PHSI 191 BIOLOGICAL PHYSICS (2024)

Course Structure

The course covers the foundations of physics for the health sciences, including maths for physics, mechanics, properties of fluids and solids, thermodynamics, optics, electrostatics, and radiation and health.

PHSI191 is a text-book-based course, and the lectures and assignments are closely integrated with the text *Introduction to Biological Physics for the Health and Life Sciences (2nd ed)*, Franklin et al (Wiley, 2019). Self-directed learning is an important aspect of this course, and students are expected to prepare for lectures by reading specified sections from the text.

**Teaching Hours:** There are a total of 51 hours of formal teaching split between lectures (36 hours) and laboratories (15 hours).

**Lectures:** There are three 1-hour lectures each week, and the course runs for the entire semester. Each physics topic in the curriculum consists of four to six lectures, and four lectures of maths are included at the start of the course.

**Laboratories:** Five 3-hour laboratory sessions the last hour of which is a dedicated problem-solving tutorial session. Five online Lab Assessment Tests (LATs) are associated with the laboratory material.

**Assessment:**

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<th>Terms requirement</th>
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<tbody>
<tr>
<td>Laboratories</td>
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<tr>
<td>Lab Assessment Tests</td>
<td>10%</td>
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<td>Progress Test</td>
<td>20%</td>
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<td>Final exam</td>
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The final exam is a three-hour, 55-question, multi-choice exam. The PHSI191 Progress Test is an optional one-hour, 20-question multi-choice exam. Plussage applies to the PHSI191 Progress Test mark.
Curriculum
Maths for Physics - 4 Lectures Review of algebra
Exponents and logarithms
Trigonometry
Systems of units and unit conversion
Vectors
Mechanics of Movement - 6 Lectures + 2 Laboratories
Kinematics, forces, statics, dynamics
Work and energy, types of energy, energy conservation
Linear momentum and momentum conservation
Torque and levers
Simple Harmonic Motion, circular and wave motion
Solids and Fluids - 6 Lectures + 1 Laboratory
Stress, strain, elasticity
Young’s modulus, shear modulus, bulk modulus
Pressure, volume, density
Surface tension, capillarity
Buoyancy and Archimedes’ principle
Dynamics of non-viscous fluids - Continuity equation, Bernoulli’s equation
Viscosity, laminar flow, turbulence, Reynolds’ number
Dynamics of viscous fluids – Poiseuille's Law
Transport Phenomena – Diffusion, osmosis
Thermodynamics - 5 Lectures + ½ Laboratory (shared with Electricity)
Temperature, heat, thermal expansion
Ideal gas law (including partial pressures, Charles’s, Dalton’s and Boyle’s Laws)
Specific heat, latent heat, phase changes
Water vapour in the air - Psychrometric chart, humidity, dry-bulb and wet-bulb
   temperature, dew point
Heat transfer - conduction, convection and radiation
First law of thermodynamics, simple processes, efficiency
Electricity - 5 Lectures + ½ Laboratory (shared with Thermodynamics)
Forces between charges, Coulomb’s law
Electric fields, energy of charges, electric potential
Conductors, insulators, capacitors
Current, Ohm’s law, simple DC circuits
Series and parallel resistors, RC circuits
Optics - 5 Lectures + ½ Laboratory (shared with Radiation)
Electromagnetic spectrum - reflection, refraction
Geometric optics, image formation
Wave optics, interference, diffraction, resolution limit
The eye and vision correction
Radiation - 5 Lectures + ½ Laboratory (shared with Optics)
Atoms, nuclei, nuclear decay, half life
Radiation: nature, types and measurement
Natural and artificial radiation
Biological effects of radiation
Radiation dose, absorbed and effective dose