) **RNA**: Structure of different RNA molecules, Mechanism and Inhibition of prokaryotic transcription. Post transcriptional modification.


v) **GENE EXPRESSION**: Regulation of gene expression in prokaryotes: Operon Concept- The Lac Operon.

vi) **RECOMBINANT DNA TECHNOLOGY**: Recombinant DNA technology and its applications, Brief idea of cloning,

**4. Cell Communication & Bio-signaling:**

Ligand-receptor interaction, autocrine and paracrine modes of signalling, Communication through adherent junctions. Cell surface receptor proteins - ion channel coupled, G-protein coupled and enzyme-coupled. Intracellular messengers – c-AMP, c-GMP, IP3, DAG, Protein kinases, Ca++, CO, NO Signal transduction pathways – Phosphatidylinositides, MAP kinase, JAK-STAT, SMAD.

**PAPER-VII - PHYH107/302**

(40+10) Marks -Theory

**1. Organization & Functions of nervous system:**

i) **Organization**: A brief outline of the organization and basic functions of the central and peripheral nervous system. Structural organization of the different parts of brain and spinal cord.

ii) **Receptors**: Definition, Structure, Classification, Mode of action. Role of blockers and stimulators (Drugs included in pharmacology). Reflex action: Definition, classification, properties.


vi) **Autonomic Nervous System:** Organization, outflow, ganglia, centers and functions. Chemical transmission in autonomic nervous system; Nicotinic and muscarinic acetyl choline receptors, alpha and beta adreno-receptors and their agonists and antagonists. Central control of autonomic nervous system for regulation of internal body homeostasis.

### 2. Skin and Body Temperature Regulation:

i) **Skin:** Histological structure of skin. Organization of sweat gland. Composition and functions of sweat. Regulation of sweat secretion. Insensible and sensible perspiration. Composition and functions of sebum. Triple response.


### iii) Pharmacological Physiology:

The importance of pharmacology in the study of physiological processes. Drugs, Agonist, Antagonist.

i) **Pharmacokinetics:** Absorption, distribution, excretion and bioavailability of drugs.
ii) **Pharmacodynamics:** Drug biotransformation and mechanism of drug action. The dose effect relationship and the characteristics of dose response curve. Assessment of drug toxicity - LD50 and ED50.


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

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**PAPER-VIII - PHYH108/303**

50 Marks –Practical

1. **Preparation of permanent histological slide:** 10 Marks
Tissue preparation, Section cutting, Staining tissues (Eosine and Hematoxylene stain) - submission of at least 5 histological slides duly signed by teacher.

2. **Histochemistry:** 10 Marks
   i) Staining of glycogen in liver by PAS method.
   ii) Staining ALP in intestine.

3. **Analytical biochemistry chromatography and Enzymology:** 15 Marks
i) Estimation of DNA by DPA method, RNA by Orcinol method, total protein by Lowry method.

ii) Effect of pH and temperature on the rate of enzyme reaction, influence of substrate concentration on the rate of enzymatic reaction and determination of Vmax and Km value of enzyme (amylase through 3, 5 dinitrosalicylate reagent).

iii) Estimation of LDH, SGOT & SGPT of supplied blood.

iv) Separation and Identification of amino acids and carbohydrates in a mixture of amino acids and sugars through TLC or paper chromatography.

4. Laboratory Note Book (Internal) + Attendance 05 Marks

5. Viva - Voce 05 Marks

6. CIA 05 Marks

**3RD SEMESTER (100 Marks)**

**PAPER-III /301**

**PHYG103: (40+10) Marks**


**PAPER-IV (PRACTICAL)**

**PHYG104/302-50 Marks**
1. Identification of permanent slides: 10 Marks
Tongue, stomach, small intestine, large intestine, liver, pancreas, thyroid, kidney, skin, Lung, spleen, lymph gland, testis, ovary, spinal cord, cerebellum, cerebral cortex, etc.

2. Fresh tissue experiments: 7 Marks
a) Staining of Squamous, ciliated & columnar epithelium by Methylene blue stain
b) Staining of Skeletal muscle fibre (Rat/Goat) by Methylene blue stain.
c) Staining of adipose tissue by Sudan III or IV.

3. Hematological Experiments: 8 Marks
a) Leishman’s staining of human blood film & identification of different blood corpuscles.
b) Preparation of haemin crystals.
c) Estimation of hemoglobin

4. Qualitative Biochemistry: 10 Marks
Qualitative tests for identification of starch, dextrin, lactose, sucrose, maltose, glucose, galactose, fructose, albumin, gelatin, peptone, lactic acid, HCl, uric acid, acetone, Glycerol, bile salts,

5. Laboratory Note Books: 5 Marks

6. Viva-Voce: 5 Marks

7. C.I.A.: 5 Marks

4TH SEMESTER-HONS
PAPER-401 (THEORY): 50 Marks
(Written Examination - 40 marks, Internal Assessment 10 marks)

i) Endocrine System and Chronobiology:

Concept & Definition of endocrine systems, glands and hormones. General classification of hormones on chemical basis. Modern Concept of hormone actions and regulation of secretion.


Thyroid Gland: Electron microscopic structure of thyroid gland. Thyroid hormone: Chemistry, Biosynthesis, Storage and Transport. Functions of T4 (Thyroxin) and T3 (Triiodothyronine). Regulation of Thyroid


Adrenal Cortex: histological structure, regulation different types of hormones and functions of adrenal cortex, Cushing's syndrome, Addison's disease, Hyperaldosteronism.


Pancreas: Histological structure of pancreatic islets. Sources, regulation, modes of action and functions of insulin and glucagon, Type-I and Type-II diabetes mellitus.

I. Hormones: Nature, Sources and Physiological functions of Gastrin, Secretin, Cholecystokinin, VIP and GIP

Pineal Gland: Endocrine Role of the Pineal and its functions.


ii) Reproductive Biology:

Primary and secondary sex organs: Physiology and anatomy, secondary sex characters. Puberty and its control.

Testis: Histological structure of testis. Spermatogenesis, Spermiogenesis and hormonal control of testicular function.


iii) Embryology:

4TH SEMESTER-HONS
PAPER-402 (THEORY): 50 Marks
(Written Examination - 40 marks, Internal Assessment 10 marks)

i) Sensory Physiology:

**Concept** of stimuli and receptors as biological transducers. Classification and distribution of receptors. Concept of generator potential (Receptor potential). Muller's law of specific nerve energies. Weber-Fechner law. Adaptations of receptor - Phasic and Tonic adaptations. Concept of fast and slow adapting receptors and its significance. Classification of general and special senses.

**General Sense:** Classification, distribution, function and neural pathway of touch, pressure, pain, thermal and kinaesthetic sensation.


**Physiology of Olfaction & Gustation:** Structure and functions of the receptor organs, nerve pathways, centers. Properties of olfactory and gustatory sensation and their transduction. Abnormalities of olfactory and taste sensation. Olfactometer.

ii) Environmental Physiology & Xenobiotic:

Concept of Environment and Classification of Pollutants and pollution. Effects of exposure to hot and cold environment and acclimatization. Heat disorders and their preventive measures. Effects of hypobaric

iii) Biotechniques and Biomedical Instruments:


Biomedical Instruments: Principle, Components and uses of USG, Endoscopy, X-ray, MRI, CT-scan, Hemodialysis, Artificial pacemaker.
1. Experimental Physiology: (10 Marks)
   i) **Small Intestine**: Kymographic recording of normal movements of rat’s intestine in Dale's apparatus. Effects of anoxia, acetylcholine and adrenaline on normal intestinal movements.
   ii) **Skeletal Muscle**: Study and use of kymograph, induction coils, key and tuning fork. Preparation of Gastrocnemius - Sciatic preparation. Kymographic recording of isotonic muscle twitch. Effects of temperature, summation and load (after-load) on muscle contraction. **(Demonstration only)**
   iii) **Heart**: Kymographic recording of heart beat of toad. Preparation of amphibian Ringer solution. Kymographic recording of perfused heart beat of toad. **(Demonstration only)**

2. Environment and Clinical Physiology: (10 Marks)
   i) Measurement of environmental temperature - dry bulb and wet bulb, relative humidity, air velocity.
   ii) Determination of O₂, CO₂, BOD and COD. Determination of total alkalinity, Ca, Mg and chloride in water by titration method.
   iii) Measurement of noise by Sound level meter.
   iv) Determination of light intensity (at library, laboratory & class room) by Lux meter.
   v) Pregnancy test (slide/strip method), Sperm count.
   vi) Routine clinical tests of urine.
   vii) Measurement of different waves of ECG,

3. Blood Biochemistry: (10 marks)
   Spectrophotometric estimation of following blood constituents:
   i) Blood glucose by Folin-Wu method,
   ii) Blood inorganic phosphate by Fiske - Subbarow method
   iii) Serum total protein by Biuret method and determination albumin globulin ratio.
   iv) Serum uric acid by Caraway’s method
   v) Estimation of cholesterol by ferric chloride method
   vi) Estimation of bilirubin by Diazo method

4. Excursion Report: (05 Marks)
   A report is to be submitted on the basis of a visit to a Medical college / University / Research Institute. Report should be prepared on scientific knowledge.

4. Laboratory Note Book (05 marks)
5. Viva - Voce (05 marks)
6. C.I.A

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4TH SEMESTER (GENERAL)
PAPER-PHYG401 (THEORY)
(Written Examination - 40 marks, Internal Assessment 10 marks)
1. **Sensory Physiology**: Classification of general and special senses, and their receptors. Receptors as biological transducers. Muller’s law of specific nerve energies. Weber-Fechner law. Concept of receptor adaptation.


   b) **Audition**: Structure of ear, auditory pathway, organ of Corti, mechanism of hearing, perception of pitch and loudness.


2. **Endocrine System**:

   **Anatomy of endocrine system**: Classification of hormones. Basic concept of the regulation of hormone actions. Positive and negative feedback mechanisms. Elementary idea of hormone action. 

1. **Quantitative Biochemical Analysis** (10 Marks)
   a) Quantitative estimation of glucose, sucrose by Benedict’s method.
   b) Estimation of lactose from milk by Benedict’s method.
   c) Estimation of blood sugar by Folin-Wu method.
   d) Estimation of chloride by Mohr’s Method.
   e) Estimation amino-nitrogen through formol-tritration method.

2. **Experimental Physiology**: (05 Marks)
   Demonstration: Students will be trained to interpret the prepared supplied curve.
   a) Use of Kymograph, induction coil and keys.
   b) Recording of simple muscle curve with sciatic nerve-gastrocnemius muscle preparation of a toad. Determination of latent period, contraction period, relaxation period & maximum height of contraction.
   c) Normal tracing of unperfused toad’s heart beat.
   d) Effect of warm saline on unperfused toad’s heart beat.
   e) Effect of ion (K+ & Ca2+) on unperfused toad’s heart beat.
   f) Effect of adrenaline and acetylcholine on unperfused toad’s heart beat.

3. **Human Experiments**: (15 Marks)
   a) Determination of PFI of an individual by Harvard Step Test and graphical plotting of changes in pulse & breathing rate during recovery period.
   b) Measurement of systolic and diastolic arterial blood pressure by sphygmomanometer and determination of pulse pressure & mean pressure during quiet rest and exercise.

4. **Diet Survey Report**: (05 Marks)
   Report should be as per ICMR specification. Report should be hand written. Each student has to prepare and submit the report on his/her own family.

5. **Laboratory Note Books**: (05 Marks)

6. **Viva-Voce**: (05 Marks)

7. **CIA** (05 Marks)

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**5TH SEMESTER-HONS**

**PAPER-501 (THEORY): 50 Marks**

*(Written Examination - 40 marks, Internal Assessment 10 marks)*

i) **Microbiology:**
   Introduction to Bacterial structure. **Microbial Culture, Nutrition and Growth:** culture media. Sterilization - types, principles and importance. Pasteurization and its application, Nutritional requirements of bacteria, nutritional types. Kinetics of microbial growth, Bacterial growth curve and physical conditions for growth, **Bacterial Metabolism:** fermentation (ethanol, lactic acid, acetic acid), glyoxylate cycle, Entner-Doudoroff pathway. **Bacterial Genetics:** elementary idea of transformation, conjugation and transduction. **Microbial Control:** Elementary idea of bacteriostatic, bactericidal and bacteriolytic agents and their mechanism of action, and antibiotic resistance. **Replication of Bacteriophages:** Lytic and Lysogenic cycles. **Microbial Pathogenesis:** host, pathogen, pathogenicity factors, Koch’s postulates, parasitism and synergism.

ii) **Immunobiology:**
Overview of Immune System: properties of immune system; types of immunity: innate immunity, acquired immunity, active and passive immunity. **Immunogens and antigens:** Properties of Paratope, epitopes and antigenic determinants, haptenes and adjuvants. **Innate immunity:** Mechanical barrier against pathogenic organism, Physiological barrier-antibacterial and antifungal substances in external body secretions, bactericidal action of HCl. Mechanism of chemotaxis, phagocytosis. role of lysozyme and reactive oxygen species. Inflammation: mechanism and effects of inflammation. Toll like receptor. **Cells & Organs:** Neutrophil, B-lymphocytes and T-lymphocytes, monocytes, macrophages, Dendritic cells, NK cells and K cells and their surface markers. Primary and Secondary lymphoid organs. **Antibody:** Classification, structure and functions of Immunoglobulin (IgG, IgM, IgA, IgD, IgE). **Antigen-antibody interactions:** Association constant, Affinity & Avidity, Precipitation & Agglutination. **Humoral immunity:** Maturation T and B cells - thymic selection, thymus dependent and thymus independent antibodies, Kinetics of Immune responses: Primary and secondary immune responses. MHC molecules: structure of class I and II molecules, HLA, Mechanisms of Antibody formation- Antigen processing and Presentation, Cooperation of T cells B cells and macrophages. Cytokines: Types and functions. Antibody diversity. **Complements:** Classification, components, activation of pathways (classical, alternative and lectin) and functions. Biological consequences of complement activation. **Cell mediated immunity:** Effectors molecules and mechanism of cytolytic effects, NK cells and their mechanism of killing. Antibody dependent cell mediated cytotoxicity. **Hypersensitivity reactions:** Mechanism of Allergic reactions and their effects. **Autoimmunity:** Immunological basis of autoimmune diseases. **Immunization:** Mechanism of Immunization. Types of vaccines.

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**5TH SEMESTER-HONS**

**PAPER-502 (THEORY): 50 Marks**

*(Written Examination - 40 marks, Internal Assessment 10 marks)*

i) **Work Physiology, Sports Physiology and Ergonomics:**

ii) **Physiology of Stress and its Management:**

iii) **Social Physiology & Community Health:**
   **Basic Concept:** Demography, Society and Community. Factors affecting Community Health. **Nutritional Problem in Community:** Malnutrition, Under-nutrition, Kwashiorkor, Marasmus, Marasmic Rickets, Osteomalacia, Xerophthalmia, Beriberi, Pellagra, Nutritional Anaemia,

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**5TH SEMESTER-HONS**  
PAPER-503 (PRACTICAL): 50 Marks

1. **Microbiology and Biotechnology:** (05 Marks)
   i) Preparation of Culture media (broth and slants), sterilization by autoclave method and isolation of pure culture.
   ii) Staining of bacteria – Gram staining, staining of spores.
   iii) Detection of Coliform by MPN method for water portability.
   iv) DNA separation by Agarose gel electrophoresis and visualization by ethidium bromide staining.
   v) Separation of protein by SDS- PAGE, staining by Coomassie Blue.

2. **Human experiments & Anthropometric measurements:** (4+3 Marks)
   A. **Human Experiment:**
      i) Measurement of arterial blood pressure at rest, after exercise and at different postural conditions.
      ii) Modified Harvard step test and determination of physical fitness index.
      iii) Measurement of breathing rate before and after exercise.
      iv) Pneumographic records of talking, laughing, coughing, exercise, hyperventilation and breath holding.
      v) Determination of vital capacity by Student Spirometer.
   B. ** Anthropometric Measurement:**
      Weight, stature, shoulder height, elbow height, bi-acromian breadth, head breadth, head circumference and neck circumference. Mid upper arm circumference, chest circumference, waist circumference, hip circumference, waist hip ratio, BMI, BSA.

3. **Nutritional Survey:** (03 Marks)
   Nutritional assessment of a family as per ICMR specification.

4. **Grand-Viva** (10 Marks)

5. **Attendance** (05 Marks)
6. C.I.A.  

5TH SEMESTER (GENERAL)  

PHYG501 (THEORY): 50 Marks  
(Written Examination - 40 marks, Internal Assessment 10 marks)

1. Application of Physiology:  
Introduction to the application of Physiology in different fields – Hematology, Biochemistry, Molecular Biology, Space Physiology.

2. Molecular Biology and Pharmacology:  
DNA and RNA: types and functions. Elementary idea of gene, genome, genetic code, transcription, translation and genetic engineering.  

3. Environmental Physiology:  

4. Microbiology & Immunology:  
Immunization Program: Immunization against Polio, Hepatitis-B, Tetanus, Measles, Tuberculosis, AIDS- causative virus, mode of transmission, effects on human body, preventive measures.

5. Work & Sports Physiology:  
Definition of work, cardiac index, O2 debt, classification of physical work - static & dynamic, positive & negative work, cardiovascular & respiratory changes during physical exercise. Brief idea about VO2 max, physical fitness index - Harvard step test.

6. Biostatistics and Instrumentation:  
Sampling and its methods, frequency distribution, properties & computation of standard deviation. Sampling errors, standard error or difference between means.  
Principle & application of artificial pacemaker, MRI, hemo-dialysis, USG, CT scan, X-ray. Basic concept of computer and its uses.

7. Community Health Management:  
Basic Concept of Population, Society, Community and Community Health. Population control & family planning, causes and management of different types of diabetes, thalassemia, nutritional anemia, atherosclerotic
disorders, obesity, endemic goiter. Dental carries.
6th SEMESTER-HONS
PAPER-601 (THEORY): 50 Marks
(Written Examination - 40 marks, Internal Assessment 10 marks)


IV) Computer Application, Bioinformatics and Systems Biology:


Bioinformatics: Introduction to Genomic Data and Data Organization. Introduction to OMICS study. Sequence Data Banks — Introduction to sequence data banks — protein sequence data bank, NERF-PIR, SWISS-PORT. Nucleic Acid sequence data bank - Gene Bank, EMBL. Structural data bank - protein databank, SCOP, CATH and CSD; Sequence Analysis — Analysis tools for sequence data banks, pairwise alignment — NEEDLEMAN AND WUNSCH ALGORITHM, SMITH WATERMAN. Multiple alignments -BLAST, FASTA algorithm to analyze sequence pattern, motifs and profiles.

Systems Biology: Emergent properties of system biology, Biological robustness, utility of model organisms in system biology, Cell Signaling network, Immune System network.
6TH SEMESTER-HONS
PAPER-602 (PRACTICAL): 50 Marks

1. Biostatistics: (10 Marks)
   i) Exercise based on Classification of Data, Frequency and Frequency distribution, Presentation of Data, Simple and Complex Table, Graphs, Pie Charts.
   ii) Computation of mean, median, mode, standard deviation, standard error of the mean with physiological data like body temperature, height, weight, heart rate, respiratory rate, blood pressure of human subjects.
   iii) Student's 't' test and chi-square test for significance of difference between means. Determination of correlation coefficient: Spearman's rank, Product moment r.

2. Computer application: (10 Marks)
   i) Experiment on Networking and Internet access.
   ii) Preparation of body text and table by using Microsoft word.
   iii) Determination of mean, SD, SE by using Microsoft Excel.
   iv) Graphical representation of data in pie, bar and line diagram using Microsoft Excel.
   v) Presentation of study material by using Microsoft power point.

3. Review Work: (15 Marks)
   Review of literature on a topic in physiology. (Preparation 10+Seminar 05)

4. Laboratory Note Book: (05 Marks)

5. Viva – Voice: (05 Marks)

6. CIA: (05 Marks)
6TH SEMESTER (GENERAL)
PHY/G/601 (PRACTICAL): 50 Marks
(Examination - 25 marks, Internal Assessment 25 marks)

1. Laboratory Experiment: 15 Marks.
   A. Hematological Tests: 5 Marks
      a) DC of WBC, determination of clotting time, bleeding time, ABO Grouping.
      b) Demonstration - TC of RBC & WBC. Haematocrit, ESR.
   B. Clinical Pathology: 5 Marks
      a) Identification of abnormal constituents of urine - glucose, proteins, acetone, blood, bile salts.
      b) Pregnancy Test (strip method).
   C. Human Experiment: 5 Marks
      a) Pneumographic recording of normal respiratory movements, recording during drinking water, talking, forced hyperventilation & breath holding.
      b) Spirometric measurement of vital capacity.
      c) Determination of VO2 max by Queen’s College method.
      e) Calculation of body surface area.

2. Viva-Voce: 10 Marks.
3. Attendance Record: 05 Marks.
4. CIA: 20 Marks.