Department of Respiratory Care

Course Specification of
Advance Mechanical Ventilation
Course No. (RSC 455)

2023/2024

XL. Course Description:

course expands on the advanced knowledge of mechanical ventilation, equipping respiratory therapy students with the expertise to manage complex respiratory cases. Students will delve into advanced respiratory physiology and mechanics, mastering noninvasive and invasive ventilation strategies for both healthy and diseased lungs. The course explores patient-ventilator interactions, including sedation, muscle relaxation, and asynchrony. Students will learn to optimize ventilator settings, navigate special situations (ARDS, COPD, obesity, brain injury, and fistula), and utilize advanced modes like biphasic and intelligent ventilation. Advanced monitoring techniques, weaning protocols, and troubleshooting are emphasized, preparing students to provide comprehensive, evidence-based care for critically ill patients
requiring advanced ventilatory support.

IV Course Content:

A – Theoretical Aspect: (if any)

S	Units/ Topics List		No. of Weeks	Contact hours	
1	Advanced Respiratory Physiology and Mechanics:	○ Review of V/Q mismatch, compliance, and resistance in healthy and diseased lungs. ○ Impact of mechanical ventilation on respiratory physiology.	1	2	
2	Noninvasive Respiratory Support:	○ Noninvasive ventilation (NIV): CPAP, BiPAP, indications, and contraindications. ○ High-flow nasal cannula (HFNC) and high-flow nasal intubation (HFNI). ○ Patient selection, monitoring, and troubleshooting.	1	2	
3	Patient-Ventilator Interaction (Part 1):	○ Understanding patient effort and work of breathing. ○ Recognizing and managing patient-ventilator asynchrony.	1	2	
4	Strategies for Optimizing Ventilator Settings:	○ Lung-protective ventilation: low tidal volumes, PEEP, and recruitment maneuvers. ○ Individualized approaches for healthy and diseased lungs (ARDS, COPD).	1	2	
5	The Concept of Lung Protective Strategy:	○ Rationale for low tidal volume ventilation and permissive hypercapnia. ○ Prone positioning and its benefits in specific patient populations. ○ Optimal PEEP titration and its impact on lung mechanics.	1	2	
6	Patient-Ventilator Interaction (Part 2):	○ Sedation and analgesia in ventilated patients. ○ Neuromuscular blockade and its implications. ○ Strategies to enhance patient-ventilator synchrony.	1	2	
7	Mechanical Ventilationin Special Situations (Part 1):	○ ARDS: specific ventilator settings, adjunctive therapies (ECMO). ○ COPD/Severe asthma: managing air trapping, auto-PEEP, and bronchospasm.	1	2	
8	Med-term exam		1	2	
9	Mechanical Ventilationin Special Situations (Part 2):	○ Obesity: challenges and considerations for ventilator management. ○ Traumatic brain injury: optimizing cerebral perfusion and minimizing complications. ○ Bronchopleural fistula: special considerations and management strategies.	1	2	

10	Advanced Modes of Mechanical Ventilation (Part 1):	○ Dual modes and biphasic modes: APRV, BiPAP,etc. ○ Criteria, indications, contraindications, and complications of each mode.	1	2	
11	Advanced Modes of Mechanical Ventilation (Part 2):	○ Intelligent modes, effort-adapted modes, andhigh-frequency oscillatory ventilation (HFOV). ○ Principles, advantages, and limitations of eachmode.	1	2	
12	Patient Monitoring during Mechanical Ventilation:	○ Advanced ventilator graphics and waveforms(flow-time, pressure-volume loops). ○ Esophageal manometry, transcutaneous monitoring, and capnography.	1	2	
13	Weaning from Mechanical Ventilation:	○ Definitions, steps, and weaning modes (PSV, SIMV). ○ Weaning protocols and predictors of successful weaning. ○ Managing difficult-to-wean patients and prolonged mechanical ventilation. ○ Tracheostomy and permanent ventilator dependence.	1	2	
14	Advanced Troubleshooting of Mechanical Ventilation:	○ Systematic approach to identifying and resolving ventilator issues. ○ Common alarms, causes, and management strategies. ○ Safety considerations and backup ventilationplans.	1	2	
15	Review and Integration:	○ Case studies and simulations to consolidate knowledge and skills. ○ Q&A session for clarification and discussion.	1	2	
16	Final Exam		1	2	-
TOTAL			16	32	-
Number of Weeks /and Units Per Semester			16 weeks	2 Credits	-

B - Practical Aspect: (if any)				
S	Tasks/ Experiments	Number of weeks	contact hours	
1	Ventilator Familiarization Lab: • Hands-on exploration and operation of various advanced mechanical ventilators (e.g., models with APRV, BiPAP, HFOV capabilities). • Identification and manipulation of ventilator controls and settings. • Practice setting up and initiating ventilation on a test lung.	1	2	
2	Airway Resistance and Compliance Simulation Lab: • Using lung simulators to observe the effects of different lung compliance and airway resistance on ventilator waveforms and pressures. • Adjusting ventilator settings to optimize ventilation in simulated scenarios.	1	2	
3	Noninvasive Ventilation (NIV) Application Lab: • Practical experience applying NIV masks and interfaces to patients/mannequins. • Setting up and adjusting CPAP and BiPAP devices, monitoring patient response. • Troubleshooting common NIV challenges (mask leak, interface intolerance).	1	2	
4	High-Flow Nasal Cannula (HFNC) Lab: • Setting up and titrating HFNC flow rates and FiO2. • Assessing patient comfort and response to HFNC therapy. • Troubleshooting common HFNC issues (e.g., condensation, skin irritation).	1	2	
5	Patient-Ventilator Asynchrony Lab: • Recognizing different types of asynchrony on ventilator waveforms. • Practicing interventions to correct asynchrony (e.g., adjusting trigger sensitivity, flow rates).	1	2	

6	Lung Protective Ventilation Strategies Lab: • Setting up low tidal volume ventilation on a ventilator. • Performing lung recruitment maneuvers (e.g., sustained inflation). • Titrating PEEP and monitoring for hemodynamic effects.	1	2	
7	Prone Positioning Simulation Lab: • Simulating the safe and effective turning of a ventilated patient into the prone position. • Monitoring for complications and assessing patient tolerance.	1	2	
8	ARDS Ventilator Management Lab: • Using lung simulators to replicate ARDS conditions. • Optimizing ventilator settings for ARDS patients (low tidal volume, high PEEP). • Simulating ECMO as an adjunctive therapy in severe ARDS.	1	2	
9	COPD/Asthma Ventilator Management Lab: • Adjusting ventilator settings to address air trapping and auto-PEEP. • Simulating bronchospasm and practicing interventions (e.g., bronchodilator administration).	1	2	
10	Ventilator Management in Special Populations Lab: • Simulating ventilator management in obese patients, considering unique challenges. • Applying lung-protective strategies and monitoring for complications. • Simulating ventilator management in traumatic brain injury, optimizing cerebralperfusion.	1	2	
11	Advanced Ventilation Modes Lab: • Hands-on experience with APRV, BiPAP, and other advanced modes. • Comparing and contrasting different modes based on patient needs and disease states.	1	2	
12	Ventilator Waveform Analysis Lab: • Analyzing flow-time and pressure-volume loops to assess patient-ventilator interaction and lung mechanics. • Interpreting waveforms to detect asynchrony, air trapping, and other issues.	1	2	
13	Weaning and Extubation Simulation Lab: • Practicing spontaneous breathing trials (SBTs) and other weaning techniques. • Troubleshooting weaning challenges and identifying appropriate next steps. • Simulating extubation procedures and post-extubation care.	1	2	
14	Ventilator Troubleshooting Lab: • Hands-on experience troubleshooting common ventilator alarms and malfunctions. • Practicing safety procedures and backup ventilation strategies. • Simulating scenarios involving ventilator failure and equipment malfunctions.	1	2	
15	Final lab- Exam	1	2	-
TOTAL		15	30	-
Number of Weeks /and Units Per Semester		15 weeks	1 Credits	-

VI. Teaching strategies of the course:

58. Lecture method **59.**Practical Evaluation **60.**Physical Assessment**61.**Clinical exam
62. Brainstorming
63. Demonstration
64. Case study discussions

.Schedule of Assessment Tasks for Students during the Semester
Theoretical part

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	
1	Attendance andActivities	15th week	5	5%	
2	Student assignment	5th and 12th week	5	5%	
3	Mid-term exam	7th or 8th week	10	10%	
4	Final exam	16th -17th week	40	40 %	
Total Theory Weight			60	60%	