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University of Mysore

(Estd.1916)

Ph. D. in PHYSICS

UNIVERSITY OF MYSORE

Department of Studies in Physics

Manasagangotri, Mysuru-570 006

Regulations and Syllabus

Ph. D. in PHYSICS

Chairman
Board of Studies in Physics
University of Mysore
Manasagangotri, MYSURU 570 006

UNIVERSITY OF MYSORE

GUIDELINES AND REGULATIONS

LEADING TO

PH. D. IN PHYSICS

Programme Details

Name of the Department	:	Department of Studies in Physics
Subject	:	Physics
Faculty	:	Science and Technology
Name of the Programme	:	Ph. D.

Ph. D. in Physics

Program Outcomes

- A period of sustained in depth study in physics on a specific topic.
- Skills to enable the student to critically examine the background literature relevant to their specific research area.
- The opportunity to expand the student's knowledge of their research area, including its theoretical foundations and the specific techniques used to study it.
- An environment to develop skills in written work, oral presentation and publishing the results of their research in high-profile scientific journals, through constructive feedback of written work and oral presentations.

Pedagogy

- Class room teaching has been upgraded from black board and chalk to interactive, student friendly smart classrooms.
- One on one interaction with the research scholars and the faculty members.
- Hands on experience for the research scholars are given for handling different instruments in various laboratories with collaborative departments.
- Research scholars are encouraged to present seminar/research paper presentation to improve their oral and soft skills.
- Presentations on literature review and research methodologies have to be done by the research scholars.
- Invited talks from eminent scientists are organized so as to make the research scholars up to date on the current research activities.

COURSE I: RESEARCH METHODOLOGY

Course Outcomes

On successful completion of this program the student will be able to:

- Have a thorough knowledge of the literature and a comprehensive understanding of scientific methods and techniques applicable to their own research.
- Be able to demonstrate originality in the application of knowledge, together with a practical understanding of how research and enquiry are used to create and interpret knowledge in their field.
- Have developed the ability to critically evaluate current research, research techniques and methodologies.
- Have self-direction and originality in tackling and solving complex problems.
- Act independently in the planning and implementation of research and have gained oral presentation and scientific writing skills.

UNIT I

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. Definition and sources of error. Propagation of errors. 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.

UNIT II

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 results; partition function of a harmonic oscillator, average energy, classical and quantum mechanical results.

UNIT III

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

UNIT IV

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.

References:

- Schaum's Outline of Statistics, Spiegel M.R. and Stephens L.J., McGraw Hill, USA, 1998.
- An Introduction to Numerical Analysis, Atkinson K.E., John Wiley and Sons, 1989; pp.17–34.
- Numerical Recipes in C, Press W.H., Flannery B.T., Teukolsky S.A., and Vetterling W.T., Cambridge University Press, Cambridge, 1988; Chapter 14.
- Statistical mechanics: A Survival Guide, Glazer A.M. and Wark J.S., Oxford University Press, 2001.
- 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.
- Introduction to Electrodynamics, 3rd Edition, Griffiths D.J., Prentice-Hall of India, 1999.
- Electromagnetics, Laud B.B., Wiley Eastern Limited, 1983; Chapters 3, 4 and 11.s
- Classical Electrodynamics, 3rd Edition, Jackson J.D., John Wiley and Sons, USA, 1998; Chapters 8 and 9.

COURSE II: LITERATURE REVIEW

Course Outcomes

The course will enable the students to acquire

- The ability to critically examine the background literature relevant to their specific research area.
- thorough knowledge of the literature and a comprehensive understanding of scientific methods and techniques applicable to their own research.