

Course title	Circulation and Respiration				
Course code	GEMD-201				
Course type	Required				
Level	Undergraduate				
Year / Semester	Year 2, Semester 3				
Teacher's name	Evgenios Metaxas				
ECTS	13	Teaching Periods per Week			
		Large Group Learning	Small Group Learning	Laboratories & Skills	Clinical Practice
		6	6	5	6
Course purpose and objectives	<p>The aim of this course is to:</p> <ul style="list-style-type: none"> • Provide the students with an understanding of the normal structure and function of the cardiovascular system and the respiratory system. • Introduce the students to the pathophysiology and pathology of various conditions affecting the cardiovascular and respiratory systems. • Provide the students with an understanding of the clinical manifestations of various cardiovascular and respiratory conditions. • Introduce the students to the investigative and therapeutic principles underlying the management of cardiovascular and respiratory conditions. • Develop the student's consultation skills and professional competencies in relationship to managing patients with cardiovascular and respiratory conditions. 				
Learning outcomes	<p>At the end of the course, the student will be able to:</p> <p><u>Cardiovascular System</u> <i>Knowledge</i></p> <ol style="list-style-type: none"> 1. Demonstrate a thorough knowledge of the <u>structure</u> of the heart, including (but not confined to): <ul style="list-style-type: none"> • The four heart chambers • The layers of the heart wall (endocardium; myocardium; pericardium) <ul style="list-style-type: none"> ○ The heart valves, including the relevant anatomical structures (nodules, chordae tendinae, papillary muscles, ostia, etc.) • The coronary circulation, incl. the anatomy of the left and right coronary artery, and the regions of the heart that they supply 				

- Describe variations of the coronary circulation between individuals and their clinical significance of this
 - Outline how structural abnormalities in the coronary circulation might result in ischaemic heart disease
 - The venous drainage of the heart
 - The anatomy of the conducting system of the heart
 - The anatomical relationship of the heart to other organs in the thorax
 - The histology of cardiac muscle
2. Demonstrate a thorough knowledge of the structure of the vascular system, including (but not confined to):
- The aortic arch and its branches
 - The common variations of the branches of the aortic arch and their clinical significance
 - The descending thoracic aorta and its branches
 - The distal arterial system, including its histological structure (e.g. vascular smooth muscle, endothelium, etc.)
 - The capillary system
 - The peripheral venous system, including the superior and inferior vena cava and their major tributaries
 - The azygos venous system
3. Explain the embryological development of the heart and great vessels
- Describe the major changes to the structure of function of the heart and major blood vessels that happen in the post-partum period and early infancy.
 - Describe the remnants of fetal structures present in the adult heart and great vessels
4. Demonstrate a thorough understanding of the functioning of the heart, including (but not confined to):
- The Cardiac Cycle (i.e. as summarized in the Volume-Pressure [“Wiggers”] Diagram)
 - The sequence of opening and closing of the heart valves during the cardiac cycle
 - The excitatory and conductive system of the heart
 - The physiology and biochemistry of cardiac muscle contraction and relaxation (i.e. genesis of action potentials in the cardiac muscle, excitation-contraction coupling, etc.)
 - The determinants of cardiac contractility including:
 - intrinsic regulation – the Frank-Starling mechanism
 - extrinsic regulation – the role of the sympathetic and parasympathetic nervous system,
 - the effect of serum ion levels on heart function
 - the effect of temperature on heart function

- Explain what is meant by Cardiac Output and Venous Return to the heart
 - Explain the concepts of 'preload' and 'afterload' in the context of optimum cardiac function
 - Explain the concepts of 'heart failure' on the basis of deranged cardiac preload and/or afterload.
5. Demonstrate a thorough understanding of the functioning of the vascular system, including (but not confined to):
- The major differences between the arterial and venous systems
 - How systemic circulation is maintained, in terms of the relationship between blood pressure, blood flow, and vascular resistance
 - The particular role of the autonomic nervous system in the regulation of blood pressure, blood flow and vascular resistance
 - The role of capacitance vessels and of distal arteries and arterioles in the genesis and maintenance of systolic and diastolic BP
 - The role of the kidneys and the renin-angiotensin-aldosterone axis in the regulation of blood pressure
 - Describe the pathophysiology of hypertension, based on an understanding of cardiac output and systemic vascular resistance
 - The autoregulation of blood flow to different organs and tissues
 - Explain how ischaemic heart disease relates to reduced blood flow in the coronary circulation
 - The function of the azygos venous system
 - The role of the lymphatic system in maintaining overall fluid balance
 - Outline the pathophysiology underlying atherosclerosis on the one hand and venous thromboembolism on the other
6. Describe the structure and function of the pulmonary circulation
- Compare and contrast the systemic and pulmonary circulations in terms of blood pressure, blood flow, vascular resistance.
 - Explain how the pulmonary circulation can be compromised in certain disease states (e.g. pulmonary embolism, COPD, primary pulmonary hypertension, etc.)
7. Understand the meaning of 'shock' and its underlying pathophysiology.
8. Understand the structure and function of lipoproteins.

- Have a basic understanding of the nature of lipoprotein disorders/dyslipidemias.
9. Describe the pharmacology (mechanisms of action, adverse effects, clinical indications, therapeutic roles) of commonly used cardiovascular drugs including:
- Diuretics
 - Antihypertensive agents
 - Drugs used to treat heart failure
 - Anti-arrhythmic agents
 - Anti-anginal agents
 - Lipid-lowering agents
 - Anti-platelet agents, fibrinolytics and anti-coagulants

Skills

10. Take a focused (i.e. symptom-specific) history in a patient with cardiovascular signs/symptoms.
11. Perform a complete cardiovascular examination, including:
- Assessment of the pulse and BP measurement
12. Describe the sites for optimal auscultation of the heart valves, using skeletal landmarks
13. Auscultate the precordium and identify normal heart sounds over the cardiac apex and in the aortic, mitral, pulmonary, and tricuspid areas
14. Appreciate deviations from normality on cardiac auscultation (e.g. with abnormal heart sounds, systolic murmurs, diastolic murmurs, pericardial rub, etc.)
15. Perform an ECG/EKG
- Describe and recognize the normal Electrocardiogram (ECG/EKG)
16. Describe the steps in interpreting a normal ECG (e.g. rhythm, heart rate, heart rhythm, cardiac axis, P-R, QRS and Q-T intervals)
17. Recognize gross deviations from the normal ECG/EKG appearance – e.g. cardiac hypertrophy, cardiac ischemia/infarction, etc.)
18. Recognize major cardiac dysrhythmias on the ECG/EKG – e.g. atrial fibrillation, heart block, supra-ventricular and ventricular dysrhythmias
19. Assess the peripheral vascular tree, both its arterial and venous components
20. Be trained and certified as a First Aid Responder (and thereafter maintain this training and certification every two years)

Professional Competencies

21. Describe the epidemiology of cardiovascular disease, including the major syndromes of hypertension, ischaemic heart disease and stroke.

Respiratory System

Knowledge

22. Describe the anatomy of the upper airways, including the:

- Larynx
- Trachea

23. Describe the anatomy of the:

- Lungs
- Respiratory tree (i.e. conducting and respiratory zones)
- Pleura
- Diaphragm
- Phrenic nerve

24. Describe the surface anatomy of the thorax with particular reference to the upper airways and the lungs

- Relate the anatomy of the trachea to other organs in the thorax
- Relate the gross anatomy of the lungs to the other organs in the thorax
- Identify the structures that perforate the diaphragm and their spatial relationship to one another

25. Describe the anatomy of the thoracic skeleton, including:

- The major anatomical landmarks
- The bones of the thoracic cage
- The muscles of the thorax

26. Describe the blood supply, lymphatic drainage and innervation of:

- The lungs
- The upper airways
- The lungs
- The visceral and parietal pleura

27. Describe the subdivisions and levels of the mediastinum

- Identify the mediastinal structures and describe their anatomical relationships

28. Apply your anatomical knowledge in explaining:

- Where an inhaled/aspirated foreign body is most likely to be found in the bronchial tree
- The clinical manifestations of phrenic nerve lesions (e.g. phrenic nerve irritation, phrenic nerve palsy)

29. Describe lung mechanics/mechanics of pulmonary ventilation

- Explain the concepts of pulmonary ventilation and alveolar ventilation

30. Describe lung volumes and capacities

- Apply this knowledge to an explanation of what "lung function studies" measure

31. Describe the concepts of pulmonary gas exchange

- Describe the diffusion of oxygen and carbon dioxide through the respiratory membrane

32. Describe the transport of oxygen and carbon dioxide in the blood from the lungs to the tissues

33. Describe the control/regulation of respiration.

34. Revise the physiology of the pulmonary circulation (c.f. CVS module), defining pulmonary blood pressure, blood flow, and vascular resistance.

- Explain the autoregulation of pulmonary blood flow
35. Apply your knowledge of pulmonary physiology to explain:
- The information derived from measurement of arterial blood gases (ABGs)
 - The basic pathophysiology of obstructive lung disease
 - The basic pathophysiology of restrictive lung disease
 - The basic pathophysiology of respiratory insufficiency and respiratory failure (hypoxia, hypoxemia, hypercapnia).
 - The nature and consequences of sleep apnoea
 - The consequences of conditions that lead to ventilation/perfusion (V/Q) mismatch
 - The consequences of conditions that lead to the impaired diffusion of blood gases
 - The principles of oxygen administration in different disease states (with reference to the control of respiration)
 - The application of physiological principles to the science of deep-sea diving
36. Describe the pharmacology (mechanisms of action, adverse effects, clinical indications, therapeutic roles) of commonly used drugs to treat pulmonary diseases including:
- Bronchodilators
 - Anti-inflammatory agents
 - Surfactants
 - Antitussives
 - Anti-histamines
 - Expectorants, mucolytics
 - Decongestants

Skills

37. Take a symptom-specific history in a patient with respiratory signs/symptoms.
38. Perform a complete respiratory examination on a manikin or on a colleague
39. Appreciate deviations from normality on respiratory examination (e.g. chest wall deformity; cyanosis; tachypnoea; reduced chest expansion; etc.)
40. Identify and describe normal breath sounds
41. Identify deviations from normality on chest auscultation (e.g. presence of bronchial breathing, crackles/rales, wheezing, rhonchi, inspiratory stridor, pleural friction rub; etc.)
42. Recognize a normal CXR, identifying all key thoracic structure
43. Interpret the measurement of ABGs in a normal person and in different disease states

Professional Competencies

TBA.

Prerequisites	None	Required	None																														
Course content	<ul style="list-style-type: none"> • The normal structure and function of the cardiovascular and respiratory systems • The pathophysiology and pathology of various cardiovascular and respiratory conditions • The management of cardiovascular and respiratory conditions • The consultations skills and professional competencies required to deal with patients with cardiovascular and respiratory conditions 																																
Teaching methodology	<p>Lectures – normally two face-to-face, two on-line p/week</p> <p>Tutorials – two case-based learning small group sessions, two expert-led class discussions/debates</p> <p>Flipped classroom activities</p> <p>Community and/or hospital visits each week, relating to the case of the week</p> <p>Student centred learning/self-study</p>																																
Bibliography	<p>Required textbooks/reading</p> <table border="1"> <thead> <tr> <th>Authors</th> <th>Title</th> <th>Edition</th> <th>Publisher</th> <th>Year</th> <th>ISBN</th> </tr> </thead> <tbody> <tr> <td>John E. Hall, Michael E. Hall</td> <td>Guyton and Hall Textbook of Medical Physiology</td> <td>14th Edition</td> <td></td> <td>2020</td> <td></td> </tr> <tr> <td>Keith L. Moore, Arthur F. Dalley, Anne M. R. Agur</td> <td>Clinically oriented anatomy</td> <td>8th Edition</td> <td></td> <td>2017</td> <td></td> </tr> <tr> <td>Vinay Kumar, Abul K. Abbas, Jon C. Aster</td> <td>Robbins Basic Pathology</td> <td>10th Edition</td> <td></td> <td>2017</td> <td></td> </tr> <tr> <td>James M. Ritter, Rod J. Flower,</td> <td>Rang & Dale's Pharmacology</td> <td>9th Edition</td> <td></td> <td>2019</td> <td></td> </tr> </tbody> </table>			Authors	Title	Edition	Publisher	Year	ISBN	John E. Hall, Michael E. Hall	Guyton and Hall Textbook of Medical Physiology	14 th Edition		2020		Keith L. Moore, Arthur F. Dalley, Anne M. R. Agur	Clinically oriented anatomy	8 th Edition		2017		Vinay Kumar, Abul K. Abbas, Jon C. Aster	Robbins Basic Pathology	10 th Edition		2017		James M. Ritter, Rod J. Flower,	Rang & Dale's Pharmacology	9 th Edition		2019	
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Graeme Henderson, Yoon Kong Loke, David MacEwan, Humphrey P. Rang					
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Recommended textbooks/reading

Authors	Title	Edition	Publisher	Year	ISBN
Linda S. Costanzo	BRS: Physiology	7 th Edition		2018	
Lauralee Sherwood	Human Physiology : from Cells to Systems	9 th Edition		2015	
Edward F Goljan	Rapid Review Pathology	5 th Edition		2018	
Hussain A. Sattar	Fundamentals of Pathology: Medical Course and Step 1 Review	2020 Edition		2020	
Kaplan Medical	USMLE Step 1 Lecture Notes 2021: Pharmacology	2021 Edition		2020	
Sarah Lerchenfeldt, Gary Rosenfeld	BRS: Pharmacology	7 th Edition		2019	
Kaplan Medical	USMLE Step 1 Lecture	2021 Edition		2020	

		Notes 2021: Anatomy					
Assessment	The course will be assessed at the end of Semester 3 with a Summative Final Examination consisting of Single Best Answer MCQs (SBAs) and Short Answer Questions (SAQs). Clinical and consultation skills will be assessed in an OSCE.						
Language	English						