# Department: Physiology

**LEARNING MODULE FOR B.SC GENERAL (PHYSIOLOGY):**

**YEAR: I**

**PAPER: I (F.M. - 100)**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Topic</th>
<th>No. of Classes required</th>
<th>Objectives of the topic</th>
<th>Strategy of teaching implemented</th>
<th>Outcome</th>
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<tbody>
<tr>
<td>01</td>
<td>1. Units of Human System: Structure and functions of plasma membrane, nucleus and different cell organelles – Endoplasmic reticulum, Golgi bodies, Mitochondria, Lysosome and Peroxisome. Structure, function and classification of Epithelial, Connective, Muscular and Nervous tissues.</td>
<td>15</td>
<td>This topic aims at introducing the students about the basic structural units of a living body.</td>
<td>Chalk n talk/Interactive session/ notes handout</td>
<td>Learning of concept related to structure, functions and location of different cells</td>
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<tr>
<td>01</td>
<td>2. Biophysical and Biochemical Principles: Physiological importance of the following physical processes: Diffusion, Osmosis, Dialysis, Ultrafiltration, Surface tension, Adsorption and Absorption. A brief idea about acids, bases, buffers, indicators pH – definition, significance and maintenance of pH in the blood. Colloids - definition, classification and physiological importance. Enzymes: definition, classification, factors affecting enzyme action. Concept of coenzymes and isozymes.</td>
<td>15</td>
<td>This topic aims at introducing the students about the significance of important physiological processes</td>
<td>Chalk n talk/Interactive session/ notes handout</td>
<td>Learning about physical and chemical processes that control normal functions of a living body</td>
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<tr>
<td>01</td>
<td>3. Digestive System: Structure in relation to functions of alimentary canal and digestive glands. Composition,</td>
<td>16</td>
<td>This topic aims at introducing the students</td>
<td>Chalk n talk/Interactive session/ notes</td>
<td>Learning about human digestive system, digestion</td>
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functions and regulation of secretion of digestive juices including bile. Digestion and absorption of carbohydrate, protein and lipid. Movements of the stomach and small intestine.

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<tr>
<td>24</td>
<td><strong>This topic aims at introducing the students about Basic constituents of food and their nutritional significance</strong></td>
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<tr>
<td>24</td>
<td><strong>Chalk n talk/Interactive session/ notes handout</strong></td>
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<tr>
<td>24</td>
<td><strong>Learning about major constituents of food, vitamins, minerals and their functions</strong></td>
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<td>10</td>
<td><strong>This topic aims at introducing the students about blood and its composition</strong></td>
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<tr>
<td>10</td>
<td><strong>Chalk n talk/Interactive session/ notes handout</strong></td>
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<tr>
<td>10</td>
<td><strong>Learning about elements of blood, their functions, and related diseases.</strong></td>
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</tbody>
</table>
| 02 | 3. Cardiovascular Physiology II :  
| 02 | 4. Respiratory Physiology :  
Anatomy and histology of the respiratory passage and organs. Role of respiratory muscles in breathing. Artificial respiration. Significance of physiological and anatomical dead space. Lung volumes and capacities. Exchange of respiratory gases between lung and blood and between blood and tissues. Transport of oxygen and carbon dioxide in blood. Regulation of respiration - neural and chemical. Hypoxia. | 10 | This topic aims at introducing the students about lung and its functions | Chalk n talk/Interactive session/ notes handout | Learning about anatomy and functions of lung. Process of air circulation in the body |
| 02 | 5. Renal Physiology :  
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<td>03</td>
<td>1. Muscle Physiology : Different types of muscle and their structure. Red and white muscle. Muscular contraction: structural, mechanical and chemical changes in skeletal muscle during contraction and relaxation. Isotonic and isometric contractions. Properties of muscle: all or none law, beneficial effect, summation, refractory period, tetanus, fatigue. A brief idea about the muscle spindle.</td>
<td>20</td>
<td>This topic aims at introducing the students about Different types of muscle and their structure</td>
<td>Chalk n talk/Interactive session/ notes handout</td>
<td>Learning about structure of muscles and mechanical chemical process of muscle movement.</td>
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<tr>
<td>03</td>
<td>3. Nervous System I : A brief outline of organization and basic functions (sensory, motor and association) of the nervous system, central and peripheral nervous system. (Emphasis on the structure of spinal cord</td>
<td>06</td>
<td>This topic aims at introducing the students about the organization and</td>
<td>Chalk n talk/Interactive session/ notes handout</td>
<td>Learning about tracts that carry different types of sensations, brain, spinal cord and</td>
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<th>03</th>
<th>4. Nervous System II:</th>
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<td>A brief idea of the structure, connections and functions of cerebellum. Different nuclei and functions of thalamus and hypothalamus. Cerebral cortex: histological structure and localization of functions. CSF: composition, formation, circulation and functions. A brief description of the organization of the autonomic (sympathetic and parasympathetic) nervous system. Functions of sympathetic and parasympathetic nervous system. A brief idea of speech, aphasia, conditioning, learning and memory.</td>
<td>07</td>
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<tr>
<td>Chalk n talk/Interactive session/ notes handout</td>
<td>Learning about structure and functions of central and autonomic nervous system, learning and speech formation.</td>
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<th>5. Sensory Physiology:</th>
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<td>Chalk n talk/Interactive session/ notes handout</td>
<td>Learning about olfaction, gustation, audition and vision and related nerve pathways.</td>
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changes in retina on exposure to light.
Accommodation - mechanism and pathway.
Errors of refraction. Positive and negative after-
image. Light and dark adaptation. Elementary
idea of colour vision and colour blindness.

| 04 | 1. **Skin and Regulation of Body Temperature:**
Structure and functions of skin. Insensible and
sensible perspiration Regulation of body
temperature -- physical and physiological
processes involved in it. Physiology of sweat
secretion and its regulation. | 10 | This topic aims
at introducing
the students
about the
structure and
functions of skin. Chalk n
talk/Interactive
session/ notes
handout | Learning about
temperature
regulation in
human body |

| 04 | 2. **Endocrine System I:**
Anatomy of endocrine system. Hormones -
classification. Basic concept of regulation of
hormone actions. Positive and negative feedback
mechanism. Elementary idea of hormone action. 
*Hypothalamus:* Basic concept of neurohormone.
Hypothalamo-hypophyseal tract and portal
system.
*Pituitary:* Histological structure, hormones,
functions. Hypo and hyperactive states of
pituitary gland.
*Thyroid:* Histological structure. Functions of
thyroid hormones (T4T3) Thyrocalcitonin. Hypo
and hyper-active states of thyroid.
*Parathyroid:* Histological structure, functions of
parathyroid hormone. Tetany. | 20 | This topic aims
at introducing
the students
about the
anatomy and
functions of
endocrine system
Chalk n
talk/Interactive
session/ notes
handout | Learning about
Elementary idea
of endocrine
glands and
hormone action. |

| 04 | 3. **Endocrine System II:**
*Adrenal Cortex:* Histological structure and
functions of different hormones. Hypo and hyper-
active states of adrenal cortex.
*Adrenal Medulla:* Histological structure and
functions of medullary hormones. The relation of
functions of different glands. Hypo and hyper-
active states of adrenal cortex. | 20 | This topic aims
at introducing
the students
about other
important glands
Chalk n
talk/Interactive
session/ notes
handout | Learning about
Elementary idea
of adrenal gland,
pancreas and
their functions |
adrenal medulla with the sympathetic nervous system.


| 04 | **4. Reproductive Physiology I:** Primary and accessory sex organs and secondary sex characters. Testis: histology, spermatogenesis, testicular hormones and their functions. Ovary: histology, oogenesis, ovarian hormones and their functions. | 07 | This topic aims at introducing the students about primary and accessory sex organs and secondary sex characters. | Chalk n talk/Interactive session/ notes handout | Learning about histology and functions of testis and ovary |
| 04 | **5. Reproductive Physiology II:** Oestrus and menstrual cycles and their hormonal control. Fertilization, implantation and structure and functions of placenta. Maintenance of pregnancy – role of hormones. Development of mammary gland and lactation - role of hormones. | 07 | This topic aims at introducing the students about reproductive processes in human body. | Chalk n talk/Interactive session/ notes handout | Learning about menstrual cycle, fertilization, pregnancy and lactation |
### YEAR: II
### PAPER: III (F.M. - 100)

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| 05   | 1. Histology :  
   i) Haematological experiments :  
      a) Leishman's staining of human blood film and identification of different types of blood corpuscles.  
      b) Preparation of Haemin crystals.  
   ii) Fresh tissue experiments:  
      a) Examination and staining of fresh tissues (other than blood) squamous, cornified, and ciliated and columnar epithelium, skeletal muscle, cardiac muscle by methylene blue stain.  
      b) Silver nitrate preparation of node of Ranvier. | 30 | This topic aims at introducing the students to do experiments on living tissues | Demonstration and Practical work | Learning about blood constituents, fresh tissues from different types |
| 05 | 2. Biochemistry:  
*Qualitative Experiments:* Qualitative tests for identification of starch, dextrin, lactose, sucrose, glucose, fructose, albumin, gelatin, peptone, lactic acid, hydrochloric acid, uric acid, acetone, glycerol, bile salts, urea.  
*Quantitative Experiments:*  
   a) Quantitative estimation of glucose by Benedict’s method.  
   b) Quantitative estimation of amino-nitrogen by Sorensen’s formol titration method. | 40 | This topic aims at enabling the students to identify important biomolecules through different tests. | Demonstration and Practical work | Learning about important biomolecules and the tests to identify them |
|----|--------------------------------------------------|----|-------------------------------------------------|-----------------------------|--------------------------------------------------|
| 05 | 3. Experimental Physiology with Human Experiment:  
   a) Use of kymograph, induction coil and key.  
   b) Recording of simple muscle curve with sciatic-gastrocnemius muscle preparation of toad and determination of latent period, period of contraction and period of relaxation and maximum height of contraction.  
   c) Normal tracing of toad’s unperfused heartbeat.  
   d) Effect of warm saline on toad’s unperfused heartbeat.  
   e) Measurement of systolic and diastolic arterial pressure by sphygmomanometer and determination of pulse pressure and mean pressure during rest and exercise. | 10 | This topic aims at introducing the studentsto examine some functions on toad and human. | Demonstration and Practical work | Learning about use of important machines to determine normal functions of human and toad |
| 05 | 4. Laboratory Note Books:  
i) Biochemistry ; ii) Histology ; iii) Experimental | | | | |


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<td>06</td>
<td><strong>1. Haematology:</strong> Blood groups - ABO and Rh. Blood transfusion - precaution and hazards. Immunological basis of identification of ABO and Rh blood groups. Functions and estimation of haemoglobin. Abnormal haemoglobins - thalassaemia and sickle-cell anaemia. Definition, determination and significance of TC, DC, ESR, Arneth count, PCV, MCV, MHC, MCHC, bleeding time, clotting time and prothrombin time. Anaemia - types (definition and causes). Leucocytosis, leucopenia and leukaemia. Purpura.</td>
<td>10</td>
<td>This topic aims at introducing the students about immunology and blood related diseases</td>
<td>Chalk n talk/Interactive session/ notes handout</td>
<td>Learning about blood groups, haemoglobins, anaemia</td>
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<tr>
<td>06</td>
<td><strong>2. Biochemistry and Molecular Biology:</strong> Brief idea of HMP shunt and its significance (detailed enzymatic reactions are not required). Lipoproteins - types and functions. Purine and pyrimidine bases, nucleosides, nucleotides and polynucleotides. Structure of DNA and RNA. Elementary idea of gene, genome, transcription, genetic code, translation and genetic engineering. (10 lectures) Pathophysiological significance of the following blood constituents: glucose, urea, creatinine, uric acid, cholesterol, bilirubin, SGPT and SGOT, alkaline and acid</td>
<td>15</td>
<td>This topic aims at introducing the students about molecular basis of a living cells</td>
<td>Chalk n talk/Interactive session/ notes handout</td>
<td>Learning about DNA, RNA, their functions and some pathophysiological conditions</td>
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phosphatases and ketone bodies.

| 06 | **3. Microbiology and Immunology** :
Virus - DNA virus and RNA virus.
Bacteriophage. Bacteria-structure and morphological classification. Gram positive and Gram negative and acid-fast bacteria.
Pathogenic and non-pathogenic bacteria - definition with a few examples. Sterilization and Pasteurization. A brief idea of antibiotics.
Elementary knowledge of innate and acquired immunity. Humoral and cell mediated immunity
Vaccination - principles and importance of immunization. Basic principle of immunological detection of pregnancy. | 15 | This topic aims at introducing the students about micro-organisms and immunity. Chalk n talk/Interactive session/notes handout | Learning about virus, bacteria and related physiological processes. |
| 06 | **4. Social Physiology** :
Dietary management or obese, diabetic person, hypertensive person and athlete. Diet survey.
Malnutrition and its causes - PCM, marasmus, kwashiorkor their prevention.
Iron and iodine deficiency.
Population problem and its control. Problem of infertility and brief idea about in vitro fertilization and intrauterine gamete transfer.
Brief idea of AIDS and hepatitis B and their preventions. | 07 | This topic aims at introducing the students about composition and nutritional value of common Indian foodstuffs, population control. Chalk n talk/Interactive session/notes handout | Learning about food stuffs, diet related diseases, proper diet for different needs and population related problems and their control. |
| 06 | **5. Work Physiology**  
Physical work - definition and units of measurement. Concept and classification of physical work -- static and dynamic work, positive & negative work. Cardiovascular and respiratory changes during physical exercise. Brief idea of maximal aerobic power and excess post-exercise oxygen consumption. Basic idea of doping. EMG. Physical fitness index – Harvard step test. ECG -- normal waves and leads. Anthropometry and its uses. | 08 | This topic aims at introducing the students about concept and classification of physical work | Chalk n talk/Interactive session/ notes handout | Learning about classification of physical work, cardiovascular and respiratory changes during physical exercise. |
| --- | --- | --- | --- | --- | --- |
| 06 | **6. Environmental Physiology**  
Environment - its physiological aspects. Effect of extreme temperature on humans. Hypobaric environment - effects on physiological system, acclimatization. Hyperbaric conditions and Caisson disease. Brief idea of cyanosis, dyspnoea, hyperpnoea, apnoea and asphyxia. Some common pollutants and their effects - carbon monoxide, lead and arsenic. Effects of noise on human body and preventive measures. | 10 | This topic aims at introducing the students about environment - its physiological aspects | Chalk n talk/Interactive session/ notes handout | Learning about environment, effects on human and effects of pollutants |
| 06 | **7. Biostatistics**  
Basic concepts – variable, population, parameter, sample, statistic. Classification of data – qualitative and quantitative, continuous and discontinuous. Presentation of data – frequency distribution, bar diagram, pie diagram, frequency polygon and histogram. Mean median, mode, standard deviation and standard error. | 15 | This topic aims at introducing the students about basic idea of statistics | Chalk n talk/Interactive session/ notes handout | Learning about statistics and presentation of data |
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| 07   | 1. A. **Haematology:**  
a) DC of WBC, estimation of haemoglobin, blood group determination, bleeding time and coagulation time and WBC, ESR.  
B. **Biochemistry:**  
C. **Human Experiments:**  
a) Determination of Physical Fitness Index (PFI) of an individual by modified Harvard step test and recording of recovery heart-rate after standard exercise.  
b) Pneumographic recording of respiratory movements along with the effect of drinking of water, talking, forced hyperventilation and breathe holding.  
c) Measurement of some common anthropometric parameters: stature, weight, eye height, shoulder height, elbow height, sitting height, elbow rest height (sitting), knee height (sitting), arm reach from wall, mid-arm. |
|      | 20    | This topic aims at introducing the students to  
A. Experiments on blood  
B. Identification of biomolecules  
C. Physiological processes |
|      |       | Demonstration and Practical work |
|      | Learning about  
A. Properties of human blood  
B. Normal and abnormal constituents of human urine  
C. Measurement of physical and physiological properties |
| circumference, waist circumference, hip circumference, neck circumference, head circumference, chest circumference. d) Calculation of Body Surface Area (using a nomogram) and Body Mass Index from Anthropometric measurements. | 07 | 05 | Learning to conduct project work and how to find out physiological values. |
|---|---|---|
| **2. Field Study Report:** Any one of the followings: a) Diet survey of a family as per ICMR specification. b) Population study of physiological parameters such as height, weight, heart-rate, blood pressure, respiratory rate, PFI, TC of RBC, estimation of haemoglobin, DC of WBC as far as practicable. | | Students will have to conduct a project work on family to determine their nutritional needs. **Or** Do a population study of physiological parameters on families |