<table>
<tr><td>Course Title</td><td colspan="5">Medical Physics I: The Human Body</td></tr>
<tr><td>Course Code</td><td colspan="5">MED-101</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 1/ Semester 1 (Fall)</td></tr>
<tr><td>Teacher’s Name</td><td colspan="5">Course Lead:
Dr Vered Aharonson

Contributor:
Dr Stelios Angeli
Prof Dimitris Drikakis
Dr Nicoleta Nicolaou</td></tr>
<tr><td>ECTS</td><td>6</td><td>Lectures / week</td><td>2 to 3/ week</td><td>Laboratories, tutorial / week</td><td>0 to 1/week</td></tr>
<tr><td>Course Purpose and Objectives</td><td colspan="5">The main objectives of the course are:
To give students an introduction to general physics of the human body.
To cultivate an appreciation of the importance of physics in health and life sciences.
To assist students in the development of strong problem-solving skills.
To help students cultivate critical thinking in their approach to learning.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="5">The following list provides the learning objectives that will be covered in the lectures, lab practical sessions and tutorials of each week:

Week 1
LOBs covered during lectures:
1. Describe the concept of units.
2. Describe the concepts of accuracy, uncertainty, and significant figures.
3. Develop an understanding of the concepts used to describe motion like time, distance, displacement, speed, velocity, and acceleration.
4. Understand the relationships between time, displacement, velocity, and acceleration.
5. Understand the distinction between average and instantaneous velocity and acceleration.
6. Describe the concept of force.
7. Understand the relationship between force and motion.
8. Identify action-reaction pairs of forces.</td></tr>
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	9. Understand normal, friction and tension forces. 10. Describe the concepts of static, dynamic, stable, and unstable equilibrium. 11. Describe the concept of torque. 12. Describe the principle of moments. **Week 2** ***LOBs covered during lectures:*** 13. Understand the concepts of work, energy, power, and mechanical efficiency. 14. Understand kinetic and potential energy. 15. Explain conservation of energy. ***Tutorial (all groups):*** Review of topics covered in weeks 1 & 2. **Week 3** ***LOBs covered during lectures:*** 16. Understand the concepts of linear momentum and its relationship to Newton's three laws. 17. Explain conservation of momentum. 18. Explain the difference between elastic and inelastic collisions. 19. Analyse the kinematics, dynamics, and energetics of human motion. ***Tutorial (all groups):*** Review of topics covered in weeks 1 & 2. **Week 4** ***LOBs covered during lectures:*** 20. Develop an understanding of simple harmonic motion. 21. Understand the relationship between Hooke's law and simple harmonic motion. 22. Calculate period and frequency of a mass-spring oscillator. 23. Calculate period and frequency of a simple pendulum. 24. Calculate tensile, compressive, shear and bulk stresses. 25. Describe the concepts of stress and strain. 26. Understand elastic and plastic deformations and how the behaviour of materials under load depends on their stress-strain curve. 27. Discuss the different models of bone fractures.

28. Understand temperature and how it is measured.
29. Understand the concept of thermal equilibrium.
30. Understand thermal expansion.
31. Understand the concepts of phase change and latent heat.
32. Understand the concept of specific heat.
33. Understand how conduction, convection and radiation transfer thermal energy.
34. Understand the concepts of thermal conductivity and heat transfer coefficients.
35. Understand how the first law of thermodynamics applies to the body.
36. Understand the mechanisms the body employs for thermoregulation.
37. Know the factors affecting human comfort levels in various environments.

Tutorial (all groups):

Review of topics covered in week 3 & 4.

Week 5

LOBs covered during lectures:

38. Measure pressure in the human body.
39. State the law of Laplace and apply it to the circulatory system.
40. State the continuity equation and apply it to the circulatory system.
41. State Bernoulli's equation and one of its applications in medicine.
42. Understand the relationship between viscosity, pressure, and flow rate.
43. Apply Poiseuille's equation to flow in tubes.
44. Examine blood pressure variations along arteries, veins, and capillaries.
45. Investigate the consequences of non-uniformities in arteries.

Tutorial (all groups):

Review of topics covered in week 3 & 4.

Week 6

Summative midterm exam

Week 7

LOBs covered during lectures:

46. Understand the nature of surface tension.
47. Understand capillarity.
48. Outline the physical nature of lung operating units, i.e., alveoli.

49. Understand lung volumes.

Week 8

LOBs covered during lectures:

50. Understand the connection between simple harmonic motion and wave motion.
51. Understand the concepts of phase, frequency, wavelength, and wave velocity.
52. Understand superposition and interference of waves.
53. Understand the phenomenon of beats.
54. Understand reflection of waves by barriers and the production of standing waves.
55. Understand the transmission of energy and power by wave motion.
56. Describe how sound is produced and transmitted.
57. Explain pitch and loudness.
58. Understand the anatomy and function of the human vocal organs and ear.
59. Explain how the motion of a sound source or observer changes the observed frequency.

Tutorial (all groups):

Review of topics covered in weeks 5,7 and 8.

Week 9

LOBs covered during lectures:

60. Understand the basic nature of light.
61. Understand the place of visible light in the electromagnetic spectrum.
62. Understand how the change of light speed n different material leads to refraction and dispersion.
63. Draw ray diagrams for mirrors and lenses.
64. Use thin lens equation to calculate the type and position of an image.
65. Calculate the magnification of an image.
66. Explain how the cornea and crystalline lens image light on the retina.
67. Develop optical models of the eye.
68. Understand the causes of vision defects and how they may be corrected.
69. Outline the physics of the perception of colour.

Tutorial (all groups):

	Review of topics covered in weeks 5,7 and 8. **Week 10** ***LOBs covered during lectures:*** 70. Understand the types of charge. 71. Understand the origins of the electric force. 72. Use Coulomb's law to calculate the size of the electric force. 73. Understand the types of electric fields that exist around simple charge configurations. 74. Calculate the size and direction of the force a field exerts on charges placed within it. 75. Understand electrical potential and electrical potential energy. 76. Apply the idea of electrical potential to calculate work done by electric fields. 77. Understand the representation of electrical potential by equipotential lines and the relationship of electrical potential to electric field lines. 78. Analyse the electrical properties of the heart. 79. Discuss the signals seen in an electrocardiogram. 80. Understand the nature of electrical capacitance. 81. Describe the relationship between the stored charge, potential difference, and capacitance of a capacitor. 82. Understand the nature of electric circuits. 83. Explain electric current and electrical resistance. 84. Use Ohm's law. ***Tutorial (all groups):*** Review of topics covered in weeks 9 and 10. **Week 11** ***Tutorial (all groups):*** Review of topics covered in weeks 9 and 10. **Week 12** Review of Semester.		
Prerequisites	None	Required	None
Course Content	***Lecture Topics:*** • **Mechanics**		

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Kinematics.
Force and Newton’s laws of motion.
Statics.
Energy.
Momentum.
Simple harmonic motion.
Waves.
Sound and hearing.

Bulk Material

Elasticity: Stress and Strain.
Pressure.
Surface tension and capillarity.
Fluid dynamics of non-viscous fluids.
Fluid dynamics of viscous fluids.

Thermodynamics

Temperature and the zeroth law.
Heat transfer.
Thermodynamics and the body.

Electricity

Static electricity.
Electric force and electric field.
Electrical and potential energy.
Capacitance.
Direct currents and DC circuits.

Optics

The nature of light.
Geometric optics.
The eye and vision.

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<tr><td>Teaching Methodology</td><td>Lectures, 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>Kirsten Franklin, Paul Muir, Terry</td><td>Introduction to Biological Physics for the</td><td>2nd Edition</td><td>Wiley-Blackwell</td><td>2019</td><td>9781118934500</td></tr>
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	Scott and Paul Yates	Health and Life Sciences				

Recommended Textbooks/Reading:

Authors	Title	Edition	Publisher	Year	ISBN
Irving P. Herman	Physics of the Human Body	2nd Edition	Springer	2016	97833 19239 309
E-book Permalink: https://link.springer.com/book/10.1007/978-3-319-23932-3					
Martin Zinke Allmag	Physics of the Life Sciences	3rd Edition	Nelson Canada	2016	9780176 558697
R.K.Hobbie and B.J.Roth	Intermediate Physics for Medicine and Biology	5th Edition	Springer	2015	9783319 126814
E-book Permalink: https://link.springer.com/book/10.1007/978-3-319-12682-1					

Assessment	Medical Physics Project report (10%), Midterm Exam (30%), and Final Exam (60%). Assessment is by Single Best Answers (SBAs).
Language	English