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| **Mutah University**  **Academic Development & Quality Assurance Center** |
| **COURSE PLAN SPECIFICATION FORM**  **Course: General Physiology Faculty: Faculty of Medicine**  **Department: Biochemistry and Physiology**  **Academic Year: 2020-2021** |

1. **Course Specification & General Information:**

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| * **University: Mutah University** | * **Course Title: General Physiology** |
| * **College: Faculty of Medicine** | * **Code: 1502101** |
| * **Department: Biochemistry & Physiology** | * **Credit Hours: 3 hours** |
| * **Academic Year: 2020/2021 (Second semester)** | * **Instructor: Department Teaching Staff** |
| * **Office Hours: 45 hours** | * **Course Level: 1st year Medical Students** |

1. **Course Description:**

It is essential that all medical students receive sufficient exposure to the physiological concepts that provide the foundations needed for further studies in pharmacology, pathology, pathophysiology, and medicine.

The mechanisms of deranged function associated with any disease process cannot be appreciated without an in-depth understanding of basic biophysical and physiological mechanisms.

This course is designed to introduce and familiarize first-year medical students with basic definitions and principles related to physiology as a study of the living body at molecular, cellular as well as the level of intact organism. Fundamentals of physiological principles and the concept of internal environment and homeostasis, some examples of homeostatic mechanisms of the major functional systems and various control systems that are utilized by different organs to regulate various physiological functions are also emphasized. The functions of the nervous, muscular, respiratory, urinary and circulatory system are discussed.

The course objectives are focused primarily on normal body function. However, it is recognized that this material must be presented in a context that prepares students for their roles as physicians. Accordingly, clinical examples are used in this course to illustrate the underlying physiological principles.

1. **Objectives and Expected Learning Outcomes**
   1. To introduce and familiarize students with basic definitions and principles related to physiology as a study of the living body at molecular, cellular as well as the level of intact organism.
   2. To introduce the concept of internal environment and homeostasis with the presentation of some examples of homeostatic mechanisms of the major systems.
   3. To describe the principles and mechanisms that governs the movement of body fluids across different body membranes.
   4. To describe the electrical and ionic events that underline the excitation of reactive tissues as well as the mechanism underlying different muscle contraction.
   5. To cover the general organization and the functional aspect of the autonomic nervous system.
   6. To discuss the motor and sensory function of the nervous system.
   7. To describe the general organization and function of cardiovascular, respiratory, and renal system.
   8. Understand the role of both the kidney and the lungs in the regulation of hydrogen ions and bicarbonate buffer system.
2. **Course Plan Distribution& Learning Resources**

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| **Lectures** | **Topics to be Covered** |
| **(1-2)**  **2 L** | **Introduction, Homeostasis and Control system**   * Introduction to physiology * Homeostatic mechanisms and the relationship between homeostasis and disease * The internal environment (extracellular fluid) * The control systems of the body a- negative feedback   b- positive feedback |
| **(3-6)**  **4 L** | **Cell Membrane & Cellular Transport Mechanisms**   * General characteristics of cell membrane * Transport of ions and molecules through the cell membrane a- Diffusion (simple and facilitated)   1. Osmosis   2. Active transport (Primary, co-transport, and counter-transport)   3. Filtration   4. Vesicular Transport (phagocytosis and pinocytosis) |
| **(7-10)**  **4 L** | **Body Fluid, Fluid Compartments, Osmolality & Fluid Shift**   * Body fluid (Total, Compartments, Measurement of body fluid volumes) * Basic principles of osmosis and osmotic pressure * Equilibrium when a change occurs in the volumes and osmolarities and how to calculate fluid shifts * Edema   1. intracellular   2. extracellular |

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| **(11-16)**  **6 L** | **Excitable Membrane Physiology**   * Origin of bioelectric potentials (The Donnan effect and Gibbs- Donnan equation) * Ionic bases of the resting membrane potential (RMP) (Nerve and Muscles) * Calculation of the RMP using Nernst equation and Goldman- Hodgkin-Katz (GHK) equation * Ionic bases of action potential (Na, K, and Ca gates) and its properties   1. Nerve action potential   2. Skeletal muscle action potential   3. Smooth muscle action potential   4. Cardiac muscle action potential (five phases)      1. non-pacemaker action potential      2. pacemaker action potential * Propagation of action potential (nerve and muscle), serial versus salutatory conduction. * The refractory period (nerve, skeletal muscle, cardiac muscle, and smooth muscle) * Chemical synaptic transmission and synaptic potentials * Neuromuscular junction and neuromuscular transmission * The end plate potential and its ionic bases |
| **(17-20) 4L** | **Muscular Physiology**   * The all or none law for excitation and contraction * The excitation contraction coupling and molecular bases of skeletal muscle contraction (role of Ca2+, troponin, and tropomyosin) * Mechanics of muscle contraction (isometric, isotonic, and auxotonic contraction) * Force-velocity relationship and length-tension relationship * Summation of contraction (clonus and tetanization) * Smooth muscle contraction (neural and hormonal control) * The motor unit and recruitment technique * Resting tension (tone) in the three types of muscles |
| **(21-23) 3L** | **Autonomic Nervous System**   * Introduction and general organization * Chemical transmission of autonomic junctions (cholinergic and adrenergic transmission) * Types of cholinergic and adrenergic receptors * Effect of sympathetic and parasympathetic stimulation on specific visceral organs * Autonomic reflexes and their role in the regulation of visceral functions |

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| **(24-29)**  **6 L** | **Sensory , Motor, and Integrative Nervous System**   * Functions and organization of nervous system. * Locations and functions of cerebrospinal fluid and the blood-brain barrier. * Brain & Brainstem.   1. Cerebral cortex areas and their functions.   2. Learning and Memory   3. Basal ganglia, cerebellum, thalamus and hypothalamus, and Limbic system.   4. Reticular activating system, Wakefulness, Sleep and it’s type.   5. Electroencephalogram(EEG). * Spinal cord and Peripheral nerves   1. Reflexes (reflex arc & types of reflexes)   2. Clinical significance of dermatomes and myotomes   3. Principal sensory and motor tracts of the spinal cord.   4. Spinal cord Transection.   5. Cranial nerves; name, number, type, location and function. * Sensory modalities, sensory pathway, sensory receptors. * Somatic sensations; Tactile, Thermal, Pain (and referred pain), itch,   and proprioception. |
| **(30-41)**  **12 L** | **Cardio Vascular System (CVS)**   * Overview of the CVS * The myocardium versus the skeletal muscle * The concept of the preload, afterload, and the myocardial contractility * The Frank-Starling low of the heart * The contractility and Ca2+ kinetics * The cardiac cycle and cardiac output * The heart sound and murmurs * The electrical activity of the heart * The electrocardiography (ECG) * The control of heart rate and cardiac arrhythmias * Hemodynamics   1. Blood pressure and blood flow   2. Microcirculation and lymphatics |
| **(42-45)**  **4 L** | **Respiratory and Renal Systems and Their Role in Acid-Base Balance**   * Overview of the respiratory system * Mechanical aspects of breathing * Pulmonary ventilation versus alveolar ventilation * Gas diffusion and gas transport (O2 and CO2) * Hypoxia and asphyxia * Regulation of respiration (chemical versus non-chemical control) * Blood pH and the buffer systems of the body * Role of the lung in acidosis and alkalosis * Overview of the renal system |

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|  | - Role of the kidneys in acidosis and alkalosis |
| **Learning resources (Textbooks)** | |
| **1.** | Guyton and Hall Textbook of Medical Physiology. John E. Hall (PhD).  13th Edition (2015). ISBN: 978-1455770052 |
| **2.** | Ganong's Review of Medical Physiology. Kim E. Barrett , Susan M. Barman, Scott Boitano, and Heddwen Brooks. 25th Edition (2015)  ISBN-13: 978-0071825108 |
| **3.** | Medical Physiology: Principles for Clinical Medicine. Rodney A.  Rhoades and David R. Bell. 4th Edition (2012). ISBN: 978-1609134273 |
|  | **Other learning resources (Reference Books)** |
| **1.** | Principles of Human Physiology. Cindy L. Stanfield. 5th Edition (2012)  ISBN: 978-0321819345 |
| **2.** | Medical Physiology. Walter F. Boron, Emile L. Boulpaep. 2nd Updated  Edition (2012). ISBN: 978-1437717532 |

1. **Teaching strategies to be used to develop that knowledge**

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| **No.** | **Teaching strategies** |
| **1** | Lectures. |
| **2** | Discussions. |

1. **Methods of assessment**

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| **No.** | **Assessment task** | **Proportion of Final Assessment** |
| **1.** | Midterm Exam (MCQ) | 40% of total mark |
| **2.** | Final Exam (MCQ) | 60% of total mark |
| **Total** | | **(100%)** |

1. **General Instructions:**

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| **No** | **Additional Notes, office hours, attendance policy, etc….** |
| **1.** | All university roles are adopted strictly by the department |
| **2.** | Unjustified absence during the course can lead to exemption from  attending the exams |