<table>
<tr><td>Course Title</td><td colspan="5">Physiology I</td></tr>
<tr><td>Course Code</td><td colspan="5">MED-203</td></tr>
<tr><td>Course Type</td><td colspan="5">Required</td></tr>
<tr><td>Level</td><td colspan="5">Undergraduate</td></tr>
<tr><td>Year / Semester</td><td colspan="5">Year 2/ Semester 3 (Fall)</td></tr>
<tr><td>Teacher’s Name</td><td colspan="5">Course Lead:
Prof Marios Panos
Contributors:
Prof Avgis Hadjipapas
Dr Christos Varounis
Dr Agnieszka Swiecicka Mitsides</td></tr>
<tr><td>ECTS</td><td>6</td><td>Lectures / week</td><td>5</td><td>Laboratories / week</td><td>2</td></tr>
<tr><td>Course Purpose and Objectives</td><td colspan="5">The main objectives of the course are:
To describe fundamental mechanisms underlying normal function of cells, tissues, organs, and organ systems of the human body.
To explain basic mechanisms of homeostasis by integrating the functions of cells, tissues, organs, and organ systems.
To enhance an understanding of anatomy, by linking structure and function.
To provide a strong scientific basis to medicine, the clinical counterpart of physiology.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="5">The following list provides the learning objectives (LOBs) that will be covered in the lectures and practicals of each week (please note that no new learning objectives will be covered in tutorials since these will be used to revisit previous topics and answer students’ questions):
Week 1
LOBs covered during lectures:
Describe cell structure and function.
Describe the composition of body fluid compartments.
Define osmolality and tonicity.
Describe the structure of the cell membrane.
Outline water and solute transport.
Explain resting and action potential by ionic channel and concentration gradients.
Explain action potential generation and propagation, voltage and ion gated channels.
Describe the function of the synapse.</td></tr>
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9. Outline pre- and post- transmitter release, reception and breakdown in relation to impulse transmission and muscle fiber contraction.

Week 2

LOBs covered during lectures:

10. Explain synapse function (pre- and post- transmitter release reception and breakdown).
11. Outline muscle mechanics.

Week 3

LOBs covered during lectures:

12. Describe and contrast smooth muscle and cardiac muscle.
13. Describe cardiac function and electro-mechanical coupling.
14. Describe the Cardiac Cycle.
15. Explain the origin of normal and abnormal heart sounds in relation to the Cardiac Cycle.
16. Explain cardiac cycle and its relation to intracardiac pressure changes, heart sounds and the electrocardiogram.
17. Describe the physiology of the circulation, defining stroke volume, cardiac output and total peripheral resistance (TPR) and explain how they are linked by Starling's Law of the Heart.
18. Outline the function of the electrocardiogram.
19. Explain the origin of the PQRST electrical wave and identify electrocardiographic changes in cardiac arrhythmias, myocardial infarction and myopathies.
20. Describe coronary endothelium and secretory function, vascular smooth muscle, microcirculation and lymph flow (including mechanisms of atherosclerosis).
21. State Laplace's law and explain the link to heart work and mural tension.
22. Describe Cardiac Output (preload, afterload and contractility).
23. Describe the process of atherosclerosis and thromboembolism.
24. State and explain Poisseulles' Law.
25. Outline the dynamics and local control of blood flow and circulation in specific vascular beds.
26. Describe the dynamics and control of coronary blood flow, heart muscle oxygen consumption and biochemistry and explain events leading to ischaemia.
27. Describe the basic organization of the cardiovascular system.
28. Describe the relationship of vascular anatomy, radius, flow and pressure gradients and Poiseuille's Law.
29. Describe the generation of arterial blood pressure and its control and mechanisms of arterial hypertension.
30. Outline the regulation of the systemic circulation and describe changes in response to cold, heat and shock.

31. Describe the factors influencing the maintenance of blood pressure.

Week 4

No lectures during this week.

Week 5

LOBs covered during lectures:

32. Describe inspired air gas content and the mechanics of air flow to the alveoli and alveolar ventilation.
33. Describe Fick's law of diffusion and how it moves gases from air to blood to cells.
34. Describe the origin, composition and physical properties of pulmonary surfactant and explain how its lack leads to alveolar collapse during expiration.
35. Outline pulmonary gas exchange.
36. Describe pulmonary circulation and carriage of oxygen in blood by haemoglobin, from lungs to tissues.
37. Describe respiratory control and outline ways in which failure to gas exchange leads to hypoxaemia/hypercapnia.
38. Explain what determines airway resistance in normal lung and what changes in Chronic Obstructive Pulmonary Disease (COPD).
39. Explain the overall respiratory and non-respiratory functions of the respiratory system.
40. Describe multisystem homeostatic mechanisms which contribute towards adaptation to extreme heat and cold.

Week 6

LOBs covered during lectures:

41. Describe ways of intercellular communication and signal transduction.
42. Contrast the location and signalling pathways of membrane bound and intracellular hormone receptors.
43. Compare and contrast hormone actions that are exerted through changes in gene expression with those exerted through changes in protein activity, such as through phosphorylation.
44. Contrast the signal transduction pathways involved in G-protein coupled receptors, receptor enzymes and ligand-gated ion channels.
45. Explain the effects of secretion, excretion, degradation, and volume of distribution on the concentration of a hormone in blood plasma.
46. Describe the lung and the circulation of blood in the foetus and how these change at birth.
47. Describe tropic hormones and the function and control of pituitary target glands and explain the importance of patterns of hormone secretion, such as pulsatile, circadian (diurnal) and menstrual.
48. Explain the principle of negative and positive feedback and feed forward control of hormone secretion.

Week 7

Formative Midterm Exam

LOBs covered during lectures:

49. Outline the synthesis, regulation, storage, secretion, transport, target, mechanism of action, effect, and secretion of the key hormones associated with the hypothalamic –pituitary axis.
50. Explain the role of the hypothalamus in temperature regulation.
51. Outline the anatomy and function of the anterior and posterior pituitary glands
52. Outline the synthesis, regulation, storage, secretion, transport, target, mechanism of action, effect, and secretion of the key hormones associated with the thyroid gland, parathyroid gland, pancreas, kidney, adrenal gland, ovary and testis.
53. Describe calcium and phosphate regulation
54. Describe thyroid hormone functions, secretion, feedback control and hyperthyroid/hypothyroid states.
55. Describe adrenal cortex hormone secretion and control.
56. Describe adrenal cortex, the renin-angiotensin system and mineralocorticoid effects on the kidney and blood pressure.
57. Outline the role of the adrenal medulla in catecholamine secretion.
58. Describe the role of the adrenalin stress response.
59. Describe the role of steroid hormones, including vitamin D.
60. Describe the role of the adrenal in the manufacture of sex hormones.
61. Describe the events occurring at adrenarche in both sexes and some common conditions in which the events do not occur normally.

Week 8

LOBs covered during lectures:

62. Describe multisystem homeostatic mechanisms which contribute towards adaptation to extreme heat, cold
63. Describe multisystem homeostatic mechanisms which contribute towards adaptation to extreme heat, cold, high altitude (low atmospheric pressure).

Week 9

LOBs covered during lectures:

64. Describe blood constituents, the production and function of red cells, haemoglobin, O2 and CO2 transport, transport proteins.
65. Describe the role of platelets and the intrinsic and extrinsic systems in the coagulation cascade of haemostasis.
66. Differentiate the processes of ingestion, digestion, absorption, secretion, and excretion for the major classes of nutrients (carbohydrates, proteins, fats) and state the location in the GI tract where each process occurs.
67. Describe the dynamic pressure changes that occur in the regions of the oesophagus after initiation of the swallowing reflex and how these pressure changes propel a bolus of food from the mouth to the stomach.

Week 10

LOBs covered during lectures:

68. Describe the functions of the duodenum, jejunum, ileum, large intestine and pancreas.
69. Explain the contribution of pancreatic secretion ad bile in producing alkaline pH in the duodenum.
70. Describe the intrinsic and extrinsic of the coagulation cascade.
71. Describe pancreatic hormone actions on carbohydrate, fat and protein metabolism.
72. Describe pancreatic hormone interactions with cortisol, epinephrine and growth hormone.
73. Describe energy balance (intake-expenditure) and nutritional requirements, nutritional status assessment.
74. Describe the features of metabolic adaptation to starvation, protein-calorie malnutrition, vitamin deficiencies and Anorexia Nervosa.
75. Describe the location and process of water and electrolyte absorption.
76. Compare and contrast the function of the stomach, duodenum, small and large bowel.
77. Describe gastrointestinal defence mechanisms and gut flora.

Week 11

LOBs covered during lectures:

78. Describe liver function/acinar structure, synthetic and metabolic functions of hepatocytes, bile secretion, gallbladder function and the actions of cholecystokinin.
79. Describe the function of the jejunum, ileum, pancreas and pancreaticobiliary tree with respect to the digestion and absorption of food.
80. Describe multisystem homeostatic mechanisms which contribute towards deep sea diving (high atmospheric pressure).
81. Describe the control of peristalsis by the enteric nervous system, endocrine and neural regulatory functions, including gastrointestinal (neuroendocrine) hormones.
82. Describe the sequence of events in the colon and anal sphincters occurring during reflexive defecation, differentiating those movements under voluntary control and those under autonomic control.
83. Describe the disorders of motility that can lead to gastroparesis, achalasia, diarrhoea, constipation, megacolon and Irritable Bowel Syndrome.

Week 12

LOBs covered during lectures:

84. Describe multisystem homeostatic mechanisms which contribute towards deep sea diving (high atmospheric pressure).
85. Describe multisystem homeostatic mechanisms which contribute towards adaptation to extreme heat, cold, high altitude (low atmospheric pressure).

Prerequisites	None	Required	None
Course Content	***Topics covered in lectures*** • Introduction to the course, advice and allocation of Poster projects • Introduction to Physiology and Homeostasis/Body Fluid Compartments. • Cell physiology and Solute Transport. • Plasma membrane potential. • Nerve conduction - Resting, action potential and ionic movement. • Propagation of Nerve Action Potential, synapses and neurotransmitters. • The Neuromuscular Junction. **CARDIOVASCULAR SYSTEM:** • Skeletal muscle structure, Molecular basis of contraction, Differences between skeletal, Cardiac and Smooth Muscle. • Skeletal muscle mechanics, Muscle metabolism and fiber types, Control of motor movement. • CARDIOVASCULAR SYSTEM: Cardiac physiology and anatomy- the heart as a pump I. • CARDIOVASCULAR SYSTEM: Mechanical events in cardiac cycle, pressure changes and heart sounds, • the heart as a pump II. • CARDIOVASCULAR SYSTEM: Concepts of preload, afterload and contractility, the heart as a pump III. • CARDIOVASCULAR SYSTEM: The ECG, coronary blood flow, atherosclerosis. • CARDIOVASCULAR SYSTEM: Circulation, blood vessels, physics of blood flow. • CARDIOVASCULAR SYSTEM: Blood pressure and its control. • CARDIOVASCULAR SYSTEM: More on Blood pressure control, postural changes, exercise, shock. • CARDIOVASCULAR SYSTEM: Cardiovascular adaptation to exercise, cold, heat and shock. **RESPIRATORY SYSTEM:** • Anatomy, Mechanics, Upper and Lower airways. • Pulmonary gas exchange and gas transport. • Control of Respiration. • Restrictive and obstructive disease. • Foetal lung, circulation, changes at birth. **ENDOCRINE SYSTEM:** • Intercellular & Neural/ Hormonal communication • Introduction to Endocrinology & Hypothalamus Pituitary, Circadian rhythm. • Central Endocrine Glands feedback mechanism control and growth hormone as a specific example. • Posterior Pituitary. • Adrenal Glands (adrenal cortex-adrenal medulla, glucocorticoids, renal). • Thyroid, Hyperthyroidism, Hypothyroidism. • Parathyroid, Control of Calcium and bone metabolism. • Adrenarche in both sexes and common abnormal conditions and sex hormones. • ADAPTATION TO ENVIRONMENTAL EXTREMES I: Heat and Cold. • THE BLOOD I: Red blood cells, white blood cells, platelets & haemostasis. • THE BLOOD II: Red blood cells, white blood cells, platelets & haemostasis.		

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THE BLOOD III: Coagulation cascade.
ADAPTATION TO ENVIRONMENTAL EXTREMES I: High altitude
ADAPTATION TO ENVIRONMENTAL EXTREMES II:Deep sea diving

GASTROINTESTINAL SYSTEM:

Introduction
Mouth, Pharynx and Oesophagus
Stomach, Gastric Secretion, Duodenum.
Duodenum and pancreatic and bile secretion.
Pancreas and Control of Fuel Metabolism
Liver and small bowel
Small bowel, absorption and GI hormones
Large bowel and large bowel motility of the GI Track
Enteric nervous system and disorders of motility.
ENERGY BALANCE and NUTRITIONAL STATUS ASSESSMENT

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<tr><td>Teaching Methodology</td><td>Lectures, Practicals, Tutorials.</td></tr>
<tr><td>Bibliography</td><td>
Required Textbooks / Reading:
<table>
<tr><th>Authors</th><th>Title</th><th>Edition</th><th>Publisher</th><th>Year</th><th>ISBN</th></tr>
<tr><td>Sherwood, Laura Lee</td><td>Human Physiology: from Cells to Systems</td><td>9th Edition</td><td>Brooks Cole</td><td>2015</td><td>9781285866932 (hardcover)</td></tr>
<tr><td colspan="6">Permalink E-book
https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,sso&db=edsebk&AN=2378291&site=eds-live&custid=s1098328</td></tr>
</table>
Recommended Textbooks/Reading:
<table>
<tr><th>Authors</th><th>Title</th><th>Edition</th><th>Publisher</th><th>Year</th><th>ISBN</th></tr>
<tr><td>Costanzo, Linda</td><td>Costanzo Physiology</td><td>7th Edition</td><td>Saunders/ Elsevier</td><td>2021</td><td>9780323793339</td></tr>
<tr><td>Costanzo, Linda</td><td>BRS: Physiology</td><td>8th Edition</td><td>Kluwer</td><td>2022</td><td>9781975153656</td></tr>
<tr><td>Thomas A. Brown</td><td>Rapid Review Physiology</td><td>2nd Edition</td><td>Mosby</td><td>2011</td><td>9780323072601</td></tr>
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<tr><td>Assessment</td><td>For the course MED-203 Physiology I there will be a Formative Midterm Exam. The grade for the course will be contributed by a Poster/Oral Presentation (20%) and a Summative Final Exam (80%). Written exams consist of Single Best Answer MCQs (SBAs) and Short Answer Questions (SAQs).</td></tr>
<tr><td>Language</td><td>English</td></tr>
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