مفردات الاختبار التحريري برنامج الماجستير - قسم الفيزياء

Below are the topics covered in the MSc admission examination:

1.General physics: Motion in one dimension, The concept of force, Newton's first law, Newton's second law, the force of gravity and weight, Newton's third law, Vectors, laws of motion, Work and kinetic energy, Potential energy and conservation of energy. Newton's law of universal gravitation. Free-fall acceleration and the gravitational force, Kepler's laws and the motion of planets, gravitational potential energy, energy considerations in planetary and satellite motion, Motion of an object attached to a spring, mathematical representation of simple harmonic motion, energy of the simple harmonic motion, the pendulum, damped oscillations, forced oscillations.

2. Classical Mechanics: Euler's equation, functions with several dependent variables, Euler's equation when auxiliary conditions are imposed , Hamiltonian's principle, generalized coordinates, Lagrange's equations of motion in generalized coordinates, Lagrange's equations with undetermined multipliers, equivalence of Lagrange's and Newton's equations, a theorem concerning the kinetic energy, conservation theorems, canonical equations of motion– Hamiltonian mechanics

3. Optics & Photonics: The Laws of Geometric Optics and Image Formation: Reflection, Refraction, Dispersion and prism, Total internal reflection, Images formed by flat mirror, Images formed by spherical mirrors, Images formed by refraction, Thin lenses.
Conditions for interference, Young's double-slit experiment, Intensity distribution of the double-slit interference pattern, Change of phase due to reflection, Interference in thin films.

4.Quantum Mechanics: Development of the quantum theory, Experiments that led to the formulation of quantum mechanics, Wave-particle duality. Schrödinger equation, Statistical interpretation, Probability, Normalization, Fourier transform, Momentum, Position and momentum operators, Expectation value, Eherenfest's theorem, Uncertainty principle. Time-Independent Schrödinger Equation.

5. Statistical Mechanics & Thermodynamics : The laws of thermodynamics, Definitions: System, Surroundings, Boundary, Open system, Closed system, Isolated system, Extensive property, Intensive property, State of a system at equilibrium, Processes (quasi-static, reversible, irreversible, adiabatic, isobaric, isothermal, isochoric, cyclic), Coin-tossing experiment. System of distinguishable particles. Thermodynamic probability and entropy. Quantum states and energy levels. Density of quantum states.

6. Electricity ,Magnetism and Electrodynamics: Electric fields, Gauss' law, electric potential. Capacitance and dielectrics are introduced, and then the course moves to the magnetic field, faraday's law, inductance, alternating current circuits, Outline the concepts of electromagnetic vector fields, Law-Maxwell's Equation, Electric Potential, Relationship between and Maxwell's Equation, Electric Dipole and Flux lines, Energy Density in Electrostatic Fields.

7. Solid State Physics: Crystal Structure: Periodic array of atoms; fundamental types of lattices; index systems for crystal planes, simple crystal structures; direct imaging of atomic structure; non-ideal crystal structures. Wave Diffraction and the Reciprocal Lattices: Diffraction of waves by crystals; scattered wave amplitude; Brillouin zones; Fourier analysis of the basis.

References:

1. Serway R.A. and Jewett J.W., ***Physics for Scientists and Engineers with Modern Physics,*** 9th Edition, Brooks/Cole, Belmont, CA, USA (2014).
2. Halliday D. and Resnick R., ***Physics***, 9thEdition, John Wiley and sons (2011).
3. Griffiths D.J***., Introduction to Quantum Mechanics,*** 2nd Edition, Pearson Prentice Hall, NJ, USA(2004).
4. Sadiku M., ***Elements of Electromagnetic***, 2nd Edition, Saunders College (1995).
5. Kittel C. and Kroemer H., ***Thermal Physics,*** W. H. Freeman and Company, New York (1980).
6. Thornton S.T. and Marion J.B., Classical Dynamics of Particles and Systems, 5th Edition, Thomas Learning Inc. (2004).
7. Kittel C., Introduction to Solid State Physics, 8th Edition, John Wiley & Sons, NY (2004).