University of Mysore

Department of Studies in Physics
Manasagangotri, Mysuru 570006

Syllabus for Course Work for Ph.D. in Physics

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 3

Quantum Mechanics: Relativistic quantum mechanics: Probability conservation. The Dirac equation, algebra of Dirac matrices, plane wave solutions. Relativistic covariance. Spin angular momentum, Nonrelativistic approximation, magnetic moment, relativistic energy spectrum of hydrogen. Classical and quantum field theory. Dis-

crete to continuous systems with examples. Classical scalar field, classical Maxwell field, Vector potentials in quantum mechanics. Quantized radiation field. Emission and absorption of photons by atoms.

(Ref. : Advanced Quantum Mechanics, Sakurai J.J Addison-Wesley Publishing Co. Inc, Reading, Massachusetts, LFirst ISE reprint, 1999.

Quantum Mechanics, Schiff. L. I, Third Edition, McGraw-Hill Book Company, New Delhi, 1968.)

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.)