Department of Physiology and Medical Physics

Attitude

The department of Physiology and medical Physics looks for fulfilment of the requirements of the society with highly qualified medical staff and researchers who are capable to enrich the medical field and solve the medical problems.

Aims

1- Providing a full comprehension for the physiological aspects.

2- Elucidating the physiological mechanisms to discover the highly organized human body.

3- Establishing the concept of modern learning through internet, medical journals, books, seminars, and workshops.

4- Encouraging the students to perform scientific researches and medical studies depending upon the scientific knowledge they have received.

5- The ability to distinguish between the normal and abnormal performance of the body systems.

Teaching and Learning Methods

Different methods are depended to conduct the syllabi of the curriculum such as lectures, tutorials, demonstrations, practical sessions and scientific activities. The use of the technology is highly depended like power point presentations and videos. Besides, the students are induced to participate in scientific discussions and innovations.

CURRICULUM OF PHYSIOLOGY

First Year Curriculum

(First Semester)

15 hours theory (1 hour / week)

I. Cell Physiology (3 hours)

Objective

The students should be able to argue the major components of the cell, the function of the cellular organelles and a brief a-bout apoptosis.

1- Plasma membrane, cytoplasm and its organelles.

2- Nucleus and its function.

3- Functions of other organelles.

II. Body Fluids (4 hours)

Objective

The students should be able to argue the body fluids compartments and their volumes, the ionic composition of extracellular and intracellular fluids, their amounts and distribution in specific sodium, potassium, and calcium.

1- Fluid compartment.

2- Extracellular and Intracellular fluids.

3- Water and electrolyte balance.

4- Edema.

III. Muscles (3 hours)

Objective

After mastering the material in this chapter, the student must be able to discuss the types of muscles, their features, structure and functions.

1- General classification of the muscles

2- Skeletal muscle

3- Cardiac muscle

4- Smooth muscle

IV. Nervous System- Introduction (5 hours)

Objective

In this chapter the students should be enlightened with introductory knowledge about the nervous system which enables them to explain and illustrate the general organization of the nervous system besides anatomic and physiologic bases for division of the autonomic nervous system into sympathetic, parasympathetic and enteric divisions, and the neurotransmitters used by the sympathetic and parasympathetic divisions.

1- Introduction.

2- General organization of nervous system.

3- Sympathetic nervous system.

4- Parasympathetic nervous system.

5- Enteric nervous system.

6- Neurotransmitters.

First Year Curriculum

(Second Semester)

15 hours theory (1 hour / week)

I. Physiology of Gastrointestinal system (15 hours)

Objective

The students must be well enlightened and capable of discussing the anatomical parts of GIT, the secretory and motor function of each part, the role of autonomic and enteric plexuses in control gut function.

1- GIT anatomy and general principles of its physiology.
2- Saliva and swallowing.
3- Stomach motility and secretion.
4- Small intestine motility.
5- Large intestine motility and secretion.
6- Pancreas.
7- Liver.

Second Year Curriculum

(First Semester)

60 hours theory (4 hours / week)

I. Blood Physiology (14 hours)

Objective

Upon mastering the material in this chapter, the students should be well informed about the major functions of blood, the pathological changes in R.B.C. morphology and function, the causes and types of anemia, blood clotting phases, blood typing and its role in blood transfusion, the role of cellular and innate immunity, and the role of T-cell subtypes in adaptive immunity.

1- Blood volume and plasma.
2- Red Blood Corpuscles.
3- Haemoglobin structure and types.
4- Anemia.
5- Blood Groups (ABO system) and transfusion reaction.
6- Homeostasis and Platelets.
7- Extrinsic and Intrinsic pathways of coagulation.
8- Tests of hemostasis, hemophilia.
9- Immunity and Tissue typing.
10- Tolerance, Autoimmune diseases, and graft rejection.

II. Physiology of Renal System (12 hours)

Objective

The students must be fully understood and able to explain and describe the major components of renal system, the process of glomerular filtration and tubular absorption, the concentrating ability of the kidney and the role of kidney in regulation of body fluid, ions concentration and acid – base balance.

1- Renal circulation and glomerular filtration.
2- Tubular reabsorption.
3- Tubular secretion.
4- Water excretion by the kidneys.
5- Role of the kidney in electrolyte balance.
6- Renal mechanisms of acidification of urine and its significance in the regulation of pH.
7- Regulation of body fluid volume.
8- Renal function test.

III. Physiology of Respiratory System (14 hours)

Objective

In this chapter the students should be able to explain and describe the anatomy of airways and lungs, generation of pleural pressure, movement of air in and out of lungs depending upon the changes in alveolar pressure, the measurement of lung volumes and air flow in patients by the use of spirometry, the process of gas transfer by the blood, the pulmonary circulation and ventilation / perfusion, and the process of control of ventilation.

1- Physiological functions of the lungs.
2- Process of respiration: Mechanics of breathing.

3- Lung Volumes and Capacities.

4- Compliance of the lung, role of surfactant.

5- Pulmonary and Alveolar ventilation.

6- Transport of O_2 by the blood.

7- Transport of CO_2 by the blood.

8- Role of Respiratory system in acid – base regulation.

9- Regulation of breathing: voluntary and involuntary control.

10- Regulation of breathing: ventilatory responses to CO_2 rise and O_2 lack.

IV. Nerve, Muscle, and Autonomic Nervous System (20 hours)

Objective

In this chapter the students should be able to explain how the central nervous system regulates autonomic function, the role of autonomic nervous system in regulating the involuntary "background operating system" functions of the body, the design of the unique anatomic and cellular features of neurons and is relation to their function, the role of neuronal cytoskeleton in axonal transport, growth and metabolic maintenance of neurons, molecular mechanisms of ionic conductance events that underline initiation, termination, and propagation of action potential, the way that neurotransmitter release alters postsynaptic membrane potentials, excitation-contraction coupling, the role of all or non – law, the isotonic, isometric contractions, and the cause that the contraction of a smooth muscle cell can be graded whereas that of a skeletal muscle fiber cannot.

1- Generation of membrane potential of nerve cell.

2- Excitation and conduction.

3- Nerve action potential.

4- Electrogenesis of action potential.

5- Orthodromic and antidromic conduction – properties of mixed nerve.

6- Skeletal muscle.

7- The contractile response – muscle twitch.

8- Properties of skeletal muscle in the intact organism – motor units.

9- Energy source and metabolism.

10- Strength – duration curve – cardiac muscle.

11- The smooth muscle.

12- The neuromuscular junction.

13- Autonomic nervous system, anatomical consideration – sympathetic and parasympathetic nervous systems.

14- Types of autonomic innervation and reflex arc.

15- Higher autonomic centers and neurotransmitters in autonomic nervous systems.

16- Physiology of micturition.

Second Year Curriculum

(Second Semester)

60 hours theory (4 hours / week)

I. Physiology of Central Nervous system (18 hours)

Objective

Upon mastering the material in this chapter the student should be able to describe the different types of receptors, spinal cord tracts, and the role of cerebral cortex, cerebellum, and basal ganglia of control of body movements, different types of reflexes. Besides, the student should be able to describe the special senses and mechanism of their action.

1- General sensation.

2- Tactile vibration and position senses.

3- Pain sensation.

4- Spinal cord transaction.

5- Thalamus central representation of sensation.

6- Reticular activating system.

7- Motor cortex and motor pathway.

8- Basal ganglia.

9- Cerebellum.

10- Language, learning and memory.

11- Cerebrospinal fluid.

12- Limbic system.

13- Visual sensation.

14- Audition (Hearing).

15- Vestibular function.

16- Gustation (Taste).

17- Olfaction (Smell).

II. Physiology of Cardiovascular System (18 hours)

Objective

Upon mastering the material in this chapter the student should be able to describe the major components of CVS, the events of cardiac cycle, the control of blood flow and blood pressure, and the pumping property of the cardiac muscle.

1- Functional design of cardiovascular structure of the heart and blood vessels.

2- Properties of cardiac muscle – autorhythmicity and conductivity.

3- Properties of cardiac muscle – contractility and refractory characteristics.

4- Electrophysiology of the heart (ECG).

5- Mechanical events in cardiac cycle.

6- Heart sounds and murmurs.

7- Cardiac output.

8- Work and efficiency of the heart.

9- Vascular system – condition of flow and pressure.

10- Blood pressure and its regulation.

11- Circulatory regulation, general nervous and local peripheral mechanisms.

12- Circulation through special regions; coronary, skeletal muscle, cerebral and skin circulation.

13- Cardiovascular haemostasis, cardiac insufficiency, shock, and postural changes.

14- Starling forces across capillary beds.

15- Venous pressure and flow.

III. Physiology of Endocrine and Reproductive systems (18 hours)

Objective

Upon mastering the material in this chapter the student should be able to describe the different types of hormones, their interaction with each other, the different endocrine glands and tissues, the function of each hormone, the regulation of each hormone, the effects of under and overproduction of hormones, the reproductive system of males and females, the process of gametogenesis and fertilization.

1- Hypothalamic hormones.

2- Posterior pituitary gland hormones.

3- Anterior pituitary gland hormones.

4- Growth hormone.

5- Thyroid gland hormones.

6- Hypo and hyperthyroidism.

7- Ca^{+2} metabolism, vitamin D.

8- Ca^{+2} metabolism, Parathyroid hormone.

9- Pancreatic hormones (insulin) and (glucagon)

10- Diabetes Mellitus.

11- Metabolic syndrome.

12- Hypoglycemia.

13- Adrenal gland: Anatomy and physiology.

14- Mineralcorticoids and glucocorticoids.

15- Catecholamines.

16- Male reproductive system.

17- Female reproductive system.

18- Physiology of pregnancy.

IV. Physiology of Aviation, High-Altitude, Deep seas and diving (6 hours)

Objective

The students must understand the changes of pressure and other forces that face the human in the high altitudes or in the deep seas.

1- Effects of Low Oxygen Pressure on the Body

2- Natural Acclimatization of Native Human Beings Living at High Altitudes

3- Effects of Acceleratory Forces on the Body in Aviation and Space Physiology

4- Relationship of Pressure to Sea Depth

5- Effect of High Partial Pressures of Individual Gases on the Body.

Second Year Practical Curriculum

(First Semester)

45 hours practical (3 hours / week)

I- Blood Experiments

1- Introduction.

2- Osmotic fragility test.

3- RBC count.

4- WBC count.

5- Platelet count.

6- Blood film (WBC differential count).

7- Hemoglobin.

8- PCV.

9- Blood group.

10- ESR.

11- Capillary Hess test.

12- Bleeding time.

13- Clotting time.

II. Nerve and Muscle Experiments

1- Introduction.

2- Instruments and dissection.

3- Simple muscle twitch (SMT).

4- Effect of temperature on SMT.

5- Effect of strength of stimulus on SMT.

6- Nerve conduction velocity.

7- Fatigue.

8- Tetanus.

9- Effect of temperature on frog`s heart.

10- Stannius ligature.

11- Electrical stimulation of frog`s heart.

12- Effect of drugs and ions.

13- Review.

(Second Semester)

45 hours practical (3 hours / week)

1- Introduction.

2- Electrocardiography.

3- Cardiopulmonary Resuscitation.

4- Visual tests.

5- Pulmonary function test.

6- Measurement of blood pressure and pulse exam.

7- Hearing test.

8- Chest exam.

9- Abdominal exam.

10- Neurological Exam.

11- Exercise physiology.

12- Period of apnea.

13- Glucose tolerance test.

14- Urine exam.

15- Pregnancy test.

CURRICULUM OF MEDICAL PHYSICS

Medical Physics Curriculum

1st year

(PHYphs-11)1st semester

Theory lectures

1. Terminology, Modeling, measurement, how to make a full diagnose.
    - Definition of some Terminology and how to make a full diagnose.
2. Forces on and in the human body, Distribution of mass in the human body.
    - Clinical applications of gravity, frictional forces.
    - Forces on and in the human body discuss the force which is control all motions in the world force is very important in the body.
3. Dynamics, Centrifuge, Sedimentation velocity. Mathematical problems for medical applications.
    - This chapter discuss the force which is control all motions in the world force is very important in body.
4. Physics of the skeleton, the functions of bones, Types of bones, What is the bone made of.
    - Physics of the skeleton is described the physical law and their effect on the bone because of the importance of bone to the proper functioning of the body.
5. Terminology, Modeling ,measurement ,how to make a full diagnose
6. Forces on and in the human body, Distribution of mass in the human body. Clinical applications of gravity, frictional forces.
7. Dynamics, Centrifuge, Sedimentation velocity. Mathematical problems for medical applications
8. Physics of the skeleton, The functions of bones, Types of bones, What is the bone made of?
9. Elastic properties of biological materials. Compressibility. Bone remodeling.
10. Lubrication of bone joints. The function of synovial fluid. Measurement of bone mineral in the human body. Mathematical problems for medical applications

11. Heat and cold in medicine: physical basis of heat and temperature, thermometry and temperature scales,
12. Thermo-grams for mapping the body's temperature.
13. Heat therapy, the techniques for producing heat in body, and The therapeutic effects of heating the body.
14. Cold in medicine
15. Energy, work, and power of the body:
16. Conservation of energy in the body, energy change in the body.
17. Work and power, Heat losses from the body, Mathematical problems for medical applications.
18. Pressure: measurement of pressure in the body, Pressure inside the skull, Eye pressure, pressure in the digestive system.
19. Pressure in the skeleton. Pressure in the urinary bladder, pressure effects while diving, hyperbaric oxygen therapy (HOT), , Mathematical problems for medical applications.
20. The physics of lung and breathing function of lung, The airways.
21. How the blood and lung interact, principles of diffusion.
22. Partial pressures of O2 and Co2, Combination of O2 with Hb, Co poisoning.
23. Measurement of lung volumes, pressure-Air flow-volume relationships of the lungs.
24. Physics of alveoli, the breathing mechanism.
25. Work of breathing, Physics of some lung diseases, Mathematical problems for medical applications.
26. Physics of cardiovascular system: Major components of the (CVS), work done by the heart, Laplace law.
27. Blood pressure and it measurement, Bernoulli's principle, Viscosity &Poiseuille's law.
28. Blood flow, heart sound, the physics of some CVS diseases.

(PHYPhs-P1) 1st semester

1. A. How to write a report in practical physics

b. methods for finding errors
c. The Principle of vernier and the use of vernier caliper. (Sheet)

2. The use of micrometer and traveling microscope. (Sheet)

3. A.Simple pendulum: (Armitage P.22)
a. Acceleration of gravity.

b. Method of data analysis and representation.

4. Pulmonary function tests. (Sheet)

5. Flow of water through a capillary tube: To show that the rate of flow is proportional to the applied pressure. (Armitage P.42)

6. Flow of water through a capillary tube to deduce the viscosity of water. (Armitage P.43)

7. Variation of the resistance of a wire with temperature and measurement of its temperature coefficient. (Armitage P.140)

8. A.Surface tension of water by the capillary tube method. (ArmitageP.36)

9. Blood pressure. (Sheet)

10. Determination of the speed of sound using a resonance tube (using a set of tuning forks). (Armitage P.122)

11. Behavior of: a. capacitor b .inductance c. resistance toward A.C & .D.C(Armitage P.192)

12. Spiral spring (Armitage P.16)

13. Final examination

(PHYPhs-12) 2nd semester

2hours/week for 15 weeks (2 credits)

Theory lectures

1.Electricity within the body

- The nervous system and the neuron
- Electrical potentials of nerves, Electromyogram (EMG).

2. Electrical activity of the heart

- Electric Dipole model
- ECG tracing.

3.Electric signals from the brain

- Electroretinogram (ERG)
- Magnetic signals from the heart and brain.

4.Cardiovascular Instrumentation

- Biopotentials of the heart
- Electrodes
- Amplifiers
- Defibrillators
- Pacemakers.

5.Sound in medicine

- Spectrum of sound
- Wave classification
- The physical characteristics of sound waves.
- The loudness and intensity level (decibel scale).
- Audiometer.

6.Ultrasonic sound

- The sonar techniques.
- A-Scan, B-Scan and M-scan.
- Ultrasound to measure motion.
- Doppler effect Physics of the ear and hearing.
- Mathematical problems for medical applications

7.Light in medicine

- The spectrum of electromagnetic waves.
- The properties of light.
- Mirror equations.
- Lens equations.
- Application of ultraviolet and infrared light in medicine.

- Interference, diffraction and polarization.
- Snell's law.
- Fiber optics and microscopes in medicine.
- Mathematical problems for medical applications

8.The eye and vision

- Elements of the eye.
- The light detector of the eye.
- Color vision.
- Optical defects of the eye.
- Visual acuity of the eye.
- Optical density (OD).

9.Laser

- Properties of Laser.
- Population inversion
- Types of laser.
- Basic principles of laser operation.
- Laser output and its modification
- Types of laser operation
- Frequency doubling.
- Laser interaction with tissue and its medical applications
- Laser delivery systems
- Laser hazards and precaution

10.Atomic structure:

- Atomic energy levels.
- Physics of diagnostic
- Production of X-ray beams.
- How X-rays are absorbed.

- Making an X-ray image.
- Computed tomography (CT) scan.
- How dose X-ray lose its energy inside human body.
- Photoelectric effect
- Compton scattering and pair production.
- Bremsstrahlung production.
- Fluorescence and phosphorescence.
- Mathematical problems for medical applications

11.Physics of nuclear medicine

- Medical radioisotopes.
- Activity. Radioactivity.
- Nuclear diagnostic.
- Mathematical problems for medical applications

12.Physics of radiation therapy protection

- Megavoltage therapy.
- Radiation protection in nuclear medicine.
- Biological effects of ionization radiation in the human body.
- Exposure. Biological effectiveness
- Absorbed dose.
- Mathematical problems for medical applications

13.Magnetic resonance imaging (MRI)

- Basic principles.
- MR active nuclei
- Larmor equation
- The free induction signal (FID).
- The Bloch differential equations.
- MRI parameters (spin density, T1 and T2 relaxation times)

Medical Physics Curriculum

(PHYPhs-P2) 2nd semester

3hours/week for 15 weeks (1.5 credits)

Practical Sessions

- Introduction
- Using laser beam to study single-slit &circular hole diffraction.
- Focal length of a diverging lens using a converging lens.
- Use of a spectrometer to measure the refractive index of the glass of prism
- Use of a spectrometer to measure the dispersive power of glass
- Polarization of light using the polarimeter.
- Visual evoked potential (VEP).
- Focal length of a converging lens using plane mirror; Snellen chart to test vision.
- Focal length of a converging lens by graphical method.
- Measurement of the wave length of sodium light using a diffraction grating.
- Refractive index of glass and liquid by real and apparent depth using a traveling microscope.
- Studying the reflaction &refraction using laser beam
- Erythrocyte sedimentation rate (ESR).
- Scattering of beta particles by solids absorption in aluminum

CURRICULUM OF FOUNDATIONS OF MEDICINE

Principles of Medicine Curriculum

(First Year)

Theoretical only (30 Hours - 1Hour / Week)

I- Historical review about development of medicine

- Islamic and Western medicine

- Contemporary history of health services in Iraq

II- Health and related items

1. Definition of health, disease & public health
2. Ecology of health
3. Measuring population health
4. Prevention & levels of prevention
5. Natural history of disease
6. Health & medical care
7. Health care system in Iraq
8. Environmental health: relevance & scope sanitation
9. Water & related diseases
10. Air pollution & health
11. Environment of work
12. Occupational risks associated with the job of physicians

III. Terminology

IV. First Aids