Miami Dade College

Course Description

RET1484 | Respiratory Care Pathophysiology 1 | 2.00 credits

This is an introductory course in the study of pulmonary and cardiovascular anatomy, physiology and pathology. Students will learn terminology, disease classification, diagnostic techniques and related physiological concepts. Prerequisite: ENC1101. Corequisite: RET1024.

Course Competencies

Competency 1: The student will describe the anatomy and physiology of the respiratory system, the process of ventilation in the human lung, the diffusion of pulmonary gases, the anatomy and physiology of the circulatory system, oxygen and carbon dioxide transport, acid-base balance and regulation (and the effect of pathology on the process), ventilation-perfusion relationships and the effect of pulmonary pathology on that process, neural control of ventilation in the healthy adult, fetal development of the cardiopulmonary system and the effects of aging on the cardiopulmonary system by:

1. Describing the four major components and the primary functions of the upper airways
2. Identifying the major structures and the three primary functions of the nose
3. Identifying the structures and function of the upper airways and pharynx
4. Discussing the structure and function of the tracheobronchial tree
5. Identifying the location of the cartilaginous and non-cartilaginous airways
6. Describing the structure and function of the bronchial blood supply and pulmonary vascular system
7. Describing the sites of gas exchange, including the structure and function
8. Identifying the effects the sympathetic and parasympathetic nervous systems have on the following: heart, bronchial smooth muscle, bronchial glands, salivary glands, stomach, intestines, and eyes
9. Identifying the structures of the lungs and lung segments from the anterior, posterior, lateral, and medial views
10. Identifying the components of the mediastinum, pleural membranes, and bony thorax
11. Describing the structure and function of the diaphragm and accessory muscles of expiration and inspiration Ventilation
12. Defining ventilation
13. Explaining the role of atmospheric pressure, pressure gradients, and Boyle's law on pulmonary ventilation
14. Differentiating between the following pressure gradients across the lungs: driving pressure, trans-respiratory pressure, transmural pressure, and transthoracic pressure
15. Describing how the primary mechanisms of ventilation are applied to the human airways, including the excursion of the diaphragm and the effects on pleural pressure, intra-alveolar pressure, and gas flow during inspiration, end-inspiration, expiration, and end-expiration
16. Describing the elastic properties of the lung and chest wall
17. Defining and calculating lung compliance
18. Listing respiratory disorders that cause a deficiency of pulmonary surfactant
19. Describe how Poiseuille's law arranged for flow and Poiseuille's law arranged for pressure related to the radius of the bronchial airways.
20. Defining airway resistance and explaining how it relates to laminar flow, turbulent flow, and tracheobronchial or transitional flow.
21. Calculating airway resistance.
22. Defining time constants and explaining how they relate to alveolar units.
23. Explaining the meaning of dynamic compliance.
24. Differentiating between alveolar ventilation and dead space ventilation.
25. Describe how the depth and rate of breathing affect alveolar ventilation.
26. Calculating an individual's alveolar ventilation when given the following information: alveolar ventilation, dead space ventilation, and breaths per minute.
27. Describing how the average pleural pressure differences cause regional differences in normal lung ventilation.

28. Describe how the decreased lung compliance and increased airway resistance alter the ventilatory pattern.
29. Describing breathing conditions frequently seen by respiratory care therapists in clinical settings.
30. Diffusion of Pulmonary Gases
31. Describe Dalton's law and explain how Dalton's law relates to the partial pressure of atmospheric gases.
32. Identifying the percentage and partial pressure of the gases that compose the barometric pressure.
33. Differentiating between pressure gradients and diffusion gradients.
34. Identifying the partial pressure of the gases in the air, alveoli, and blood. 5. Calculating the ideal alveolar gas equation.
35. Describe how oxygen and carbon dioxide normally diffuse across the alveolar-capillary membrane.
36. Explaining how Fick's law relates to gas diffusion.
37. Describe how Henry's and Graham's laws relate to the diffusion constants in Fick's law.
38. Defining perfusion limited and explaining how it relates to a gas such as nitrous oxide.
39. Defining diffusion limited and explaining how it relates to a gas such as carbon monoxide.
40. Describing how oxygen can be classified as perfusion or diffusion limited.
41. Anatomy & Physiology of the Circulatory System
42. Describing the function of the following specialized cells (formed elements) in the plasma: red blood cells (erythrocytes), white blood cells (leukocytes), and platelets (thrombocytes).
43. Describing the structure and function of the components of the heart.
44. Describing the function of the major components of the pericardium.
45. Describing the significant components of the heart wall, the blood supply of the heart, how blood flows through the heart, and the components of the pulmonary and systemic vascular systems.
46. Explaining the neural control of the vascular system.
47. Describing the function of the baroreceptors.
48. Differentiating between the following types of pressures: intravascular pressure, transmural pressure, and driving pressure.
49. Describing how ventricular systole and ventricular diastole relate to the cardiac cycle and blood pressure.
50. Listing the intraluminal blood pressures throughout the pulmonary and systemic vascular systems.
51. Describing how blood volume affects blood pressure.
52. Describing the influence of gravity on blood flow.
53. Defining the determinants of cardiac output.
54. Defining vascular resistance.
55. Oxygen & Carbon Dioxide Transport
56. Calculating the quantity of oxygen that dissolves in the blood's plasma.
57. Describing the significant features of hemoglobin.
58. Calculating the quantity of oxygen that combines with hemoglobin.
59. Describe how the percentage of hemoglobin bound to oxygen, oxygen pressure, and oxygen content relate to the oxyhemoglobin dissociation curve.
60. Describing the clinical significance of the flat portion of the oxyhemoglobin dissociation curve. Identifying the factors that shift the oxyhemoglobin dissociation curve to the right.
61. Identifying the factors that shift the oxyhemoglobin dissociation curve to the left.
62. Explaining the clinical significance of a right or left shift of the oxyhemoglobin dissociation curve about the loading of oxygen in the lungs and the unloading of oxygen in the tissues.
63. Performing the following oxygen transport calculations: total oxygen delivery, arterial-venous oxygen content difference, oxygen consumption, oxygen extraction ratio, and mixed venous oxygen saturation.
64. Identifying the factors that increase and decrease the oxygen transport calculations.
65. Differentiating between the forms of pulmonary shunting.
66. Describing the differences between hypoxemia and hypoxia.
67. Defining the four main types of tissue hypoxia.
68. Explaining the meaning of cyanosis.
69. List the three ways carbon dioxide is transported in the plasma.
70. List the three ways carbon dioxide is transported in the red blood cells.

71. Describing how carbon dioxide is converted to HCO3 at the tissue sites and then transported in the plasma to the lungs. 18. Explaining how carbon dioxide is eliminated in the lungs.
72. Describe how the carbon dioxide dissociation curve differs from the oxyhemoglobin dissociation curve.
73. Explaining how the Haldane effect relates to the carbon dioxide dissociation curve.
74. Acid-base Balance and Regulation
75. Describing the acid-base balance and regulation of the body.
76. Identifying the following acid-base disturbances on the PCO2/HCO3/pH nomogram: acute ventilatory failure with respiratory acidosis, acute ventilatory failure with partial renal compensation, and chronic ventilatory failure with complete renal compensation.
77. Identifying common causes of acute ventilatory failure.
78. Identifying the following acid-base disturbances on the PCO2/HCO3/pH nomogram: acute alveolar hyperventilation (respiratory alkalosis), acute alveolar hyperventilation (with partial renal compensation), and chronic alveolar hyperventilation (with complete renal compensation). Identifying common causes of acute alveolar hyperventilation.
79. Identifying the following acid-base disturbances on the PCO2/HCO3/pH nomogram: metabolic acidosis, including the anion gap; metabolic acidosis with partial respiratory compensation; metabolic acidosis with complete respiratory compensation; and combined metabolic and respiratory acidosis.
80. Identifying common causes of metabolic acidosis.
81. Identifying the following acid-base disturbances on the PCO2/ HCO32/pH nomogram: metabolic alkalosis, metabolic alkalosis with partial respiratory compensation, metabolic alkalosis with complete respiratory compensation, and combined metabolic and respiratory alkalosis. 9. Identifying common causes of metabolic alkalosis.
82. Describing base excess/deficit.
83. Ventilation-Perfusion Relationships
84. Defining ventilation-perfusion ratio.
85. Describing the overall ventilation-perfusion ratio in the normal upright lung.
86. Explaining how the ventilation-perfusion ratio progressively changes from the upper to the lower lung regions in the normal upright lung.
87. Describing how an increased and decreased ventilation-perfusion ratio affects alveolar gases.
88. Describing how the ventilation-perfusion ratio affects end-capillary gases and the pH level.
89. Defining respiratory quotient.
90. Defining respiratory exchange ratio.
91. Identifying respiratory disorders that increase and decrease the ventilation-perfusion ratio.
92. Control of Ventilation
93. Describing the function of the respiratory neurons of the medullary respiratory centers.
94. Describing the influence of the pontine respiratory centers on the medullary respiratory centers.
95. Describing the major areas of the body that influence breathing.
96. Describing important factors that influence breathing.

Competency 2: The student will describe the function of the electrical conduction system of the heart and how to assess its function by ECG interpretation by

1. Electrophysiology of the Heart
2. Describing the electrophysiology of the heart, including action potential and phases 1 through 4.
3. Describing the properties of the cardiac muscle, including automaticity, excitability, conductivity, and contractility.
4. Explaining the refractory periods of the heart. 4. Identifying the major components of the conductive system of the heart.
5. Describing the cardiac effects of the sympathetic nervous system and the parasympathetic nervous system
6. 2.2 12 Lead ECG 1. Describing the components of the standard limb leads.
7. Describing how an electrical impulse of the heart is recorded when it moves toward a positive electrode, moves away from a positive electrode, and moves perpendicular to a positive and negative electrode.
8. Identifying how the left lateral leads and inferior leads monitor the frontal plane of the heart.

9. Describing the components of the precordial (chest) leads.
10. Identifying how precordial leads monitor the horizontal plane of the heart.
11. Describing the modified chest lead.
12. Explaining the normal electrocardiogram (ECG) configurations and their expected measurements
13. 2.3 ECG interpretation
14. Describing the systematic approach to ECG interpretation.
15. Explaining the P wave, PR interval, QRS complex, QRS rate, and QRS rhythm in the normal sinus rhythm.
16. Describing the P wave, PR interval, QRS complex, QRS rate, and QRS rhythm in abnormal sinus mechanisms.
17. Describing the P wave, PR interval, QRS complex, QRS rate, and QRS rhythm in abnormal atrial mechanisms.
18. Describing the P wave, PR interval, QRS complex, QRS rate, and QRS rhythm for abnormal ventricular mechanisms.
19. Describing the P wave, PR interval, QRS complex, QRS rate, and QRS rhythm in atrioventricular (AV) defects.

Competency 3: The student will describe and interpret key hemodynamic measurements by:

1. List the abbreviations and normal ranges of the following hemodynamic values directly measured using the pulmonary artery catheter: central venous pressure, right atrial pressure, mean pulmonary artery pressure, pulmonary capillary wedge pressure, and cardiac output.
2. List the abbreviations and normal ranges of the computed hemodynamic values: stroke volume, stroke volume index, cardiac index, right and left ventricular stroke work index, pulmonary vascular resistance, and systemic vascular resistance.
3. Explaining the factors that increase and decrease stroke volume, stroke volume index, cardiac output, cardiac index, right ventricular stroke work index, and left ventricular stroke work index.
4. Listing the factors that increase and decrease pulmonary vascular resistance.
5. Listing the factors that increase and decrease systemic vascular resistance.

Competency 4: The student will identify and describe renal function and failure and the effects on the Cardiopulmonary System by:

1. Describing the formation of urine.
2. Explaining the control of urine concentration and volume.
3. Describing the role of the kidneys in regulating sodium, potassium, calcium, magnesium, phosphate, and acid-base balance.
4. Describe the role of the capillary fluid shift and renal systems in controlling the blood volume.
5. Identifying common causes of renal disorders.
6. Describe how mechanical ventilation alters urinary output.
7. Describe cardiopulmonary problems that can develop with renal failure.

Learning Outcomes:

1. Communication
2. Computer / Technology Usage
3. Critical Thinking
4. Information Literacy
5. Numbers / Data