

Course code	Course Name	L-T-P-Credits	Year of Introduction
BM201	BASIC MEDICAL SCIENCES FOR ENGINEERS	3-1-0-4	2016

Prerequisite : Nil

Course Objectives

- To serve as a foundation course for engineers in health care field.
- To introduce the basic anatomy of the major systems of engineering importance in human body.
- To study the basic physiological concepts of these systems.
- To explore the basic engineering principles related to human physiology.

Syllabus

Introduction to Anatomy & Physiology – cell - cell membrane, transport, membrane potential. Nervous System: Central Peripheral & Autonomic nervous - Muscular System - Skeletal system - Cardiovascular system - Respiratory System - Urinary System - Components and functions.

Expected Outcome

Students would be able to get an overview of the major organ systems of engineering importance in human body, their basic anatomy and physiology with emphasis on the engineering principles. This shall act as a foundation in the modeling, design, development, manufacturing and research in the field of health care.

Text Books:

1. Lauralee Sherwood, Human Physiology: From Cells to Systems, Brooks/Cole, Cengage Learning.
2. Arthur C. Guyton, Textbook of Medical Physiology, Prism Books (Pvt) Ltd & W.B. Saunders Company.

Reference Books:

1. Samson Wright, Cyril A. Keele (editor), Eric Neil (editor): Applied Physiology, Oxford University Press.
2. J.B.West.: Best and Taylor's Physiological Basis of Medical Practice, Williams and Wilkins, Baltimore.
3. W.F.Ganong: Review of Medical Physiology, Prentice-Hall, Connecticut.
4. Kathleen J.W. Wilson, Ross and Wilson, Anatomy and Physiology in Health and Illness, ELBS/Churchill Livingstone.

COURSE PLAN

Module	Contents	Hours	Sem. Exam Marks
I	Introduction to Anatomy & Physiology: definition & relationship of structure & function. Functional organization of body – cells, tissues, organs & systems – Types. Concept of homeostasis – intracellular & extracellular fluids. Homeostatic control systems – negative & positive feedback	4	15%

	and feed forward mechanisms.		
	Cell: Basic structure, organelles & their functions – types. Cell membrane – structure, transport across cell membranes – passive diffusion – Fick’s law - electrochemical gradient – osmosis - facilitated diffusion – active transport – Na ⁺ -K ⁺ , Ca ²⁺ pumps – Counter & co-transport. Membrane Potential: Resting membrane potential – Action Potential (concepts only).	4	
II	Nervous System: Organization, Neurons – structure – types. Central nervous system: Overview, Cerebrum – Cerebral cortex – General organization – motor, sensory, language & association areas – major functions. Basal ganglia, Thalamus & Hypothalamus – functions. Introduction to EEG & EP.	5	15%
	Limbic system – components & basic functions. Learning & Memory: Plasticity - short term & long term memory – comparison – long term potentiation.	3	
	Cerebellum, Brain Stem – basic structure & functions, Spinal cord – nerves, spinal reflex.	3	
	FIRST INTERNAL EXAM		
III	Peripheral nervous system: Efferent & afferent division. Special senses – organs of vision, hearing & equilibrium, taste and smell –structure & basic mechanisms. Visual pathway and processing. Autonomic nervous system: Sympathetic & Parasympathetic	4	15%
	Muscular System: Basic structure & mechanism of contraction of skeletal, cardiac & smooth muscles.	3	
	Skeletal system: Bones – Basic structure & composition – classification of bones & joints in human body.	3	
IV	Cardiovascular System: Heart – Anatomy – location – pump – valves - major arteries & veins – cardiac muscle – electrical activity – pacemaker – normal & ectopic – cardiac action potential – spread – cardiac cycle. ECG – origin, waveform–cardiac rhythm & rate – normal & abnormal, myocardial ischemia & infarction, atherosclerosis – definitions. Heart sounds & murmurs. Cardiac output – stroke volume.	4	15%
	Systemic & Pulmonary circulation - blood flow – pressure gradient – vascular resistance – Poiseulle’s law – vascular tree – blood pressure – systolic & diastolic – hyper & hypotension mean arterial pressure. Lymphatic system – functions.	3	
	Blood: Components – plasma – hematocrit – plasma proteins – erythrocytes – hemoglobin – anemia – blood typing – transfusion reaction – universal donor & acceptor – leukocytes – functions & types – platelets – blood clotting.	3	
SECOND INTERNAL EXAM			
V	Respiratory System: Components & anatomy.	2	20%

	Respiratory mechanics – respiratory cycle – inspiration & expiration mechanisms - airway resistance – pulmonary compliance & elastic recoil – pulmonary surfactants – lung volumes & capacities – spiograms – pulmonary & alveolar ventilation. Gas exchange – partial pressure gradients.	4	
	Gas transport – % Hb saturation – oxygen – Hb dissociation curve. Abnormal arterial partial pressures, respiratory acidosis & alkalosis, apnea & dyspnea.	3	
VI	Urinary System: Components & anatomy.	2	20%
	Kidneys – functions, anatomy & basic processes– nephron – types – components. Basic renal processes – basics of glomerular filtration, tubular reabsorption & secretion – urine excretion & plasma clearance – micturition.	4	
	Body fluids – fluid balance – acid-base balance.	2	
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks: 100

Exam Duration: 3 Hours

There shall be three parts for the question paper.

Part A includes Modules 1 & 2 and shall have three questions of fifteen marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Part B includes Modules 3 & 4 and shall have three questions of fifteen marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Part C includes Modules 5 & 6 and shall have three questions of twenty marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Note: Each part shall have questions uniformly covering both the modules in it.