**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**
**COURSE CURRICULUM**

Course Title: Human Physiology
(Code: 3320302)

| Diploma Programme in which this course is offered | Semester in which offered |
|---|---|
| Biomedical Engineering | Second Semester |

## 1. RATIONALE

Human Physiology is the study of how the body functions, from the smallest part (Cell) all the way to the whole body. The purpose of this course is to encourage students to develop understanding of the functions of cells, tissues, organs and body systems within the body and how they interact with each other for proper functioning of the body. Students should gain familiarities with physiological terms and their meaning, understanding of general physiology of major systems, their importance in design of biomedical devices. The subject also provides increased awareness of personal health.

## 2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency

i. **Describe the principle functions of the major body systems and organs and interrelationship between them.**

## 3. TEACHING AND EXAMINATION SCHEME

| Teaching Scheme (In Hours) | | | Total Credits (L+T+P) | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory Marks | | Practical Marks | | Total Marks |
| L | T | P | C | ESE | PA | ESE | PA | |
| 4 | 0 | 4 | 8 | 70 | 30 | 40 | 60 | **200** |

**Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit **ESE** - End Semester Examination; **PA** - Progressive Assessment.

**Note:** It is the responsibility of the institute heads that marks for **PA of theory** & **ESE and PA of practical** for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

## 4. DETAILED COURSE CONTENT

| Unit | Major Learning Outcomes | Topics and Sub-topics |
|---|---|---|
| **Unit – I**<br><br>**Human Physiology, Cell, Tissues and Blood** | 1a.Define human physiology.<br>1b.Differentiate anatomy and physiology.<br>1c.Describe the functions of cell membrane<br>1d.Describe the functions of nucleus<br>1e.Describe the functions of various cell organelles within cytoplasm<br>1f.Define action potential including depolarization, re-polarization and resting membrane potential.<br>1g.Describe the functions of Epithelial tissue<br>1h.Describe the functions of Blood<br>1i.Describe the functions of RBC, WBC, Platelets | **1.1 Introduction to physiology**<br>**1.2 Functions of cell and cell organism-** like cell membrane , Nucleus<br>**1.3 Cytoplasm**<br>(i) Endoplasmic Reticulum<br>(ii) Rough Endoplasmic Reticulum<br>(iii)Golgi Apparatus<br>(iv)Lysosomes<br>(v) Mitochondria<br>(vi) Ribosomes<br>(vii)Cytoskeleton(Microtubules and Microfilament)<br>**1.4Cellelectrophysilogy**<br>**1.5 Epithelial tissue**<br>**1.6 Connective tissues**<br>**1.7 Blood**<br>**1.8 Red blood cells(RBC), White blood cells(WBC), platelets** |
| **Unit– II**<br><br>**Cardiovascular System** | 2a.Explain Conducting system of heart<br>2b.Explain blood flow through heart<br>2c.Define Various terms related to heart<br>2d.Explain ECG waves | **2.1 Conducting System of Heart**<br>**2.2 Blood flow through heart**<br>**2.3 Heart related terms:**<br>i) Cardiac cycle<br>ii) Heart Sounds<br>iii) Heart rate<br>iv) Pulse<br>v) Cardiac output<br>vi) Blood pressure (systolic, diastolic, pulse and mean arterial pressure)<br>vii) Rhythmicity<br>viii) Contractility<br>ix) Conductivity<br>x) Excitability<br>**2.4 Electrocardiogram(ECG)** |
| **Unit– III**<br><br>**Respiratory and Digestive System** | 3a.Explain mechanism of respiration<br>3b.Define internal and external respiration<br>3c.Describe the transport of $O_2$ and $CO_2$ gases<br>3d.Draw spirogram & define various lungs volume & capacities<br>3e.Enlist the various functions of digestive system | **3.1Mechanism of respiration**<br>**3.2 Principle of gas exchange**.<br>i) Internal respiration<br>ii) External respiration<br>**3.3 Transport of oxygen and carbon dioxide**<br>**3.4 Pulmonary volumes and capacities (Spirogram)**<br>**3.5 Digestive system-**functions of stomach, small intestine, large intestine, liver |
| **Unit – IV**<br><br>**Skeletal and Muscular Systems** | 4a.Enlist the various functions of bones | **4.1 Bones-** functions of bone such as long, short, irregular ,flat, sesamoid. |

| Unit | Major Learning Outcomes | Topics and Sub-topics |
|---|---|---|
| **Unit –V**<br><br>**Excretory, Integumentary System and Endocrine System** | 5a.Describe various functions of kidney<br>5b.Explain micturition process<br>5c.Describe various functions of skin<br>5d.Enlist the Various hormones secreted by different glands with their functions. | **5.1 Excretory system**<br>i) Kidney<br>ii)Urine Micturition<br>**5.2 Integumentary system-**functions of skin<br>**5.3 Endocrine System- Hormones with their functions** |
| **Unit – VI**<br><br>**Nervous System** | 6a.Define the various property of Neurons<br>6b.Explain structural features of neuron<br>6c.Define synapse<br>6d.Outline concepts of different waves (α,β,γ,θ) of EEG with its frequency and amplitude<br>6e.Classify the synapses on basis of functional and anatomical aspects | **6.1Neurons**<br>i) Properties of neurons<br>ii) Structural feature of neuron<br>**6.2 Synapse**<br>i) Classification of synapse<br>**6.3 Electroencephalogram (EEG)** |
| **Unit – VII**<br><br>**Special Senses** | 7a.Explain Physiology of sight<br>7b.Draw and elucidate pathway of optic nerve through brain<br>7c.Explain Physiology of hearing<br>7d.Describe physiology of taste and smell | **7.1 Physiology of sight -**using pathway of optic nerve through brain<br>**7.2 Physiology of hearing**<br>**7.3 Physiology of taste and smell** |

## 5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

| Unit No. | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|---|---|---|---|---|---|---|
| | | | R Level | U Level | A Level | Total Marks |
| **I** | Human physiology ,cell ,tissues and blood | 08 | 4 | 8 | 0 | 12 |
| **II** | Cardiovascular System | 08 | 6 | 6 | 0 | 12 |
| **III** | Respiratory and digestive System | 10 | 4 | 10 | 0 | 14 |
| **IV** | Skeletal and Muscular Systems | 04 | 2 | 2 | 0 | 04 |
| **V** | Excretory, Integumentary System and Endocrine | 08 | 4 | 4 | 0 | 08 |
| **VI** | Nervous System | 10 | 4 | 6 | 0 | 10 |
| **VII** | Special Senses | 08 | 0 | 10 | 0 | 10 |
| | **Total** | **56** | **24** | **46** | **00** | **70** |

**Legends:** R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

**Note:** This specification table shall be treated as only general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.

## 6. SUGGESTED LIST OF EXERCISES/PRACTICALS

The exercises/practical/experiments should be properly designed and implemented with an attempt to develop different types of skills so that students are able to acquire above mentioned competency. Following is the list of exercises/practical/experiments for guidance.

| Sr. No. | Unit No. | Practical Exercises | Approx Hrs. required |
|---|---|---|---|
| 1 | I | Identify the various anatomical planes and anatomical terms from given chart. | 02 |
| 2 | II | Draw the biological cells by observing under microscope. | 02 |
| 3 | II | Identify variety of cells of blood by observing under microscope. | 02 |
| 4 | II | Find out blood group of a sample. | 02 |
| 5 | II | Measure blood pressure using sphygmomanometer and stethoscope. | 02 |
| 6 | III | Distinguish the various parts and understand the working of those parts of systematic and pulmonary circulatory system of human body using chart/model. | 02 |
| 7 | III | Recognize the internal structure of Human heart using heart model. | 02 |
| 8 | III | Explain the blood flow through the heart using heart lung model. | 02 |
| 9 | V | Interpret electrical activity of heart by observing ECG. | 02 |
| 10 | VI | Calculate heart rate using electrocardiogram. | 02 |
| 11 | V | Use stethoscope to listen heart sound. | 02 |
| 12 | V | Measure oxygen saturation using pulse oximeter. | 02 |
| 13 | VII | Distinguish the various parts of respiratory tract using respiratory model system. | 02 |
| 14 | III | Measure lung volumes and capacities using spirometer (spirogram). | 04 |
| 15 | III | Identify the various parts and explain the working of those parts of lungs using lung model. | 02 |
| 16 | III | Identify the various parts of digestive system with the help of digestive model. | 02 |
| 17 | VI | Use Electroencephalograph to obtain EEG. | 02 |
| 18 | IV | Use Electromyography to obtain EMG. | 02 |
| 19 | IV | Identify bones and joints of skeleton using human skeleton model. | 02 |
| 20 | VII | Discriminate the various layers of skin using skin model. | 02 |
| 21 | VII | Explain internal structure of special senses using charts/models. | 02 |
| | | **Total** | **44** |

Note: Out of above 21 practicals, minimum 16 practical are to be performed

## 7. SUGGESTED LIST OF STUDENT ACTIVITIES

7.1 Students should prepare the charts for each and every system in groups.

7.2 Student should prepare list of Biomedical Instruments used for each and every system from internet and attach its photographs in file/journal.

7.3 Student should prepare list of Disorders/Diseases related for each and every system from internet and attach its photographs in file/journal.

## 8. SUGGESTED LEARNING RESOURCES

### A. List of Books

| Sr. No. | Title of Book | Author | Publication |
|---|---|---|---|
| 1. | Human anatomy and physiology made easy | Dr. Padma Sanghani | Akshat,2010 |
| 2. | Human anatomy and physiology | Ross and Wilson | Elsevier,2010 |
| 3. | Essentials of medical physiology | K.. Sembulingam Prema Sembulingam | Jaypee,2010 |

### B. List of Major Equipment/ Instrument

1. Microscope
2. Hb analyzer
3. Stethoscope
4. Sphygmomanometer
5. Electrocardiograph
6. Electromyograph
7. Electroencephalograph
8. Pulse oximeter
9. Spirometer
10. Human anatomical models

### C. List of Software/Learning Websites

http://www.gpgbiomedical.hpage.com

www.getbodysmart.com/

http://www.visiblebody.com/ (for 3D structure of different organs)

https://www.biodigitalhuman.com/home/

## 9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

**Faculty Members from Polytechnics**

- **Prof. A.K.BULA**, Lecturer , Department of Instrumentation Engg. G. P. Gandhinagar
- **Prof. S.S.MALKAN,** Lecturer, Department of Biomedical Engg. G. G. P. Ahmedabad
- **Prof. M.H.DAVE**, Lecturer, Department of Biomedical Engg. G. P. Gandhinaga**r**
- **Prof. N.D.MAKWANA**, Lecturer, Department of Biomedical Engg. G.P.Gandhinagar

**Coordinator and Faculty Members from NITTTR Bhopal**

- **Dr. S.K.Gupta**, Professor and Coordinator for State of Gujarat.