<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 Constantinos Zervides</td></tr>
<tr><td>ECTS</td><td>6</td><td>Lectures / week</td><td>3</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 give students an introduction to physics of the human body.
To cultivate an appreciation of the importance of medical physics.
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 acceleration due to gravity.
2. Describe the concept of force.
3. Describe the concept of units.
4. Describe the concepts of accuracy, uncertainty and significant figures.
5. Describe the concept of equilibrium.
6. Describe the concept of torque.
7. Explain motion in one plane and levers.
8. Investigate statics in the body.
9. Investigate the principle of moments.
10. Describe the concept of centre of gravity/centre of mass.

Week 2
LOBs covered during lectures:
11. Analyse the kinematics, dynamics and energetics of human motion.
12. Describe the concepts of distance and displacement.</td></tr>
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13. Describe the concepts of speed, velocity and acceleration.
14. Describe the concepts of Kinetic and Potential energy.
15. Explain conservation of energy.
16. Outline body stability and skeletal muscles action.
17. Discuss the overall and local stability of the body.
18. Analyse standing starts, walking, running and jumping.
19. Describe the concept of momentum.
20. Investigate elastic and inelastic body collisions.

Week 3

LOBs covered during lectures:

21. Describe the concepts of stress and strain.
22. Describe the concept of elasticity.
23. Investigate fractures of body materials and parts.
24. Explain the performance of the human body under normal and extraordinary conditions.
25. Explain Hooke's Law.
26. Discuss time-independent material models.
27. Discuss the different models of bone fractures.

Tutorial (all groups):

Review of topics covered in weeks 1 & 2.

Week 4

LOBs covered during lectures:

28. Discuss thermal equilibrium.
29. Explain the concept of temperature.
30. Analyse models of body heat loss.
31. Investigate the laws of thermodynamics.
32. Explain thermoregulation.

LOBs covered during lab practical (all groups):

33. Investigate heat transfer by radiation.
34. Investigate heat transfer by conduction.
35. Investigate heat transfer by convection.

Week 5

LOBs covered during lectures:

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

Tutorial (all groups):

Review of topics covered in week 3 & 4.

Week 6

MIDTERM EXAM

LOBs covered during lectures:

43. Analyse volume, pressure and air flow during breathing using models.
44. Outline the physical nature of lung operating units, i.e. alveoli.
45. Describe the physical consequences of a diseased lung using models.

Tutorial (all groups):

Review of topics covered in week 5.

Week 7

Study Week

Week 8

LOBs covered during lectures:

46. Describe the properties of sound waves.
47. Describe how sound is produced in speech.
48. Explain pitch and loudness.
49. Characterise the human voice.
50. Outline sound propagation in the outer and middle ear.
51. Explain how nerve signals are generated in the inner ear.

Week 9

LOBs covered during lectures:

52. Describe the concepts of reflection and refraction.

	53. Explain how the cornea and crystalline lens image light on the retina. 54. Develop models of lens systems. 55. Develop optical models of the eye. 56. Link image formation and eye properties to vision and visual perception. 57. Outline the physics of the perception of colour. ***Tutorial (all groups):*** Review of topics covered in weeks 6 - 8. **Week 10** ***LOBs covered during lectures:*** 58. Analyse the electrical properties of the heart. 59. Discuss the importance of body electrical signals to diagnosis. 60. Explain the importance of electrical conduction for the human body. ***LOBs covered during lab practical (all groups):*** 61. Investigate normal and abnormal ECG. 62. Investigate normal and abnormal spirometry readings. **Week 11** ***LOBs covered during lectures:*** 63. Outline feedback and control in the body. 64. Describe how high blood pressure is controlled in the body. 65. Describe how temperature is regulated in the body. 66. Describe the regulation of the eye pupil size. ***Tutorial (all groups):*** Review of topics covered in weeks 9 - 11. **Week 12** **Review of Semester.**		
Prerequisites	None	Required	None
Course Content	***Lecture Topics:*** • Statics of the body. • Body kinematics. ○ Kinematics, standing and walking		

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Running and jumping

Collisions of the human body.
Elastic properties of the body.
Viscoelasticity.
Bone fractures.
Conservation of energy and heat flow.
Loss of body heat.
Body temperature.
Characteristic pressures in the body.
Basic physics of pressure and flow of fluids.
Pressure and flow in the body.
Physics of the circulation system.
The physics of the alveoli and breathing.
Volume of the lungs.
Breathing under usual and unusual conditions.
The physics of sound waves.
Speech production
Hearing and other vibrations in the body.
Focusing and imaging with lenses.
Imaging and detection by the eye.
Electrical properties of body tissue
Electrical properties and signals of the heart.
Basics of feedback and control.
Regulation of temperature and control of blood pressure.
Regulation during exercise and of the pupil size.

Laboratory Experiments and Demonstrations:

Heat and thermodynamics.
ECG.

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<tr><td>Teaching Methodology</td><td>Lectures, Tutorials, Laboratory Practical Sessions.</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</td><td>1st Edition</td><td>John Wiley & Sons</td><td>2010</td><td>9780470665930</td></tr>
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Scott and Paul Yates	for the 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	9783 3192 3930 9
Martin Zinke Allmag	Physics of the Life Sciences	2nd Edition	Cengage Learning	2012	978017 650268 3
R.K.Hobbie and B.J.Roth	Intermediat e Physics for Medicine and Biology	5th Edition	Springer	2015	978331 912681 4

Assessment	Laboratory reports (10%), Midterm Exam (30%), and Final Exam (60%). Assessment is by Single Best Answers (SBAs) and Short Answer Questions (SAQs).
Language	English