Institute *of* **Physics**

MPhys Equivalence Report Template Core of Physics Topics

Save this PDF to your computer and complete it off-line.

Name | Membership Number

If you hold an IOP accredited BSc give details here:

Title | Completion Date | Awarding Body

OTHERWISE explain briefly your knowledge of each topic and how it was gained:

(for example:

- 'diffraction included in Physics 101 Optics and Waves course.'
- 'Heisenberg covered in Wave Mechanics in second year'
- 'magnetic properties of paramagnetic material in final year solid state option'
- 'xxx by private study ref: Eisberg, Modern Physics pp123-145, used in yyy project')

Mathematics for Physicists

• Trigonometric and hyperbolic functions; complex numbers	
• Series expansions, limits and convergence	
• Calculus to the level of multiple integrals; solution of linear ordinary and partial differential equations	
• Three-dimensional trigonometry	
• Vectors to the level of div, grad and curl; divergence theorem and Stokes' theorem	
• Matrices to the level of eigenvalues and eigenvectors	
• Fourier series and transforms including the convolution theorem	
• Probability distributions	

Mechanics and Relativity

Classical mechanics to include:	
• Newton's laws and conservation laws including rotation	
• Newtonian gravitation to the level of Kepler's laws	
Special relativity to the level of:	
• Lorentz transformations and the energy-momentum relationship	

Quantum Physics

Background to quantum mechanics to include:	
• Black body radiation	
• Photoelectric effect	
• Wave-particle duality	
• Heisenberg's Uncertainty Principle	
Schrödinger wave equation to include:	
• Wave function and its interpretation	
• Standard solutions and quantum numbers to the level of the hydrogen atom	
• Tunnelling	
• First order time independent perturbation theory	
Atomic, nuclear and particle physics to include:	
• Quantum structure and spectra of simple atoms	
• Nuclear masses and binding energies	
• Radioactive decay, fission and fusion	
• Pauli exclusion principle, fermions and bosons and elementary particles	
• Fundamental forces and the Standard Model	

Condensed Matter Physics

• Mechanical properties of matter to include elasticity and thermal expansion	
• Inter-atomic forces and bonding	
• Phonons and heat capacity	
• Crystal structure and Bragg scattering	
• Electron theory of solids to the level of simple band structure	
• Semiconductors and doping	
• Magnetic properties of matter	

Oscillations and Waves

• Free, damped, forced and coupled oscillations to include resonance and normal modes	
• Waves in linear media to the level of group velocity	
• Waves on strings, sound waves and electromagnetic waves	
• Doppler effect	

Electromagnetism

• Electrostatics and magnetostatics	
• DC and AC circuit analysis to the level of complex impedance, transients and resonance	
• Gauss, Faraday, Ampère, Lenz and Lorentz laws to the level of their vector expression	
• Maxwell's equations and plane electromagnetic wave solution; Poynting vector	
• Electromagnetic spectrum	
• Polarisation of waves and behaviour at plane interfaces	

Optics

• Geometrical optics to the level of simple optical systems	
• Interference and diffraction at single and multiple apertures	
• Dispersion by prisms and diffraction gratings	
• Optical cavities and laser action	

Thermodynamics and Statistical Physics

Zeroth, first and second laws of thermodynamics to include:	
• Temperature scales, work, internal energy and heat capacity	
• Entropy, free energies and the Carnot Cycle	
• Changes of state	
Statistical mechanics to include:	
• Kinetic theory of gases and the gas laws to the level of Van der Waals equation	
• Statistical basis of entropy	
• Maxwell-Boltzmann distribution	
• Bose-Einstein and Fermi-Dirac distributions	
• Density of states and partition function	

Details of project
