Jaypee University of Information Technology, Waknaghat -173234

M.Sc. Physics Programme -2014

The MSc Physics is a four-semester program and will focus on the basics and application of physical sciences, especially Nanotechnology, Materials Science, Electronics etc. The program stresses on interdisciplinary fields like modeling, simulation and extensive laboratory and Project work. The courses will prepare students for research career in an industrial or national research laboratory environment. The course designed provides a platform for the research in cutting edge technology and it covers all the aspects of national examination of repute like GATE, NET. ***Brilliant candidates after passing M.Sc. Physics course may be considered for PhD programme.***

Fee Structure: Tuition Fee Rs. 35,000 per semester

Eligibility Criteria:

B.Sc. with Physics as one of the subjects of study from a University established by law in India with at least 60% marks in aggregate.

The admission to M.Sc. Physics will be made strictly on the basis of marks obtained in the Entrance Test and past academic record of the candidate. The Entrance Test shall be of 100 marks and 50 marks are for past academic record of the student. The entrance test shall be of multiple choice questions (MCQ) in nature as per the B.Sc. courses prescribed by Universities (see the attached syllabus). There will be 80 questions of 1.25 marks each. The wrong answers will fetch minus 0.25 marks for every question (negative marking). The duration of the test will be 1.5 hours. The break-up of 50 marks for the past academic record will be as under

1. Matric or Equivalent Examination 10% of the percentage of marks obtained
2. +2 or Equivalent Examination 15% of the percentage of marks obtained
3. B.Sc./or any other equivalent examination 25% of the percentage of marks obtained

The minimum qualifying marks for the Entrance Test will be 35% for calling the candidates for admission counseling.

How to Apply:

i. Application may be **downloaded** from the website: **www.juit.ac.in**
ii. Please enclose a Demand Draft of **Rs.500/-** in favour of **Jaypee University of Information Technology**, payable at **Shimla** as Application fee.
iii. Application Form duly completed must reach before due date to:

Head
Department of Physics and Materials Science,
Jaypee University of Information Technology,
Waknaghat, Solan, HP 173234

Last date to Apply: June 25, 2014
Date of entrance examination: July 06, 2014
Time of entrance examination: 11:30 AM
Examination Centre: Jaypee University of Information Technology, Waknaghat, Solan, HP 173234.
Date of declaration of result: July 07, 2014 (05:00 PM)
[Result can be seen on Website: **www.juit.ac.in**]

Syllabus for M.Sc. Entrance Examination
Subject: Physics

I. Mechanics and Relativity:

Relationship of conservation laws and symmetries of space and time. Inertial frames of reference. Galilean transformation and Galilean invariance. Non-inertial frames, Coriolis force and its applications. Focault's pendulum. Concept of stationary universal frame of reference and search for ether. Michelson- Morley experiment, postulates of special theory of relativity. Lorentz transformations. Observer in relativity. Relativity of simultaneity. Length contraction. Time dilation. Relativistic addition of velocities. Relativistic Doppler effect. Variation of mass with velocity and mass energy equivalence. Increase of mass in an inelastic collision, Relativistic momentum and energies. Transformation of momentum , energy. Minkowsky space. Various forces in nature (qualitative). Central forces, Centre of mass. Equivalent one body problem. Equation of motion under a force law. Equation of orbit and turning points. Kepler's laws.

II. Electricity and Magnetism:

Scalar and vector fields, Differentiation of vector with respect to scalars, gradient, divergence, curl operations and their meaning. Idea of line, surface and volume integrals, Gauss, Stokes and Green's theorems, Electric potential due to a dipole and quadrupole, long uniformly changed wire, charged disc. Electric potential energy. Curl of a vector field, stokes theorem and its application to electrostatic field. Electric field as gradient of a scalar potential, calculation of electric field due to a point charge and a dipole from potential. Electromagnetic waves in a medium having finite permeability and permittivity but with conductivity= 0. The wave equation for electromagnetic waves. Poynting vector. Impedance of a dielectric to electromagnetic waves. Electromagnetic waves in a medium of properties. Skin depth. E.M waves in a conductor and anomalous dispersion. Electrostatic Fields in Dielectrics: Polarization of matter. Atomic and molecular dipoles, induced. Dipole moment and atomic polarizability. Electric susceptibility and polarization vector Capacity of a capacitor filled with Dielectrics. Dielectrics and Gauss's law Displacement vector-Establishment of relation. Energy stored in a dielectric medium. Magnetic Fields in Matter: Behavior of various substances in magnetic fields. Definition of M and H and their relation to free and bound currents. Magnetic permeability and susceptibility and their interrelation. Orbital motion of electrons and diamagnetism. Electron spin and paramagnetic. Ferromagnetism. Domain theory of ferromagnetism, magnetization curve, hysterics loss, ferrites.

III. Waves and Vibrations:

Interference, Diffraction, and Polarization.

Damped Harmonic Motion and Superposition of Harmonic Motions Damped S.H.M. Logarithmic decrement. Relaxation time. The quality factor, q value of a simple harmonic oscillator. The Forced Oscillator: Transient and steady behaviour of forced oscillator. Displacement and velocity variation with driving force frequency. Variation of phase with frequency. Power supplied to an oscillator and its variation with frequency. Q- value and band width. Q-value as an amplification factor

IV. Statistical Physics and Thermodynamics:

Different Statistics in Physics, Phase space and division into elementary cells. Three kinds of statistics. The basic approach in the three statistics. M-B. Statistics applied to an ideal gas in equilibrium, experimental verification of the Maxwell Boltzmann's law of distribution of molecular speeds. Need for quantum statistics, h as a natural constant and its implications, Indistinguishability of particles and its implications. B-E statistics, Bose Einstein and Fermi

Dirac Statistics: Derivation of Planck's law of radiation, deduction of Wien's distribution law and Stefan's law from plank's law. Fermi-Dirac statistics. Applications to liquid helium, free electrons gas (Fermi level and Fermi Energy), Comparison of M-B, B-E, F-D statistics, Entropy and Laws of Thermodynamics: Application of thermodynamics to the thermoelectric effect, change of entropy along a reversible path in a p-v diagram, entropy of a perfect gas, equation of state of ideal gas from simple statistical considerations, heat death of the universe.

V. Atomic Physics:

Schrodinger's theory; Need for differential wave equation; time dependent and time independent forms of Schrodinger's wave equation, expectation values Born's interpretation of wave function, properties of wave function; Expectation values, Particle in a box (one, two and three dimensional) ; harmonic oscillator. Confining potentials. Operators: Position, Momentum, Angular Momentum and Total Energy (Hamiltonian). Atoms with one electron: Hydrogen atom and its spectrum, Frank – Hertz experiments, Quantization of angular momentum; vector atom model L-S, J-J coupling, Zeeman effect (normal and anomalous). Fine structure of hydrogen spectrum; electron spin. The Stern - Gerlach experiment, spin-orbit coupling.

VI. Solid State Physics:

Crystal bonding: Potential between a pair of atoms, Lennard-Jones potential, Ionic, Covalent, Vander - Waal's. Calculation of cohesive energy for ionic and inert gas system. Lattice Vibration: Vibrations of one dimensional monoatomic chain under haromonic and nearest neighbour interaction approximation, Concept of phonons, density of modes (1-D), specific heat Einstein and Debye's models of specific heat. Extension to 3-D conceptual. Free electron theory of metals: Classical picture, Fermi gas, density of states, Fermi energy and fermi velocity, electronic contribution to specific heat of metals. Band Theory of Metals: Kronig Penny model, Brillouin zones, electrons in periodic structure, energy bands, energy gaps, effective mass of electrons and holes, metals, insulators, semiconductors, Superconductivity: Resistance to currents, occurrence of super conductivity, idea of critical field, Meissner effect, type I and type II superconductors, isotope effect, penetration of Magnetic field, thermodynamic effect, Flux quantization.

VII. Nuclear Physics:

Radioactivity: Models of decay, description of the processes of alpha emission, electron emission, positron emission, electron – capture, gamma ray emission and internal conversion, law of decay, disintegration constant, half life and mean life, unit of radioactivity. Radioactive dating, Radio- active tracers, Qualitative discussion of alpha, beta and gamma ray spectra, Geiger nuttal law, Interaction of Nuclear Radiation with matter: Energy loss due to ionization (Bethe- Block formula) t energy loss of electrons, Cerenkov radiation, Rutherford scattering multiple coulomb scattering, passage of gamma- rays through matter. Compton scattering, pair production radiation loss by fast electrons, Radiation length and electron- gamma showers, position a annihilation, Relativistic Kinematics.

VIII. Electronics:

Junctions Diodes: p-n junctions, biased junction , V-A characteristics, Zener diode, tunnel diode, LED and LCD, Solar cell. Diode as circuit element, load line concept. Rectifiers: Half wave and full wave rectifiers, efficiency and ripple factor, filter circuits, Voltage regulation, Transistors: Characteristics of a transistor in CB, CE and CC mode, graphical analysis of the CE configuration, Thevnin's Theorem, Norton Theorem, Constant Voltage and current generator, idea of equivalent circuits, low frequency equivalent circuits, h-parameters, bias stability, thermal runaway.