Department of Physics
香港城市大學
City University of Hong Kong

Qualifying Examination for PhD Students
Topic and Reference Book List

Physics Branch	Topics	Reference Book(s)
Electrodynamics	Coulomb's law, Gauss's law, scalar potential, vector potential, electric and magnetic energy, solution of Laplace's equation in simple systems, Ampere's law, Biot-Savart law, electric polarization, magnetization, constitutive relations, Lorentz force law, Maxwell's equations and boundary conditions, Poynting's theorem, radiation pressure, linear and circular polarization, reflection and refraction of plane wave at an interface, rectangular waveguide, electric dipole radiation, spacetime structure, Lorentz transformations, time dilation, Lorentz contraction, relativistic energy and momentum	1. Introduction to Electrodynamics, 4th edition, by David J, Griffiths
Instrumentation Physics	1. Physical principles and paractical application of various modern characterization methods such as OM, SEM, TEM, XRD, XPS, Raman Spectroscopy, AFM et al 2. introduction of the theory of thermal neutron scattering 3. synchrotron radiation	1. X-Ray Diffraction A Practical Approach C. Suryanarayana and M. Grant Norton 2. Encyclopedia of Materials Characterization, edited by C Richard Brundle, Charles A Evans, Jr, and Shaun Wilson, Butterworth-Heinemann (1992) (PHY8501)
Soft Matter and Biophysics	1. Mechanical properties of cells and tissues 2. Electromagnetic properties of cells and tissues 3. Radiation (ionizing) biology	1. Introduction to Cell Mechanics and Mechanobiology Christopher R. Jacobs, Hayden Huang, Ronald Y. Kwon Chs. 1-5 2. Tissue Mechanics Cowin, Stephen C., Doty, Stephen B. Chs. 1-8 3. Radiation Biophysics Edward L Alpen Chs. 1-7

Solid State Physics	1. Properties of typical lattice structures (Aschroft & Mermin, Chap 4-5); 2. Bloch Theorem and Electronic Band Structures (Aschroft & Mermin, Chap 7-9); 3. Solution of simple tight-binding models (Aschroft & Mermin, Chap 10); 4. Basic Theory of Electron Conduction (Aschroft & Mermin, Chap 12-14); 5. Phonons (Kittel, Chap 4-5); 6. Basics of Semiconductors (Aschroft & Mermin, Chap 28-29); 7. BCS Theory of Superconductivity (Aschroft & Mermin, Chap 34).	1. Aschroft & Mermin, Solid State Physics; 2. Charles Kittel, Introduction to Solid State Physics.
Statistical Mechanics	Thermodynamics & statistical mechanics (1) Thermodynamic quantities; (2) Laws of thermodynamics; (3) Maxwell relations; (4) Thermodynamics of phase equilibrium; (5) Ensembles in statistical mechanics; (6) Boltzmann distribution; (7) Bose–Einstein distribution; (8) Fermi–Dirac distribution; (9) partition functions; (10)Fluctuation-dissipation theorem & Brownian motion	1. Statistical Physics of Particles by Mehran Kardar 2. Thermodynamics & statistical physics by WANG Zhicheng, Higher Education Press in China
Quantum Mechanics	Fundamental concepts: Wave-particle duality, Uncertainty principle, Dirac notation, Schrödinger equation (Particle-in-a-box, Harmonic oscillator etc.), Operator and matrix methods, Bohr's model of an atom, Angular momentum and spin, Identical particles, Second quantization, Perturbation theory, Scattering	1. David J. Griffiths, Introduction to Quantum Mechanics, Cambridge University Press; 3rd edition (August 16, 2018). 2. J. J. Sakurai, Modern Quantum Mechanics, Cambridge University Press; 2nd edition (September 22, 2017).

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