

Bergen Community College
Division of Health Professions
Respiratory Care Program
RSP-222; Cardiopulmonary Anatomy & Physiology

Course Information

Semester and Year:

Course and Section Number: RSP-222-001

Meeting Times and Locations:

Instructor:

Office Location:

Departmental Secretary:

Office Hours:

Contact information:

Course Description

This course is a study of physiologic mechanisms of the cardiopulmonary system, including a review of the anatomy of the pulmonary and circulating systems; ventilatory physics / mechanics, gas diffusion, physiology of internal and external respiration, oxygen transport, carbon dioxide transport and elimination, ventilation / perfusion relationships; and the neurological control of ventilation.

Credits: 2 (2 lecture hours)

Prerequisites: BIO-109, RSP-110, RSP-119, and RSP-121.

Co-requisites: RSP-210, RSP-220, and RSP-225

Student Learning Outcomes: As a result of meeting the requirements in this course the student will:

1. Differentiate ventilatory physics mechanics in the normal and abnormal lung.
2. Examine normal gas diffusion in the lung.
3. Appraise affective oxygen and carbon dioxide transport and carbon dioxide elimination.
4. Apply the ventilation / perfusion relationship to normal lung function.
5. Apply the neurological control of ventilation to normal and abnormal ventilation patterns.
6. Describe the anatomy of the pulmonary and circulating systems as it applies to a respiratory therapist.

Means of Assessments

A student in this course is assessed through:

- Four (4) quizzes that contain multiple choice, short answer, or calculation questions that will be used to assess competency.
- A cardiac arrhythmia presentation is used to assess communication skills and group performance.

Course Content

Module Learning Outcomes

Module 1 – Review of the Anatomy of the Respiratory System

1. Differentiate between the structures of the upper and lower airways.
2. Describe how the upper and lower airways differ in their ability to filter, humidify, and warm inspired gas.
3. List the goals of artificial airway humidification when natural humidification mechanisms are bypassed.
4. Describe what keeps the large cartilaginous airways and small non-cartilaginous airways patent.
5. Identify the difference between conducting airways and the respiratory zones of the lung.
6. Differentiate between the lobes and segments of the right and left lungs.
7. Explain why the pleural membranes normally have a subatmospheric pressure between them and how this subatmospheric pressure is related to lung volume.
8. Explain the functional differences between primary and accessory muscles of ventilation.
9. Describe the anatomical difference in the upper airway related to placement of an artificial airway.
10. Identify which spinal cord levels correlate with diaphragmatic nerve and muscle function.

Module 2 – Control of Ventilation

1. Discuss the regulation of respiration.
2. Describe the medullary and pons centers.
3. Discuss the events occurring within the respiratory centers during the breathing cycle.
4. Describe selected reflexes from the lung and chest wall that alter ventilation.
5. Discuss the nerve supply of the pulmonary system.
6. Describe the pulmonary afferent and efferent nerve pathways.
7. Differentiate the stretch, irritant, and juxtacapillary receptors.

Module 3 – Mechanics of Ventilation

1. Describe how static lung volumes and capacities are influenced by changes in the elastic recoil forces of the lungs and chest wall.
2. Describe the pressure gradients that determine lung volume and airflow rate into and out of the lung.
3. List factors that cause lung compliance and airway resistance to change.
4. Describe how surface tension and pulmonary surfactant influence lung compliance, inflation pressure, alveolar stability, and work of breathing.
5. Explain how lung compliance and airway resistance determine passive emptying and filling rates of the lung during breathing.
6. Explain the work of breathing, respiratory muscular strength, and respiratory muscular fatigue are clinically assessed.

Module 4 – Oxygen Equilibrium and Transport

1. Explain oxygen is transported in the body.
2. Explain the mechanisms involved whereby oxygen and carbon dioxide is dissolved in blood.
3. Measure the volume percent of oxygen dissolved in blood related to conditions of normal and abnormal physiology.
4. Describe hemoglobin and explain how it combines with oxygen.
5. Describe the nature of oxygen dissociation curve.
6. Discuss factors affecting the shifting of the curve and what effect the shifting of the curve has on the oxygen carrying capacity of the blood.
7. Describe the process by which oxygen enters the cell tissue from the blood.
8. Explain the volumes percent difference between arterial and venous blood.
9. Discuss oxygen consumption and the respiratory quotient.

Module 5 – Carbon Dioxide Equilibrium and Transport

1. Differentiate the methods of carbon dioxide is transported in the body.
2. Employ the chemical equation for the reaction that gives rise to the bicarbonate ion.
3. Explain the role of carbonic anhydrase in the erythrocyte.

Module 6 – Gas Diffusion

1. Evaluate the effect of ventilation and partial pressure upon arterial oxygen and carbon dioxide content.
2. Summarize the diffusion of gases in the pulmonary system.
3. Differentiate Graham's, Fick's, and Henry's Laws as it applies to respiratory physiology.
4. Summarize the perfusion and diffusion limitations of oxygen and carbon dioxide.
5. Describe conditions that would decrease the diffusion rate of the lungs.
6. Understand the partial pressure, normal values, of the atmospheric gases, alveolar gases, arterial gases, and mixed venous gases.
7. Calculate values using the alveolar-air equation.

Module 7 – Ventilation and Pulmonary Blood Flow

1. Define and discuss the significance and relationship between anatomical, alveolar, and physiological dead space.
2. Discuss the significance of the ventilation-perfusion relationship.
3. Describe pulmonary vascular resistance and discuss factors that alter resistance.
4. Describe the distribution of blood flow and discuss factors that cause uneven distribution.
5. Define and calculate the shunt effect on arterial oxygen content.
6. Given variables, calculate shunt value.
7. Identify normal perfusion-ventilation ratios and values for all lung zones.
8. Describe the effect of increasing and decreasing ventilation-perfusion ratios.
9. Compare how alveolar-arterial oxygen differences, the shunt equation, and alveolar dead space measurements (Bohr equation) are used as indices of ventilation-perfusion inequality.

Module 8 – Functional Anatomy of the Cardiovascular System

1. Describe the gross anatomy and function of each structure of the heart.
2. Explain how the atria, ventricles, and heart valves work together to pump blood through the pulmonary and systemic circulations.
3. Describe coronary circulation.
4. Describe the structure of the arteries, arterioles, capillaries, venules, and veins.

Module 9 – Cardiac Electrophysiology

1. Interpret the cardiac events associated with the electrocardiogram.
2. Understand the relationship of electrical and mechanical events during a cardiac cycle.
3. Identify the components of normal ECG tracing.
4. Understand the transmission of an electrical impulse related to the conducting system of the heart.
5. Select the medication used to treat cardiac arrhythmias and cardiac failure (vasopressors, inotropes, and antiarrhythmic drugs).
6. Understand routes of administering medications during cardiac arrest.

Course Texts and Other Study Materials

Required

- Respiratory Care Anatomy and Physiology Foundations for Clinical Practice, 5th ed., Beachey – ISBN: 9780323757034

Recommended

- Workbook for Respiratory Care Anatomy and Physiology Foundations for Clinical Practice, 3rd ed., Beachey – ISBN: 978-0-323-08586-1
- Egan’s Fundamentals of Respiratory Care, 13th ed., Kacmarek, ISBN: 9780323931991

Quiz and Presentation Requirements

Quizzes

- Four (4) quizzes are used to assess module level comprehension of the course learning outcomes. Each quiz contains questions for two or more modules.

Cardiac Arrhythmia Presentation

- The students will present, as a group, their assigned electrocardiography rhythm. Each cardiac arrhythmia, when appropriate, may include the 6-step interpretation method (or discussion about why it cannot be interpreted), a patient’s physical signs and symptoms, and applicable treatments. Grading will be in the following categories: organization, materials, content, response to questions, and presentation. The grading rubric and weight distribution is posted on Canvas. Each group will submit no less than 3 multiple choice or true false questions to be used on quiz 4.

Grading

Assessments	
Quiz 1	25 pts
Quiz 2	25 pts
Quiz 3	35 pts
Quiz 4	30 pts

Cardiac Arrhythmia Presentation	35 pts
Total points	150 pts

Grade Scheme

Letter	Description	Range
A	The student must show superior theoretical knowledge.	93 – 100
B+	The student must merit high-quality classroom work and theoretical knowledge.	88 – 92.9
B	The student must show above-average knowledge.	83 – 87.9
C+	The student meets the standard of achievement with reasonable knowledge.	78 – 82.9
F	The student fails to meet minimum course standards.	<78

Late work or Quizzes:

Late work and make-up quizzes will be penalized with a grade being no greater than seventy-eight percent (78%). In-class activities cannot be reconciled because of the evaluation method participatory and will be recorded as zero (0). Quizzes are scheduled during the last two weeks of semester but before the last scheduled class. All late course work must be completed before the last scheduled class. If a quiz is not completed before the last scheduled class day, a grade of zero (0) will be recorded.

Academic Integrity Policy and Attendance Policy

Academic Integrity

Academic dishonesty is a serious violation of BCC policy and personal ethics and will be treated as such if the reason for suspicion should arise. Students should be careful to avoid plagiarism, falsification, and compliance. Academic integrity is vital to an academic community and for fair evaluation of student assessments. All assessments submitted must be your own, completed in accordance with the college's academic policies and the student code of conduct. You may not engage in unauthorized collaboration or make use of any artificial intelligence (AI) composition systems. Academic dishonesty also includes cheating on examinations. Refer to the [BCC student code of conduct](#), student handbook for additional information, and the statement on plagiarism (<https://catalog.bergen.edu/content.php?catoid=4&navoid=163#academic-dishonesty>).

BCC Attendance Policy

All students are expected to attend punctually every scheduled meeting of each course for which they are registered. Attendance and lateness policies and sanctions are to be determined by the instructor for each section of each course. These will be established in writing on the individual course outline. Attendance is maintained by the instructor for administrative and counseling purposes.

Course Attendance Policy

Attendance and punctuality in all class sessions is required. Attendance for lectures is factored into the total grade for the course. Two (2) points are deducted for every absence. One (1) point is deducted if the student arrives after the attendance is recorded. If you are late, be sure to see the professor in that class so the absence can be corrected to a lateness.

Departmental Policy Statements

- Acceptable quality of work and mature behavior is always expected from every student. Students are regarded as professionals and are expected to conduct themselves accordingly.
- High standards of professional performance demand that students maintain good academic progress throughout their course of study in the program.
- Students demonstrating chronic tardiness or absenteeism will be placed on academic warning or probation and may be subjected to termination from the program.
- Absence from a class during a scheduled exam will be subject to the policy of the instructor for that specific course. If the student is going to miss a scheduled exam it is expected that the student will contact the instructor ahead of time by e-mail.
- All students are required to adhere to the policies and procedures of the school as outlined in the college catalogue.
- Additional department policies are in the Student Policies and Procedures Manual.
- Remediation
 - The program's defined process for addressing deficiencies in a student's knowledge, skills, professional behavior, and competencies so that the correction of these deficiencies can be ascertained and documented. The program must conduct these evaluations equitably and with sufficient frequency to facilitate prompt identification of learning deficiencies and the development of a means for their remediation within a suitable time frame.
 - The remediation process is initiated by faculty when any student is at risk of failing a course due to difficulty accomplishing course objectives and / or requirements. At risk behaviors include academic deficiency (non-passing quiz, examination, laboratory competency), lack of clinical competency (not abiding by policy and procedures, unsafe behavior), and lapses in professional conduct.

Support Services

- The program faculty maintains office hours for counseling and is available to provide tutorial assistance to students.
- Students must make appointments in advance to meet with the respective instructors.
- Students may also obtain assistance from the [College Tutoring Center](#). Appointments must be made in advance through this center.
- The College has a [personal counseling center](#) for those students who may need personal assistance. Appointments are made directly through this center.
- Any problems, concerns, or questions should be directed to the course instructor or the student's advisor.
- Statement on Civility
 - Refer to the [Standards of Conduct](#) Subsection found in the Student Judicial Affairs Policies & Procedures Section found in the Student Handbook.
- Academic Integrity

- Refer to the Academic Integrity Subsection; found in the [Academic Regulations](#).
- Other possible College, Divisional, or Departmental Policy Statements to be referenced.
 - ADA statement
 - Students with documented disabilities who require accommodations by the American with Disabilities Act (ADA) can request support services from the Office of Specialized Service of Bergen Community College located in room L-115 of the Pitkin Learning Center. (www.bergen.edu/oss)
 - Sexual Harassment statement
 - Statement on acceptable use of [BCC technology](#)
- Student and Faculty Support Services
 - List support services, e.g., the [Writing Center](#), the [Math Lab](#), the Tutorial Center, [Online Writing Lab](#) (OWL), [Office of Specialized Services](#), etc.
- BCC Library
 - The [Sidney Silverman Library](#) is committed to providing a quiet, welcoming, respectful atmosphere conducive to study and research in an environment that is comfortable, clean, and safe. The use of the library will be beneficial in providing resources on researching topic information, citation styles, finding current articles among many other media services available.

General Course Expectations

Students are expected to:

- Use their BCC email address when emailing the instructor and fellow students.
- Interact during class and complete in-class activities.
- Review and follow the course calendar concerning topic discussions.
- Submit assignments in Canvas according to the syllabus deadlines.
- Utilize the Course Q&A forum to post questions for the instructor to answer.
- Purchase or rent the course textbooks.

Faculty are expected to:

- Respond within 24 hours of a communication request (except Thursdays, weekends, or holidays).
- Ensure all assignments are available and complete.
- Monitor discussion boards and replies, as necessary.
- Adhere to the course calendar.
- Include grading rubrics for key class assignments (posted within Canvas).

Course Schedule

Module Date	Topic	Readings and Pre-Class Activities	Reading Assignments
Module 1	Review of the Anatomy of the Respiratory System	Review the presentation Listen to audio.	The Airways and Alveoli, The Lungs and Chest Wall (Beachey). The Respiratory System (Egan).
Module 2 & 3	Control of Ventilation Mechanics of Ventilation	Review the presentation	Control of Ventilation, Mechanics of Ventilation (Beachey). Regulation of Breathing (Egan).
Module 3 & 4	Mechanics of Ventilation Oxygen Equilibrium and Transport	Review the presentation	Oxygen Equilibrium and Transport (Beachey). Gas Exchange and Transport, Ventilation (Egan).
	Quiz 1 (Control of Ventilation; Mechanics of Ventilation)		
Module 4	Oxygen Equilibrium and Transport		
Module 4 & 5	Oxygen Equilibrium and Transport Carbon Dioxide Equilibrium and Transport	Review the presentation	Carbon Dioxide Equilibrium and Transport (Beachey). Gas Exchange and Transport (Egan).
Module 6	Gas Diffusion	Review the presentation	
	Quiz 2 (Oxygen; Carbon dioxide)		
	<i>Spring Break</i>		
Until 7	Ventilation and Pulmonary Blood Flow	Review the presentation	Ventilation, Pulmonary Blood Flow, Ventilation-Perfusion Relationships (Beachey). Ventilation (Egan)
Module 8	Review of Anatomy of the Cardiovascular System	Review the presentation Listen to audio.	Functional Anatomy of the Cardiovascular System (Beachey). The Cardiovascular System (Egan).
	Quiz 3 (Gas diffusion; Ventilation and Pulmonary Blood Flow)		

Module 9	Cardiac Electrophysiology	Review the presentation	Cardiac Electrophysiology (Beachey). The Cardiovascular System (Egan).
	Cardiac Arrhythmia Presentation		The Electrocardiogram and Cardiac Arrhythmias in Adults (Beachey). The Cardiovascular System (Egan).
	Cardiac Arrhythmia Presentation		
	Quiz 4 (Cardiac Electrophysiology; Cardiac Arrhythmia)		

Note to Students: This course schedule is subject to change depending upon the progress of the course. All material will be covered, and students are responsible for the content.