Tata Institute of Fundamental Research

Entrance test for the Ph.D. Programme: Sample Questions

PHYSICAL SCIENCES

SYLLABUS

In general, the syllabus for the Admissions Tests in Physics (Written and Interview) is typically a course of studies in Physics as the main subject in the Undergraduate and Masters levels in an Indian University. The questions in the written test (multiple-choice type) and the interviews are distributed over the following areas: Classical Mechanics; Mathematics relevant to Physics; Electricity and Magnetism; Quantum Mechanics; Heat, Thermodynamics and Statistical Physics; General Physics; Modern Physics; Electronics and Experimental Physics.

SAMPLE QUESTIONS

(NOTE: Wrong answers will get you negative marks)

1. The function $f(z) = z^2 + 1$ is integrated over a circle of unit radius in the complex z plane. What is the value of the integral?

[a] 1 [b] i [c] 0

2. Charged particles are beamed into a region having a uniform electric field of 10^3 Newton/Coulomb and a uniform magnetic field of 10^{-2} Newton/(ampere meter). The electric and magnetic fields are at right angles to each other and the beam of particles is directed perpendicular to both of them, so that the electrical and magnetic forces on an ion oppose each other. The speed of those ions that are unaffected through this region is:

[a] 10^4 m/s [b] 10^5 m/s [c] 10^6 m/s

3. The electron in a free Hydrogen atom is initially in the state with quantum numbers $n = 3$ and $\ell = 2$. It makes an electric dipole transition to a lower energy state. Which of the given states could it finally be in?

[a] $n = 3, \ell = 0$ [b] $n = 2, \ell = 2$ [c] $n = 2, \ell = 1$

4. N particles are distributed amongst three levels having energies 0, kT and 2kT. If the total equilibrium energy of the system is approximately 425kT, what is the value of N?

[a] 1001 [b] 335 [c] 425 [d] 390 [e] 181