

Midland College
Master Syllabus
RSPT 1340
Advanced Cardiopulmonary Anatomy and Physiology

Course Description

An advanced presentation of the anatomy and physiology of the cardiovascular and pulmonary systems.

Purpose

Explain advanced concepts of cardiopulmonary anatomy and physiology; describe the neurological control of breathing; differentiate ventilation/perfusion concepts, to include acid-base balance with classification; and summarize principles of gas transport.

Text, References, and Supplies:

Des Jardins, *Cardiopulmonary Anatomy and Physiology*, 7th Edition. Delmar. 2020.
Kacmarek, *Egan's Fundamentals of Respiratory Care*. 12th Edition. Elsevier. 2021.

Students MUST actively participate by completing an academic assignment required by the instructor by the official census date. Students who do not actively participate in an academically-related activity will be reported as never attended and dropped from the course.

Disclaimer

The instructor reserves the right to make modifications to this course throughout the semester.

Course Goals/ Objectives:

- I. Identify and understand the anatomy and physiology of the **respiratory system**
 - A. Describe the four major components and the primary functions of the upper airways
 - B. Identify the structures and the three primary functions of the nose
 - C. Identify the structures and function of the upper airways and pharynx
 - D. Describe the structure and function of the larynx.
 - E. Discuss the structure and function of the tracheobronchial tree.
 - F. Identify the location and structure of the cartilaginous and non-cartilaginous airways
 - G. Describe the structure and function of the bronchial blood supply
 - H. Describe the sites of gas exchange including structure and function
 - I. Describe the structure and function of the pulmonary vascular system
 - J. Discuss the structure and function of the lymphatic system
 - K. Identify the effects of the sympathetic and parasympathetic nervous system have on the following: heart, bronchial smooth muscle, bronchial glands, salivary glands, stomach, intestines, and eyes.
 - L. Identify the structures of the lung and lung segments from the anterior, posterior, lateral, and medial views.
 - M. Identify the components of the mediastinum
 - N. Identify the components of the pleural membranes
 - O. Identify the components of the bony thorax

- P. Describe the structure and function of the diaphragm
 - Q. Describe the structure and function of the accessory muscles of expiration and inspiration.
- II. Describe ventilation
- A. Define ventilation
 - B. Explain the role of atmospheric pressure, pressure gradients, and Boyle's law on pulmonary ventilation.
 - C. Differentiate between the following pressure gradients across the lung: driving pressure, trans respiratory pressure, transmural pressure, transpulmonary pressure, and transthoracic pressure.
 - D. Describe how the primary mechanisms of ventilation are applied to the human airways and include the excursion of the diaphragm and the effects on pleural pressure, intra-alveolar pressure, and bronchial gas flow during: inspiration, end-inspiration, expiration, end-expiration.
 - E. Describe the elastic properties of the lung and chest wall
 - F. Define lung compliance
 - G. Calculate lung compliance
 - H. List respiratory disorders that cause a deficiency of pulmonary surfactant
 - I. Describe how Poiseuille's law arranged for flow and Poiseuille's law arranged for pressure relate to the radius of the bronchial airways.
 - J. Define airway resistance and explain how it relates to laminar flow, turbulent flow, and tracheobronchial or transitional flow.
 - K. Calculate airway resistance
 - L. Define time constants and explain how they relate to alveolar units
 - M. Explain the meaning of dynamic compliance.
 - N. Differentiation between alveolar ventilation and dead space ventilation
 - O. Calculate an individual's alveolar ventilation when given the following information: alveolar ventilation, dead space ventilation, and breaths per minute.
 - P. Describe how the normal pleural pressure differences cause regional differences in normal lung ventilation.
 - Q. Describe how the decreased lung compliance and increased airway resistance alter the ventilatory pattern
 - R. Describe breathing conditions frequently seen by respiratory care therapists in the clinical setting.
- III. Identify lung volumes and capacities
- A. Differentiate between different lung volumes and capacities
- IV. Discuss diffusion of pulmonary gases
- A. Describe Dalton's Law
 - B. Explain how Dalton's law relates to the partial pressure of atmospheric pressure

- C. Identify the percentage and partial pressure of the gases that compose the barometric pressure
 - D. Differentiate between pressure gradients and diffusion gradients
 - E. Identify the partial pressure of the gases in the air, alveoli, and blood
 - F. Calculate ideal alveolar gas equation
 - G. Name the nine major structures of the alveolar-capillary membrane through which a gas molecule must diffuse.
 - H. Describe how oxygen and carbon dioxide normally diffuse across the alveolar-capillary membrane
 - I. Explain how Fick's law relates to gas diffusion
 - J. Describe how Henry's law and Graham's law relate to the diffusion constants in Fick's law.
 - K. Define perfusion limited, and explain how it relates to a gas such as nitrous oxide
 - L. Define diffusion limited and explain how it relates to a gas such as carbon monoxide
 - M. Describe how oxygen can be classified as perfusion or diffusion limited
- V. Identify components of the **circulatory system**
- A. Describe the functions of the various components of the circulatory system
 - B. Describe how blood flows through the heart
 - C. Explain the neural control of the vascular system
 - D. Discuss the distribution of blood flow in the lungs
 - E. Explain cardiac output
 - F. Discuss pulmonary vascular resistance
- VI. Describe oxygen transport and carbon dioxide transport
- A. Calculate the quantity of oxygen that dissolves in the plasma of blood
 - B. Describe the major features of hemoglobin
 - C. Calculate the quantity of oxygen that combines with hemoglobin
 - D. Describe how the percentage of hemoglobin bound to oxygen, oxygen pressure, and oxygen content relate to the oxyhemoglobin dissociation curve
 - E. Describe the clinical significance of the flat portion of the oxyhemoglobin dissociation curve
 - F. Identify the factors that shift the oxyhemoglobin curve to the right
 - G. Identify the factors that shift the oxyhemoglobin curve to the left
 - H. Explain the clinical significance of a right or left shift of the oxyhemoglobin dissociation curve with regard to the loading of the oxygen in the lungs and unloading of oxygen at the tissues.
 - I. Perform the following oxygen transport calculations: total oxygen delivery, arterial-venous oxygen content difference, oxygen consumption, oxygen extraction ratio, and mixed venous oxygen saturation.
 - J. Identify factors that increase and decrease the oxygen transport calculations
 - K. Differentiate between the forms of pulmonary shunting
 - L. Describe the differences between hypoxemia and hypoxia
 - M. Define the four main types of tissue hypoxia
 - N. Explain the meaning of cyanosis
 - O. List the three ways in which carbon dioxide is transported in the plasma
 - P. List three ways in which carbon dioxide is transported in the red blood cells.
 - Q. Describe how carbon dioxide is converted to HCO_3^- at the tissue sites and then

- transported in the plasma to the lungs
 - R. Explain how carbon dioxide is eliminated in the lungs
 - S. Describe how the carbon dioxide dissociation curve differs from the oxyhemoglobin dissociation curve.
 - T. Explain how the Haldane effect relates to the carbon dioxide dissociation curve.
- VII. Describe acid/base balance
- A. Identify common causes of acute ventilatory failure
 - B. Identify common causes of acute alveolar hyperventilation
 - C. Identify common causes of metabolic acidosis
 - D. Identify common causes of metabolic alkalosis
 - E. Describe base excess/deficit
- VIII. Discuss ventilation/perfusion relationships
- A. Describe the ventilation/perfusion ratio
 - B. Describe the overall ventilation-perfusion ratio in the normal upright lung
 - C. Describe how an increased and decreased ventilation-perfusion ratio affects alveolar gases.
 - D. Describe how the ventilation-perfusion ratio affects end-capillary gases and the pH level
 - E. Define respiratory quotient
 - F. Define respiratory Exchange ratio
 - G. Identify respiratory disorders that increase the ventilation-perfusion ratio
 - H. Identify respiratory disorders that decrease the ventilation-perfusion ratio.
- IX. Explain neural control of ventilation
- A. Describe the major areas of the body that influence breathing
 - B. Describe the important factors that influence breathing
- X. Discuss the effects of aging on the cardiopulmonary system
- XI. Discuss the Electrophysiology of the Heart
- A. Describe the properties of the cardiac muscle, including automaticity, excitability, conductivity, and contractibility.
 - B. Describe the cardiac effects of the sympathetic nervous system and the parasympathetic nervous system.
- XII. Explain the standard 12-lead ECG system and Identify the components of an ECG
- XIII. Interpret various ECGs
- XIV. Identify structures of the **renal system**
- A. Describe how the following relate the kidney: hilum, ureters, cortex, medulla, renal pelvis, major calyces, minor calyces, renal papillae, renal pyramid, and nephrons
 - B. Describe how the following relate to the nephron: glomerulus, proximal tubule, loop of Henle, distal tubule, Bowman's capsule, renal corpuscle, proximal convoluted tubule, descending limb of the loop of Henle, ascending limb of the loop of Henle, distal convoluted tube and the collecting duct.
 - C. Explain how the blood vessels relate to the nephron

- D. Describe the formation of urine
 - E. Explain the control of urine concentration and volume
 - F. Describe the role of the kidneys in regulating sodium, potassium, calcium, magnesium, phosphate, and acid-base balance.
 - G. Identify common causes of renal disorders
 - H. Describe cardiopulmonary problems that develop with renal failure.
- XV. Discuss the effects of exercise on the cardiopulmonary system
- XVI. Discuss high altitude effects on the cardiopulmonary system
- XVII. Discuss high pressure environments effects on the cardiopulmonary system

Evaluation Method:

Attendance **5%**

Exams **50%**

- Exam 1
- Exam 2
- Exam 3
- Exam 4
- Exam 5
- Exam 6

Quizzes **10%**

- Quiz 1
- Quiz 2
- Quiz 3
- Quiz 4
- Quiz 5
- Quiz 6

Worksheets **15%**

Final Examination **20%**

A written final examination will be administered during the scheduled finals week. It will be comprehensive for the entire semester classes.

Each student is expected to take exams as scheduled. If an exam is missed for any reason, the student must take the exam on the student's first day back on campus or a grade of "0" will be recorded for the missed exam. Ten percent will automatically be deducted from the make-up exam score. No more than two exams per semester may be made-up (for each course). Exams may not be taken early in any class. Final exams must be taken at the scheduled time without exception.

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All final exams must be taken to proceed within the respiratory care program.

Grading Standards:

<u>A</u>	<u>90-100%</u>
<u>B</u>	<u>80-89%</u>
<u>C</u>	<u>70-79%</u>
<u>D</u>	<u><70%</u>

Student Contributions and Class Policies

Each student will spend at least 4 hours per week preparing for class. Attendance is critical in this class. The college attendance policy will be followed.

All classroom performance and behavior will be considered academic.

Advising

Any student that scores below a 70 on an exam is responsible for emailing the instructor and scheduling an advising session within 24 hours of the exam review.

Make Up exam Policy

Each student is expected to take exams as scheduled. If an exam is missed for any reason, the student must take the exam on the student's first day back on campus or a grade of "0" will be recorded for the missed exam. Ten percent will automatically be deducted from the make-up exam score. No more than two exams per semester may be made-up (for each course). Exams may not be taken early in any class.

All personal communication devices are to be placed on silence/vibrate during class time. If you must answer your device, please leave the immediate area.

No personal communication devices allowed in testing areas.

Scholastic Dishonesty and Academic Misconduct

The Midland College Policy will be followed.

Course Schedule:

The class meets for 3 lecture hours per week. 1 1/2 hours each on Monday/Wednesday from 9:00 – 10:20

Division Information:

Division Chairman: Miranda Poage, PhD

Division Office Location and Telephone: 208, 685-4600

AMERICANS WITH DISABILITIES ACT (ADA) Statement:

Midland College provides services for students with disabilities through Student Services. In order to receive accommodations, students must visit www.midland.edu/accommodation and complete the Application for Accommodation Services located under the Apply for Accommodations tab. Services or accommodations are not automatic, each student must apply and be approved to receive them. All documentation submitted will be reviewed and a "Notice of Accommodations" letter will be sent to

instructors outlining any reasonable accommodations.

NON-DISCRIMINATION STATEMENT:

Midland College does not discriminate on the basis of race, color, national origin, sex, disability or age in its program and activities. The following individuals have been designated to handle inquiries regarding the non-discrimination policies:

Wendy A. Kane

Dean of Student Life

Midland College

Title IX Coordinator/Compliance Officer

3600 N. Garfield, SSC 131

Midland, TX 79705

(432) 685-4781

Title9@midland.edu

For further information on notice of non-discrimination, visit the ED.gov Office of Civil Rights website, or call 1 (800) 421-3481.

Licensure Eligibility Notification

Completion of Midland College degrees and/or certificates does not guarantee eligibility to take a certification/registry/licensure examination. The eligibility of each person is determined on an individual basis by the regulatory body of the specific discipline. If you have a conviction of a crime other than a minor traffic violation, physical or mental disability/illness, hospitalization/treatment for chemical dependency within the past five years, current intemperate use of drugs or alcohol or a previous denial of a licensure or action by a licensing authority, you will need to contact the specific regulatory body for an individual ruling. Some programs require a criminal background check and urine and drug screen.