Course Information Form (CIF)

Course Code: RTT 132

Course Title: Respiratory Therapy II

Department: Allied Health
PCS Code: 1.2 - Occupational/Technical Instruction
CIP Code: 51.0908
Repeatability: 0

Effective Date: Summer 2026

Credit Hours

Catalog Notation: 4-0-4
Credit Hour Distribution:

Lecture: 4	Lab: 0	Clinical: 0	**Total: 4**

General Course Information

Catalog Description

Anatomical structures and their function in the respiratory system, the physiology of breathing, oxygen and carbon dioxide transport. Relationship of anatomical changes to clinical presentation in respiratory illness. Normal pulmonary function and the effect of changes in lung compliance and resistance on pulmonary function.

General Course Objectives

This course covers the fundamentals of the anatomy and physiology of the respiratory system of the human body. It includes a review of the structures, the mechanics of spontaneous ventilation, gas diffusion, oxygen transport, and the relationship of the cardiovascular system to the pulmonary system. The anatomical alterations that occur in common respiratory diseases are identified, and the key characteristics and treatment of the condition studied.

Minimum Placement Levels

English	Reading	Math
Placement out of ENG 099	Placement out of CCS 099	Placement out of MAT 072

Prerequisites

Concurrent enrollment in RTT 117, RTT 130, and RTT 131
Credit or concurrent enrollment in BIO 121
Admission into the Respiratory Care program

Methods of Evaluation

3-5 objective exams, 8-12 online quizzes, 10-12 written homework assignments, and a comprehensive final exam. Assignments, exams, and quizzes include objective questions, matching, short answer and essay questions, and calculations where appropriate.

Instructional Materials and Additional Supplies

Respiratory Care Anatomy and Physiology, Foundations for Clinical Practice, 978-0-323757034

Common school supplies. Internet access for online portions of the course.

Course Content

General Learning Outcomes (GLOs)

- Communication: Students will demonstrate the ability to read, write, listen, and speak effectively.
- Reasoning and Inquiry: Students will demonstrate the ability to solve problems using deductive reasoning and logic, quantitative reasoning, or the scientific method.

Course Segments and Student Learning Outcomes

Course Segment	Learning Outcomes	Lecture Hours	Lab Hours	Clinical Hours
Structures and Function of the Airway	1. Identify the structures located in the upper airway and their function. Identify the transition point in the airway from upper airway to lower airway. 2. Identify common abnormalities in the structures of the upper airway and discuss how the abnormality affects the function of the structure. Examples include sinusitis, epiglottitis, and laryngotracheobronchitis or croup. 3. Describe the clinical presentation in a subject who presents with an alteration in the upper airway structures, including vital signs, auscultation of lung sounds, and radiography findings. 4. Explain how the upper airway structures humidify inspired air, and how this compares to the ability of structures in the lower airway to humidify inspired air. 5. List the goals of artificial airway humidification when natural humidification mechanisms are bypassed by the artificial airway. 6. Explain how the large cartilaginous airways and the smaller non-cartilaginous airways remain patent or open throughout the breathing cycle. 7. Identify/define resistance. Explain why the larger upper airways normally present more resistance to airflow than the smaller airways. 8. Differentiate between conducting airways and the respiratory zone of the lungs. 9. Describe how the various physiologic lung clearance mechanisms function and interact, including the optimal conditions for effective mucociliary lung clearance. 10. Identify examples of abnormal physiologic processes that impair the effectiveness of lung clearance mechanisms. 11. Identify the structures in the respiratory zone of the lower airway and their functions. 12. Identify or describe the terminology related to the structures and functions of the upper airway and the respiratory zone. 13. Apply abnormal clinical assessment findings to identify the following common anatomical alterations and the possible respiratory problem: obstructive sleep apnea, croup, asthma, cystic fibrosis, laryngitis, sinusitis, obstructed airway, aspiration of foreign material, improperly placed endotracheal tube.	5	0	0
Structures and Functions of the Lungs and the Chest Wall	1. Identify the lobes and segments of the right and left lung. 2. Explain why the pleural membranes normally have a subatmospheric pressure between them. Explain how this subatmospheric pressure is related to lung volumes. 3. Explain how the systemic bronchial circulation in the lungs prevents alveolar gas and arterial blood oxygen pressures from being equal. 4. Describe the effects on the lungs of: a. Sympathetic stimulation, b. Parasympathetic stimulation, c. Nonadrenergic noncholinergic (NANC) nerve stimulation. 5. Explain how adrenergic and anticholinergic or muscarinic antagonists both elicit bronchodilation. 6. Identify and explain the effects a drug must have on the autonomic nervous system to mimic bronchodilation or block bronchoconstriction. 7. Describe the essential components of an effective cough and the impact on airway clearance when any component is compromised.	5	0	0

Course Segment	Learning Outcomes	Lecture Hours	Lab Hours	Clinical Hours
Structures and Functions of the Lungs and the Chest Wall (cont'd)	8. Identify the spinal cord levels that correlate with diaphragmatic nerve and accessory muscle function. Apply to patient case injury and the effect on ventilation. 9. Describe how chest inspection can reveal the presence of an abnormally high work of breathing. Apply to specific patient case presentations. 10. Identify the muscles of inspiration and expiration. Explain the functional differences between primary and accessory muscles of ventilation. 11. Define and explain terminology related to the structures and functions of the lungs as organs and the structures and function of the chest wall. 12. Evaluate abnormal clinical findings to identify the underlying structural abnormality or injury that has caused the clinical signs and symptoms for the following common respiratory conditions: impaired cough, open and closed pneumothorax, pleural effusion, pulmonary embolus, spinal cord injury, flail chest.			
Mechanics of Ventilation	1. Define ventilation. Differentiate ventilation and respiration. 2. Explain how elastic recoil forces of the lungs and chest wall interact to establish the resting lung volume. 3. Describe how the static lung volumes and capacities are influenced by changes in the elastic recoil forces of the lungs and chest wall. 4. Explain which pressure gradients maintain alveolar volume and which pressure gradient changes create airflow into and out of the lung. 5. Describe how spontaneous breathing and positive pressure mechanical ventilation are different and similar in the way they create pressure gradients throughout the respiratory cycle. 6. Identify how the rib cage, diaphragm, and abdominal components of the thorax move and interact differently under normal and abnormal conditions. 7. Explain the static and dynamic pressure-volume curves of the lungs, thorax, and lung-thorax system. 8. Explain how changes in airway resistance and lung compliance contribute to high inflation pressure during mechanical ventilation. 9. Identify and explain the factors that cause changes in lung compliance and airway resistance. 10. Describe how surface tension and pulmonary surfactant influence lung compliance, inflation pressure, alveolar stability, and work of breathing. Apply to specific patient case scenarios. 11. Define hysteresis and explain what causes the lung's pressure-volume curve to exhibit hysteresis. Apply to specific mechanical ventilation conditions. 12. Explain how to use pressure-volume and time-pressure curves to distinguish between elastic and frictional forces that oppose lung inflation. 13. Identify why greater muscular effort fails to increase expiratory flow rates under certain physical conditions. 14. Explain how compliance and resistance are related to the emptying and filling rates of the lung during breathing. 15. Describe the factors that predispose a patient to have to incomplete exhalation and trapping of positive pressure in the alveoli at the end of expiration. Include the dynamic collapse of the airways on forceful exhalation. 16. Assess and quantify the work of breathing, respiratory muscular strength, and respiratory muscular fatigue. 17. Define or explain terminology related to the mechanics of spontaneous and positive pressure breathing. 18. Assess pulmonary function test results; classify them as normal, obstructive, or restrictive; and correlate them to possible underlying lung abnormalities including atelectasis, asthma, chronic obstructive lung disease, pulmonary fibrosis, and surfactant deficiency.	6	0	0

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Ventilation	1. Identify minute ventilation, alveolar ventilation, and dead-space ventilation; explain how they are interrelated. 2. Analyze arterial blood gas carbon dioxide pressure ($PaCO_2$) values to identify the presence of hyperventilation or hypoventilation. 3. Explain how changes in alveolar ventilation affects arterial PCO_2. 4. Calculate the partial pressure of gases under dry and 100% relative humidity conditions. 5. Explain the rationale underlying the calculation of the anatomical dead space to tidal volume ratios. 6. Predict the effects of minute ventilation changes on alveolar ventilation, dead space ventilation, and $PaCO_2$. Determine the predicted $PaCO_2$ for changes in respiratory rate and tidal volume. 7. Explain how ventilatory pattern affects dead-space-to-tidal-volume ratio and the subsequent effect on alveolar ventilation and $PaCO_2$. Apply to specific patient clinical presentations and correlate with presenting clinical signs. 8. Explain the theoretical basis for measuring and calculating dead space and alveolar ventilation. 9. Explain the terminology related to ventilation. 10. Apply knowledge of minute ventilation, dead space ventilation, alveolar ventilation, and breathing pattern to identify effective and ineffective ventilation. Recommend changes in breathing pattern to maximize effective ventilation and inhaled medication deposition.	6	0	0
Pulmonary Function Measurements	1. Identify the clinical indications for performing pulmonary function testing. 2. Explain how the reference ranges for normal values of human pulmonary function values are obtained. 3. Identify why dilution or washout measurements of functional residual capacity in severe obstructive airway disease generally differ from those obtained by the plethysmographic method. 4. Explain why both restrictive and obstructive disease mechanisms reduce the vital capacity. 5. Identify why restrictive and obstructive diseases affect the functional residual capacity, the residual volume, and the work of breathing differently. 6. Differentiate between purely obstructive and restrictive patterns of pulmonary function tests. Apply knowledge to specific clinical cases to interpret pulmonary function results. 7. Explain why large and small airways resistance affects certain spirometric tests in different ways. 8. Identify why the results of some spirometric tests can be improved with greater effort, but the results of others are independent of effort. 9. Explain the principles behind the test that detects grossly uneven ventilation of the lungs. 10. Identify why individuals with severe obstructive pulmonary disease and normal healthy people differ in the relationship between maximum voluntary ventilation and ventilation attained during maximal exercise. 11. Explain the basic principles behind tests that are especially sensitive to increases in small airways resistance. 12. Identify and explain the acronyms and terms related to pulmonary function testing and the results of those tests. 13. Analyze pulmonary function test results to identify obstruction or restriction. Correlate with clinical presentation to identify the presence of lung disease. Suggest possible specific conditions that may be the cause of the abnormalities.	5	0	0

Course Segment	Learning Outcomes	Lecture Hours	Lab Hours	Clinical Hours
Pulmonary Blood Flow	1. Identify the similarities and differences in the pulmonary and systemic circulations' anatomy and function. 2. Explain how blood flow, pressure, and vascular resistance in the pulmonary circulation can be assessed through pulmonary artery catheterization. 3. Analyze the data obtained from the pulmonary artery catheter; identify the causes of high pulmonary artery pressure, including chronic hypoxemia, right heart failure, and congestive heart failure. 4. Explain how right and left ventricular pumping function can be assessed using data obtained from pulmonary artery catheterization. 5. Calculate pulmonary vascular resistance. 6. Differentiate between passive and active factors that affect pulmonary vascular resistance. 7. Explain how the pulmonary vasculature can accommodate great increases in blood flow during exercise without significantly raising blood pressure. 8. Explain why hypoxemia affects the right ventricle differently than the left ventricle. 9. Explain how hypoxic pulmonary vasoconstriction can be both beneficial and harmful. 10. Explain why the hypoxic pulmonary vasoconstriction response is diminished in certain pulmonary diseases. 11. Explain why inhaled vasodilating gases or medications can bring about beneficial physiologic changes not possible through systemic administration routes. 12. Compare and contrast the three pulmonary blood flow zones as described by West. 13. Describe how mechanical and physiologic changes can convert a blood flow zone in the lung to a different type of zone. 14. Explain why the relationship between blood flow and ventilation in an upright individual is different in the lung base than in the lung apex. 15. Describe the physiological mechanisms that cause pulmonary edema. 16. Describe or explain the terminology related to pulmonary blood flow. 17. Suggest available treatments for the conditions that cause pulmonary artery hypertension, and the supportive respiratory therapeutics that may be implemented for symptom management.	5	0	0
Diffusion of Pulmonary Gases	1. Define gas diffusion. Differentiate between diffusion and bulk gas flow. 2. Identify the percentage and partial pressure of the primary gases that compose the barometric pressure: nitrogen, oxygen, argon, and carbon dioxide. 3. Identify the partial pressure of oxygen, carbon dioxide, nitrogen, and water vapor in the air, the alveoli, and the blood. 4. Calculate the ideal alveolar gas equation. Discuss the effect of supplemental oxygen therapy on the gas in the alveolus and explain why the respiratory exchange ratio affects the calculation of the alveolar oxygen pressure. 5. Describe how oxygen and carbon dioxide normally diffuse across the alveolar-capillary membrane, and explain how Fick's law relates to gas diffusion. 6. Using Graham's Law and Henry's Law, explain the differences in the diffusion rates of oxygen and carbon dioxide in the lung. 7. Differentiate between perfusion-limited and diffusion-limited in the context of gas diffusion at the alveolar level. Explain why oxygen transfer from lung to pulmonary capillary blood is perfusion-limited but carbon monoxide transfer is diffusion-limited. 8. Explain the potential causes of perfusion limitation and diffusion limitations that result in compromised ventilation and oxygenation. 9. Explain how diffusion capacity is measured in the pulmonary function lab. Explain why carbon monoxide is the test gas. 10. Discuss the application of the diffusion capacity to the diagnosis of pulmonary disease. Explain why diffusion capacity may identify/detect oxygenation abnormalities before the abnormality is identified in an arterial blood gas. Identify conditions in which diffusion capacity may be affected. 11. Identify and explain terminology related to gas diffusion. 12. Integrate clinical assessment findings and knowledge of gas diffusion principles to identify the underlying cause of low arterial oxygen tension.	6	0	0

Course Segment	Learning Outcomes	Lecture Hours	Lab Hours	Clinical Hours
Oxygen Transport	1. Describe the role of blood plasma and erythrocytes in oxygen transport. Include discussion of the hemoglobin and blood volume. 2. Perform the following oxygen transport calculations: oxygen content, total oxygen delivery, arterial-venous oxygen content difference, oxygen consumption, oxygen extraction ratio, mixed venous oxygen saturation, and pulmonary shunting. 3. Identify the expected difference between arterial and venous oxygen content and discuss the effect of oxygen consumption and cardiac output on the actual difference. 4. Explain the relationship between oxygen content, oxygen-hemoglobin saturation, oxygen partial pressure, and hemoglobin concentration. Include in the explanation when and why pulse oximetry readings imply normal oxygenation status when the patient is hypoxic. 5. Describe how the following relate to the oxygen equilibrium curve: oxygen pressure, percentage of hemoglobin bound to oxygen, and oxygen content. Explain why the relationship produces a sigmoid-shaped curve instead of linear relationship. 6. Discuss the effect of temperature, pH, partial pressure of carbon dioxide, and 2,3-DPG on the oxygen equilibrium curve on oxygen binding and oxygen release. 7. Explain how shifting the oxygen equilibrium curve is of benefit to the patient with COPD with carbon dioxide retention. 8. Describe the clinical significance of: the flat portion of the oxygen equilibrium curve, the steep portion of the oxygen equilibrium curve, and the P50. 9. Explain why the sigmoid-shaped oxyhemoglobin curve is physiologically advantageous. 10. Discuss the effect of anemia on oxygenation status. Suggest appropriate respiratory therapy and definitive interventions to support this patient. 11. Discuss the effect of the hemoglobin variants fetal hemoglobin, methemoglobin, carboxyhemoglobin and sickle cell hemoglobin on oxygen binding and release to the body tissues. 12. Apply knowledge of the oxygen transport calculations to assess the oxygenation status of a patient in a given clinical case and identify the causes of any abnormalities. 13. Suggest clinical interventions to improve compromised oxygen delivery, including oxygen support, blood transfusion, and medication to improve cardiac function.	6	0	0
Carbon Dioxide Transport	1. Explain how blood levels of PCO2, dissolved CO2, carbonic acid, and alveolar ventilation are interrelated. 2. Explain how blood levels of CO2 play a role in the body's acid-base balance. 3. Use the CO2 hydration reaction to explain how changes in alveolar ventilation affect blood levels of CO2 and hydrogen ions. 4. Explain why equal CO2 production and elimination rates can coexist with normal ventilation, hypoventilation, or hyperventilation. 5. Explain how CO2 is transported in different ways in the blood plasma and erythrocytes. 6. Identify how hemoglobin in the erythrocyte helps generate plasma bicarbonate ions. 7. Explain how the Bohr and Haldane effects are mutually enhancing with regard to oxygen and carbon dioxide transport. 8. Identify or explain the terminology related to carbon dioxide equilibrium and transport. 9. Correlate the clinical respiratory assessment findings with the underlying cause for subjects presenting with a respiratory acidosis or respiratory alkalosis, and the role of ventilation in correcting a metabolic acidosis or metabolic alkalosis. 10. Explain how hypercapnia (increased blood levels of carbon dioxide) may be beneficial as a ventilation strategy in COPD. 11. Discuss how monitoring end-tidal CO2 may be used in managing mechanical ventilation and the effects of sedation or pain medications. 12. Explain the effects of intravenous sodium bicarbonate during resuscitation on intracellular acidosis, cardiac output, and oxygen release.	4	0	0

Course Segment	Learning Outcomes	Lecture Hours	Lab Hours	Clinical Hours
Control of Ventilation	1. Explain how the medullary respiratory center generates the basic breathing pattern. 2. Describe how the medullary respiratory neurons and pontine centers interact. 3. Explain how various reflexes and receptors affect ventilation, including: a. the Hering-Breuer inflation reflex, b. J-receptors and proprioceptors, and c. muscle spindles. 4. Identify how CO2 indirectly stimulates the medullary chemoreceptors. 5. Explain why high arterial PCO2 more readily stimulates the central chemoreceptors than high arterial levels of metabolically produced fixed acid. 6. Explain why arterial PCO2 is a more appropriate controller of ventilation than arterial PO2. 7. Explain why hypoxemia plays a more important role in regulating ventilation in patients with chronically high PaCO2 than patients with normal PaCO2. 8. Differentiate between the immediate and chronic effects of high altitude on ventilation and explain why they occur. 9. Identify two mechanisms whereby oxygen administration might induce hypercapnia in patients who have severe chronic obstructive pulmonary disease. 10. Explain how PaCO2 affects the cerebral circulation and intracranial pressure. 11. Identify or explain terminology associated with the control of ventilation. 12. Describe how the NAVA (Neurally Adjusted Ventilatory Assist) mode in the Getinge Servo ventilator uses dorsal respiratory group impulses to improve ventilator-patient synchrony. 13. Describe how suctioning the endotracheal tube may cause a vagovagal response and decrease the heart rate. Describe steps the respiratory therapist may take to limit this negative complication of suctioning. 14. Describe the chronic physiologic effect of the low inspired oxygen at high altitudes. Include the common symptoms of visitors at high altitudes who are not acclimated to the low oxygen levels. 15. Explain the concept of oxygen-induced hypoventilation in patients with chronic hypercapnia. 16. Explain the physiologic effect of hyperventilation on cerebral blood flow and the rationale for hyperventilation in head trauma. 17. Apply knowledge of the impact of hypoxemia, COPD, and head injury to recommend specific strategies of ventilatory support.	6	0	0
Ventilation Perfusion Relationships	1. Explain why alveolar ventilation and pulmonary capillary blood flow determine the alveolar PO2. 2. Use the oxygen-carbon dioxide diagram to characterize absolute shunt and absolute dead space. 3. Explain why there is an alveolar-arterial oxygen pressure difference in the normal lung. 4. Explain why the alveolar-arterial oxygen pressure difference increases as the fractional concentration (FIO2) increases. Apply to specific clinical patient cases to correct hypoxemia. 5. Explain why regions of the lungs with a high alveolar ventilation-to-perfusion ratio can compensate for the hypercapnia of lung areas with a low alveolar ventilation-to-perfusion ratio. 6. Differentiate between general hypoventilation, shunt, and ventilation-perfusion mismatch as causes of hypoxemia. 7. Explain why intrapulmonary shunt responds poorly to oxygen therapy. 8. Describe the major pathologic defects involved in shunt-producing and dead space-producing diseases. 9. Differentiate between the effects of absolute shunt and absolute dead space on arterial blood gases. 10. Compare and contrast the accuracy and reliability of the following shunt indicators: P(A-a)O2, PaO2/FIO2, and the PaO2/PAO2 ratios. 11. Use the classic physiologic shunt equation to calculate the fraction of shunted cardiac output. Interpret the results for degree of severity and clinical impact on oxygen delivery. Apply to specific patient clinical cases. 12. Explain why changes in cardiac output affect the arterial oxygen pressure in a patient with abnormally high intrapulmonary shunt.	6	0	0

Course Segment	Learning Outcomes	Lecture Hours	Lab Hours	Clinical Hours
Ventilation Perfusion Relationships (cont'd)	13. Discuss treatment strategies to improve oxygenation when the hypoxemia is caused by intrapulmonary shunting. 14. Explain why changes in body position are beneficial in improving oxygenation in patients with ventilation-perfusion mismatching. 15. Discuss how pulmonary gas exchange may be evaluated using the noninvasive measures of end tidal carbon dioxide and pulse oximetry. 16. Using the Bohr dead space equation, calculate total dead space and alveolar dead space. 17. Using clinical data, calculate the fraction of inspired oxygen needed to achieve the desired arterial oxygen pressure. 18. Apply knowledge of ventilation-perfusion relationships to recommend mechanical ventilation strategies and patient positioning to improve lung expansion and gas exchange.			

Total Contact Hours

Lecture Hours	Lab Hours	Clinical Hours
60	0	0