University of Mysore

Department of Studies in Physics
Manasagangotri, Mysore 570006

Syllabus for Course Work for Ph.D. in Physics – 2012

Unit 1

Description of Data: Introduction; Moments of a distribution: Mean; Variance; Skewness, Standard deviation; Efficient search for the median; Estimation of the mode for continuous data; Two distributions: Student's t-test, F-test, Chi-square test; Linear correlation; Nonparametric or Rank correlation; Smoothing of data. (Ref. : Schaum's Outline of statistics, Spiegel M.R. and Stephens L.J., McGraw Hill, USA, 1998.)

Definition and sources of error. Propagation of errors. (Ref. : An introduction to numerical analysis, Atkinson K.E., John Wiley and Sons, 1989; pp.17–34).

Modelling of data: Introduction; Least-squares as a maximum likelihood estimator; Fitting data to a straight line; General linear least squares; Nonlinear models; Confidence limits; Robust estimation. (Ref. : Numerical recipes in C, Press W.H., Flannery B.T., Teukolsky S.A., and Vetterling W.T., Cambridge University Press, Cambridge, 1988; Chapter 14.)

Unit 2

Statistical Mechanics: Partition function (Chapter 2); Partition function of a gas of non-interacting point particles, Average energy and entropy of this system (Chapter 3); Partition function of a gas of non-interacting particles with structure like molecule, average energy, classical and quantum mechanical resutls (Chapter 4); Partition function of a harmonic oscillator, average energy, classical and quantum mechanical results (Chapter 5).

(Ref. : Statistical mechanics: A survival guide, Glazer A.M. and Wark J.S., Oxford University Press, 2001.)

Unit 2

Statistical Mechanics: Partition function; Partition function of a gas of non-interacting point particles, Average energy and entropy of this system; Partition function of a gas of non-interacting particles with structure like molecule, average energy, classical and quantum mechanical resutls; Partition function of a Harmonic oscillator, average energy, classical and quantum mechanical results.

(Ref. : Statistical mecahnics, Huang K., John Wiley and Sons, USA, 1963; Chapter 15.

Statistical mechanics, 2nd Edition, Agarwal B.K., New Age International (Pvt.) Limited, 2005.)

Unit 3

Quantum Mechanics: Perturbation Theory for Bound States, Atomic Fine Structure. Time-Dependent Perturbation Theory, Fermi's Golden Rule, Radiative Identical Particles, Creation/Annihilation, State Vectors. Many Body Applications: Perturbation Theory and Quantum Statistics. Quantized Electromagnetic Fields, Photons. Relativistic quantum mechanics for electrons, Dirac Equation.

(Ref. : Quantum mechanics, 3rd Edition, Merzbacher E., John Wiley, USA, 1998; Chapters 18, 19, 21–24.)

Unit 4

Classical Electrodynamics: Boundary Value problems in electrostatics—Uniqueness theorem; Method of Electrical images; Grounded conducting sphere in uniform electric field.

Magnetization—Magnetic susceptibility and permeability; boundary conditions; Uniformly magnetized sphere in an external magnetic field.

Guided waves—TE waves in a rectangular wave guide; coaxial transmission line.

Dispersion in gases, liquids and solids.

Electric and magnetic multipoles—Multipole expansion of electromagnetic fields. Multipole transitions.

Covariant formulation of electrodynamics—Electromagnetic field tensor. Lagrangean formulation of the motion of a charged particle in an electromagnetic field.

(Ref. : Classical electrodynamics, 3rd Edition, Jackson J.D., John Wiley and Sons, USA, 1998; Chapters 8 and 9.

Introduction to electrodynamics, 3rd Edition, Griffiths D.J., Prentice-Hall of India, 1999; Chapter 9.

Electromagnetics, Laud B.B., Wiley Eastern Limited, 1983; Chapters 3, 4 and 11.)