COURSE PLAN

FIRST: BASIC INFORMATION

College	
College	: Medicine
Department	: Basic Medical Sciences
Course	
Course Title	:introduction to physiology
Course Code	: 31501100
Credit Hours	2 Hours
Prerequisite	:
Instructor	
Name	: Dr. Mohammad Shaaban
Office No.	: 3
Tel (Ext)	:
E-mail	:shabaan@bau.edu.jo
Office Hours	: Sunday , Monday, Tuesday 10:00-11:00

Class Times

Building	Day	Start Time	End Time	Room No.
Lecture Hall Complex	Sunday & Thursday	12:00	1:00	2

Text Books

PHYSIOLOGY:

1. Textbook of Medical Physiology, by Guyton and Hall, 13th edition, 2016.
2. Review of Medical Physiology, by William F. Ganong, 23th edition, 2010.

SECOND: PROFESSIONAL INFORMATION

COURSE DESCRIPTION

This course focuses on the main physiological principles and laws needed to understand different topics in physiology later on. Therefore, this course tackles units includes an introduction to cell physiology (cell receptors, osmotic pressure & osmolarity, transport mechanisms, and ionic channels), body fluid and its transport in the body, Nerve and synaptic physiology and finally muscle physiology (skeletal smooth and cardiac cell). Briefly, this course makes it easier for medical students to understand the physiology of different body systems in the next two years. The course does not survey the anatomy and physiology of any of our body organs and systems.

No	Title of Lectures 1st.Week	Learning Objectives
1	**Introduction to cell physiology**	1. Understand the calculations molarity Equivalents, Molarity vs. equivalent, pH 2. Discuss 'Homeostasis' meaning, parts, properties 3. Explain Positive and Negative Feedback
2	**Cellular physiology(I)**	1. Understand the fluid mosaic model of membrane structure 2. Explain the structure of cell membrane: A. the lipid part, B. the protein part (Integral proteins & Peripheral proteins) Discuss the transport across the cell membrane: 1. Discuss Passive transport: A. Simple diffusion: Characteristics, calculation (Fick's Law) and Factors affecting it. B. Osmosis the differences between Osmolality, Osmolarity Explain plasma osmolality including way of measuring osmolality and Osmolar gap Explain meaning of Osmotic pressure including Calculating, meaning of Reflection coefficient and effective osmotic pressure, Explain meaning of Tonicity and Osmolarity vs. tonicity
No	**Title of Lectures 2nd Week**	**Learning Objectives**
3	**Cellular physiology(II)**	C. Explain Facilitated diffusion (or Uniporter carrier proteins 2. Explain Active transport A. Discuss Primary active transport B. Discuss Secondary active transport (co-transport) C. Discuss Cell membrane mediated transport (Vesicular transport)
4	**Cellular physiology(III)**	Discuss the cellular receptors and factor affecting it Discuss types of Receptors A. Internal receptors B. Cell-Surface Receptors Explain Cell communications Explain Cell signals
No	**Title of Lectures 3rd Week**	**Learning Objectives**
5	Cellular physiology(IV)	Discuss the types of second messenger Discuss Membrane channels: 1. Water channels (Aquaporins) 2. Ionic Channels Discuss Types of ionic channels 1. Sodium channels structure gates (m and h) Discuss Epithelial sodium channels
6	Cellular physiology(V)	2. Calcium channels 3. Potassium channels
No	**Title of Lectures 4th Week**	**Learning Objectives**
7	Body Fluids	Discuss Distribution of water: 1. Intracellular fluid (ICF), 2. Extra-cellular fluid (ECF) Discuss Measuring the volumes of the fluid compartments Explain Fluid movement between body compartments: a. Infusion of isotonic NaCl (addition of isotonic fluid), b. Diarrhea-loss of isotonic fluid, c. Excessive NaCl intake-addition of NaCl, d. Sweating in a desert-loss of water Explain the ionic composition of body fluid

8	Physiology of Nerve (I)	Explain Morphology of nerve cell Explain Protein synthesis and axoplasmic transport Discuss Membrane potential is a separation of opposite charge across the plasma membrane Discuss Membrane potential is due to difference in the concentration and permeability of key ions Explain Factors affecting membrane potential: 1. Effects of Na –K pump on membrane potential 2. Effects of the movements of K alone on membrane potential: Explain Diffusion potential and Equilibrium potential: Explain the Effects of the movements of Na alone on membrane potential: Na equilibrium potential: Explain Nernst equation and Goldman Equation Is Used to calculate the Diffusion Potential
No	**Title of Lectures 5th Week**	**Learning Objectives**
9	Physiology of Nerve (II)	Explain Grading potential (local potential) Explain Resting membrane potential Explain Action potential parts Discuss Ionic basis of action potential Explain Activation and Inactivation of the Voltage Gated Sodium Channel Explain Activation and Inactivation of the Voltage Gated Potassium Channel What are the Features of graded potentials vs. action potentials Explain Re-establishing Sodium and Potassium ionic grading after action potentials are completed
10	Physiology of Nerve (III)	Explain General characteristics of nerve: 1. Explain ALL-or-none Law 2. Explain Propagation of action potentials: a. increase fiber size, b. Myelination. 3. Explain Stereotypical size and shape 4. Explain Refractory periods: a. Absolute refractory period, b. Relative refractory period Discuss Orthodromic and antidromic conduction Discuss Nerve accommodation
No	**Title of Lectures 6th Week**	**Learning Objectives**
11	Synaptic transmission (I)	Discuss Synaptic Transmission: Functional anatomy Discuss the types of synapses: 1. Electrical synaptic transmission, 2. Chemical synaptic transmission Explain General events at pre-synaptic end Explain General events at post-synaptic end:(a) Ionotrophic receptor,, (b) Metabotropic receptors Explain One way conduction Explain Chemical transmission of the synaptic activity: Explain Receptors general characteristics Discuss the Neurotransmitters types a. Small-Molecule, Rapidly Acting Transmitters

		Discuss Class I: Acetylcholine ,Class II (The Amines): Norepinephrine, Epinephrine, Dopamine, Serotonin, Histamine
12	Synaptic transmission (II)	Discuss Class III (Amino Acids): Gamma-amino butyric acid, Glycine, Glutamate, Aspartate , Class IV: Nitric oxide Discuss Input to synapses Discuss Uniform distribution of electrical potential inside the soma Discuss the synaptic summation: a. Excitatory postsynaptic potentials and Possible ionic bases, b. Inhibitory postsynaptic potentials and Possible ionic bases Discuss Some special characteristics of synaptic transmission: Fatigue of Synaptic Transmission, Effect of Acidosis or Alkalosis on Synaptic Transmission, Effect of Hypoxia on Synaptic Transmission, Effect of Drugs on Synaptic Transmission Discuss Synaptic Delay
No	**Title of Lectures 7th Week**	**Learning Objectives**
13	Autonomic Nervous System (I)	Discuss Organization of Autonomic nervous system output Discuss Sympathetic nervous system: a. Pre-ganglionic neurons of the sympathetic nervous system, b. Post-ganglionic neurons of the sympathetic nervous system Discuss Parasympathetic nervous system: a. Pre-ganglionic neurons of the parasympathetic nervous system, b. Post-ganglionic neurons of the parasympathetic nervous system Explain synergistic effect of sympathetic and parasympathetic action Neurotransmitters of the ANS
14	Autonomic Nervous System (II)	Explain Receptor types in the Autonomic nervous system output: 1. Classification of Adrenergic receptors, 2. Classification of Cholinergic receptors Numerate area of brain concerned with autonomic regulation Explain Transmission in sympathetic ganglia Explain Sympathetic and parasympathetic tone
Mid-term Exam		
No	**Title of Lectures 9th Week**	**Learning Objectives**
15	Physiology of skeletal Muscles (I)	Explain Properties of Muscle tissue What is Definition and types of Motor Unit Explain Neuromuscular junction: A. Presynaptic membrane in the distal part of the axon, B. A postsynaptic membrane of the muscle cell Explain Muscle action potential: Presynaptic neural end, Post synaptic muscular end miniature end-plate potential, End-plate potential, Explain Phases of skeletal muscle action potential: 1. Resting Phase2. Phase 0 (De-polarization), 3. Phase 1(Re-polarization) 4. Phase 2 (Hyper-polarization) Discuss Acetylcholine Receptor: Explain Myasthenia Gravis Causes Muscle Weakness
16	Physiology of skeletal Muscles (II)	Explain Transverse Tubules and sarcoplasmic reticulum system Explain Molecular Characteristics of the Contractile Filaments A. Contractile proteins actin and myosin, B. The regulatory proteins: Troponin, tropomyosin , C. The structural (accessory) proteins Titin, Nebulin, Dystrophin

		Explain Dystrophin–Glycoprotein Complex
No	**Title of Lectures 10th Week**	**Learning Objectives**
17	**Physiology of skeletal Muscles (III)**	Explain General Mechanism of Muscle contraction (Excitation–contraction coupling in skeletal muscle): 1. Travel of skeletal muscle action potential, 2. Increase cytosolic calcium concentration, 3. "Uncover" the active sites of the actin, 4. Interaction of the "Activated" Actin Filament and the Myosin Cross-Bridges Explain Chemical Events in the Motion of the Myosin Heads and Fenn effect Explain Length-tension relation in one sarcomere and hall muscle Explain force-length muscle contraction Explain Relation of Velocity of Contraction to Load
18	**Physiology of skeletal Muscles (IV)**	Explain Skeletal muscle during exercise Explain sources of energy for muscle contraction Explain Muscle Metabolic Systems in Exercise: (1) Phosphocreatine-Creatine System (2) Glycogen-Lactic Acid System, (3)Aerobic System Discuss Simple muscle twitch: 1. The latent (lag) phase, 2. In the contraction phase 3. The relaxation phase
No	**Title of Lectures 11th Week**	**Learning Objectives**
19	**Physiology of skeletal Muscles (V)**	Discuss Types of skeletal muscle fibers (skeletal myo-fiber types): Slow Fibers (Type I), Fast Fibers (Type II) Discuss Hereditary Differences between Fast-Twitch vs. Slow-Twitch Muscle Fibers Discuss the nervous system controls the amount of force our muscles produce: 1. Recruitment, 2. Rate Coding,(a. Summation & b. Complete tetanus), 3. Synchronization Discuss Treppe Discuss Isometric (Static) contractions & Isotonic contractions Explain Myoglobin Discuss Skeletal Muscle Tone and Fatigue Discuss Blood flow regulation in skeletal muscle at rest and during exercise Discuss Heat production in muscle
20	**Physiology of smooth Muscles (I)**	Discuss Structure of Smooth Muscle Discuss Physiology of Smooth Muscle: unitary or visceral smooth muscle & multiunit smooth muscle. Discuss shared characteristics of unitary or visceral smooth muscle & multiunit smooth muscle smooth muscle Discuss specific characteristics of unitary or visceral smooth muscle & multiunit smooth muscle smooth muscle Explain the Electrical activity of unitary (single-unit) or visceral smooth muscle: Resting membrane potential, Action potential
No	**Title of Lectures 12th Week**	**Learning Objectives**
21	Physiology of smooth Muscles (II)	Explain the Ionic basis of Electrical activity of unitary (single-unit) or visceral smooth muscle Explain the Molecular basis of smooth muscle contraction and Relaxation

		Explain the Comparison of Smooth Muscle Contraction and Skeletal Muscle Contraction: (1) Slow Cycling of the Myosin Cross-Bridges, (2) Low Energy Requirement to Sustain Smooth Muscle Contraction (3) Slowness of Onset of Contraction and Relaxation of the Total Smooth Muscle Tissue(4) The Maximum Force of Contraction Is Often Greater in Smooth Muscle Than in Skeletal Muscle (5) The "Latch" Mechanism Facilitates Prolonged Holding of Contractions of Smooth Muscle
22	Mechanisms of Capillary Exchange	Discuss Route across endothelial cells 1. Discuss Diffusion: Factors that affect diffusion a. Lipid-Soluble Substances Diffuse Directly Through the Cell Membranes of the Capillary Endothelium, b. Effect of Concentration Difference on Net Rate of Diffusion through the Capillary Membrane, c. Capillary density 2. Discuss Water-Soluble, Non–Lipid-Soluble Substances Diffuse Through, A. Intercellular "Pores" in the Capillary Membrane (Fenestrated capillaries), B. Intercellular clefts between the endothelial cells (continuous capillaries) 3. Discuss Transcytosis (Vesicular Transport) Explain Interstitium & interstitial fluid: "Gel" in the Interstitium and "Free" Fluid in the Interstitium.
No	**Title of Lectures 13th Week**	**Learning Objectives**
23	**Starling Forces(I)**	Explain The difference between diffusion and filtration Explain Starling Forces Explain The permeability-surface area coefficient Explain Reflection coefficient Explain Capillary plasma colloid osmotic pressure and The Gibbs-Donnan effect Discuss Interstitial fluid colloid osmotic pressure Discuss Capillary hydrostatic pressure Discuss Tissue (Interstitial) Pressure
24	**Starling Forces(II)**	Explain Significance of negative interstitial fluid pressure as a means for holding the body tissues together Explain the Functions of the lymphatic system Explain The lymphatic system plays a key role in controlling interstitial fluid protein concentration, volume, and pressure: Explain the Effect of Interstitial Fluid Pressure on Lymph Flow Discuss The terminal lymphatic capillary Pump Discuss Lymphatic Pump Increases Lymph Flow Discuss Pumping causes by external intermittent compression of lymphatic Discuss Intracellular Edema
No	**Title of Lectures 14th Week**	**Learning Objectives**
25	**Starling Forces(III)**	Discuss Extracellular Edema Discuss how Lymphatic Blockage Causes Edema Discuss Safety Factors That Normally Prevent Edema

		(1) Low compliance of the interstitium when interstitial fluid pressure is in the negative pressure range, (2) The ability of lymph flow to increase 10-to 50-fold, (3) "Wash-down" of interstitial fluid protein concentration, which reduces interstitial fluid colloid osmotic pressure as capillary filtration increases. Importance of the proteoglycan filaments as a "Spacer" for the cells and in preventing rapid flow of fluid in the tissues.
26	**Starling Forces(IV)**	Discuss Factors That Can Increase Capillary Filtration Discuss capillary exchange of fluid in the lung and pulmonary interstitial fluid dynamics Discuss Interrelations between Interstitial Fluid Pressure and Other Pressures in the Lung Discuss Negative Pulmonary Interstitial Pressure and the Mechanism for Keeping the Alveoli "Dry." Discuss Safety Factors Preventing Pulmonary Edema

COURSE OBJECTIVES

COURSE LEARNING OUTCOMES

1) Knowledge and Understanding
   1. The student should be able to deal with different types of unites in physiology
   2. The student should be able to understand the basics of the cell physiological functions
   3. The student should be able to understand different physiological functions of nerve cell
   4. The student should be able to understand different physiological functions of synapses
   5. The student should be able to understand different physiological functions of skeletal muscle
   6. The student should be able to understand different physiological functions of smooth muscle
2) Professional Skills
   Deal with unit in physiology
3) Competences (Transferable skill and attributes)
   The student now able to apply the knowledge in autonomic system to all body system
   The student now able to apply the knowledge fluid in renal system latter

COURSE SYLLABUS

COURSE LEARNING RESOURCES

Lectures, video sessions and seminars.

ONLINE RESOURCES

This system is taught by one staff.

The staff is free to give online links to the students as learning resources.

ASSESSMANT TOOLS

ASSESSMENT TOOLS	%
Mid Exam (Theory)	35
Final Exam (Theory)	65
TOTAL MARKS	100

THIRD: COURSE RULES

ATTENDANCE RULES

Attendance and participation are extremely important, in this aspect the university rules will be applied. Attendance will be recorded by the instructor for each class. Maximum allowed absence is 15% of the course.

GRADING SYSTEM

Example:

A	**4**
A-	**3.75**
B+	**3.5**
B	**3**
B-	**2.75**
C+	**2.5**
C	**2**
C-	**1.75**
D+	**1.5**
D	**1**
D-	**0.75**
F	**0.5**

REMARKS

No eating or drinking or taking is allowed in the lecture room
All student should attend the lecture room on time any delay is NOT allowed
Use of Mobile Devices During Class is prohibited. Therefore students are required to turn off their mobile devices.

COURSE COORDINATOR

Course Coordinator: Dr. Riadh Al ramadani - Department of Basic Sciences	
Signature:	**Signature:**
Date:	**Date:**