Department of Respiratory Care

Course Specification of

Respiratory physics & Mathematics

Course No. (08 05 561)

2023/2024

XXVIII. Course Description:
This course delves into the fundamental physical principles governing the function of the respiratory and cardiovascular systems. Students will explore the interplay of pressure, flow, resistance, energy, and matter within these vital systems, gaining a deeper understanding of respiratory care practices and therapies.

V. Course Content:

Distribution of Semester Weekly Plan of Course Topics/Items and Activities.

A – Theoretical Aspect:

Order	Topics List		WeekDue	Contact Hours
1	Introduction to Cardiopulmonary Physics	▪ The respiratory and cardiovascular systems as integrated units ▪ Key physical principles applicable to these systems (pressure, flow, resistance) Overview of how physics informs respiratory therapy practices	1	2
2	I. Introduction of respiratory physics	Properties of Matter ▪ Density ▪ Specific gravity ▪ Buoyancy ▪ Viscosity ▪ Surface tension ▪ Cohesion ▪ Adhesion ▪ Capillary action ▪ Meniscus States of Matter & Phase Changes ▪ Melting point ▪ Boiling point ▪ Critical temperature ▪ Condensation ▪ Evaporation ▪ Sublimation ▪ Latent heat of fusion Latent heat of vaporization	2	2
3	II. Energy andMatter	▪ Energy and Work, ▪ Kinetic Potential Energy	3	2

4	III. States of Matter	▪ Change of State, ▪ Critical Temperature and Critical Pressure, Gases Versus Vapors	4	1
5	IV. Physical Properties ofMatter	▪ Temperature, ▪ Pressure, ▪ Density, ▪ Buoyancy, ▪ Viscosity, Surface Tension	4	1
6	Gas Laws & Behaviou	▪ Boyle's Law (Relationship between pressure and volume) ▪ Charles's Law (Relationship between temperature and volume) ▪ Gay-Lussac's Law (Relationship between pressure and temperature) ▪ Dalton's Law (Partial pressures in gas mixtures) ▪ Henry's law ▪ Graham's law ▪ Molar volume ▪ Avogadro constant ▪ STPD, BTPS, ATPS Clinical applications: Oxygen storage, gas behavior in the lungs, hyperbaric chambers	5-6	4
7	Humidity:	▪ Absolute humidity ▪ Relative humidity (RH) ▪ Humidity deficit ▪ Percent body humidity (PBH) ▪ Dew point ▪ Hygrometer Water vapor pressure	7	2
8	Midterm Exam		8	2
9	Fluid Dynamics	▪ Laminar flow ▪ Turbulent flow ▪ Poiseuille's law ▪ Flow resistance ▪ Law of continuity ▪ Bernoulli principle ▪ Venturi effect ▪ Coanda effect Reynolds number	9	2

10	Thermodynamics	▪ Temperature ▪ Pressure ▪ Kinetic energy ▪ Potential energy ▪ Thermal conductivity ▪ Conduction ▪ Convection ▪ Radiation ▪ Laws of thermodynamics ▪ Adiabatic processes Joule-Thompson effect	10	2
11	Other Important physics terms	▪ Pressure ▪ Pascal's principle ▪ Tension ▪ Shear rate	11	2
		▪ Strain-gauge pressure transducers ▪ Solubility coefficient ▪ Fractional concentration van der Waals forces		
12	Work of Breathing	▪ Compliance and elastance of the lungs and chest wall ▪ Surface tension and surfactant ▪ Calculating work of breathing Clinical applications: Respiratory distress, positive pressure ventilation	12	2
13	Ventilation, Perfusion,and Gas Exchange	▪ Alveolar ventilation and dead space ▪ Ventilation-perfusion (V/Q) ratios and mismatching ▪ Diffusion of gases across the alveolar-capillary membrane ▪ Clinical applications: Hypoxemia, hypercapnia, shunt ▪ The oxygen-hemoglobin dissociation curve and factors affecting it ▪ Forms of carbon dioxide transport in the blood The Haldane and Bohr Effects	13-14	4
14	Mechanics of the Cardiovascular System	▪ Blood pressure, cardiac output, and systemic vascular resistance ▪ The cardiac cycle: Electrical activity, pressure changes ▪ Regulation of blood pressure Clinical applications: Hypertension, monitoring tools (e.g., arterial lines, cardiac catheters)	15	2
15	Final Exam		16	2

Number of Weeks /and Units Per Semester	16	32

B - Practical Aspect: (if any)

S	Tasks/ Experiments	Number of weeks	contact hours	CILOs
1	Not applicable	-	-	-
TOTAL		-	-	-
Number of Weeks /and Units Per Semester		-	-	-

VI. Teaching strategies of the course:

40. Lecture method
41. Brainstorming
42. Demonstration
43. Case study discussions

VI. Schedule of Assessment Tasks for Students during the Semester

Theoretical part

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	Attendance andActivities	15th week	5	5%	a, b
2	Student assignment	5th and 12th week	5	5%	a, b,
3	Mid-term exam	7th or 8th week	20	20%	a, b
4	Final exam	16th-17th week	70	70 %	a, b, c, d
Total Theory Weight			100	100%	