Approval : 1st senate meeting.

New Elective Course - PH 705

Course Title	**Foundation in Experimental Physics**	Course No	**PH705**			
Department	School of Basic Sciences	Structure	L	T	P	C
			3	0	1	4
Offered for	Ph.D. (Physics)	Status	**Elective**			
Faculty	Dr. Bindu Radhamany & Dr. Suman K. Pal	Type	**New**			
Pre-requisite	Consent of the teachers	To take effect from	Odd semester, 2011			
Submission date	Date of approval by School	Date of approval by BAC	Date of approval by Senate			
05.04.2011						

Objectives:

To enrich experimental knowledge by studying old experiments those have great impact on physics and also few experiments from frontier research area in physics. Also, to gain hand-on experience on advanced experiments in physics.

Course contents:

PART-A. Lectures on experiments, which made an impact on physics and/or lectures on new/modern experiments of current importance to frontier research in Physics. (Lecture Hours: 24)

A1: Great Experiments in Physics:

Starting with Galileo's experiments with motion, this study of 25 crucial discoveries includes Newton's laws of motion, Chadwick's study of the neutron, Hertz on electromagnetic waves, and more.

A2: Top 10 beautiful experiments:

1. Young's double-slit experiment applied to the interference of single electrons
2. Galileo's experiment on falling bodies (1600s)
3. Millikan's oil-drop experiment (1910s)
4. Newton's decomposition of sunlight with a prism (1665-1666)

5. Young's light-interference experiment (1801)
6. Cavendish's torsion-bar experiment (1798)
7. Eratosthenes' measurement of the Earth's circumference (3rd century BC)
8. Galileo's experiments with rolling balls down inclined planes (1600s)
9. Rutherford's discovery of the nucleus (1911)
10. Foucault's pendulum (1851)

Others experiments:

Archimedes' experiment on hydrostatics
Roemer's observations of the speed of light
Joule's paddle-wheel heat experiments
Reynolds's pipe flow experiment
Mach & Salcher's acoustic shock wave
Michelson-Morley measurement of the null effect of the ether
Röntgen's detection of Maxwell's displacement current
Oersted's discovery of electromagnetism
The Braggs' X-ray diffraction of salt crystals
Eddington's measurement of the bending of starlight
Stern-Gerlach demonstration of space quantization
Schrödinger's cat thought experiment
Trinity test of nuclear chain reaction
Wu et al.'s measurement of parity violation
Goldhaber's study of neutrino helicity
Feynman dipping an O-ring in water

A3: Experiments of current interest:

A3.1 Proton lifetime measurement.
A3.2 Bose-Einstein Condensation.
A3.3 Measurement of the Fine-Structure Constant.
A3.4 Experimental tests of Bell's inequalities
A3.5 Experiments on Quantum Computation
A3.6 The High Temperature Superconductivity Space Experiment

A3.7 Study of electronic structure of materials using photoemission spectroscopic experiments (angle integrated, angle resolved and spin resolved photoemission experiments)

PART-B. Actual Laboratory experiments (Lecture Hours: 14)

Experiments will be chosen from the list below:

1) Four probe method

2) Michelson Interferometer (white light)

3) Sand piles and rice piles, avalanche distribution

4) X-Ray of an NaCl single crystal

5) Directed percolation - spreading of ink on paper

6) Viscous fingering - effect of viscosity

7) Hall effect

8) Measurement of Band Gap in a semiconductor

9) Construction of a hologram

10) Zeeman Effect

11) Kerr Effect

12) Short noise and Johnson noise - measurement of Boltzmann constant - Absolute zero of temperature and charge of electron

13) Preparation (CVD) and characterization (AFM, STM) of thin films

14) Experiments on photon squeezing, Bose-Einstein condensation, parity-violation in weak interactions

PART-C. Demonstrations in the Experimental Laboratories in our Institute (Lecture Hours: 18)

References:

1. Firsthand Accounts from Galileo to Einstein
   - by Morris H. Shamos,ISBN: 0486253465
2. http://physicsweb.org/articles/world/15/9/2
3. Microwave Journal | Date: September 1, 1991 | Author: Webb, Denis C.; Nisenoff, M.
4. 'High temperature superconductivity space experiment (HTSSE)' Authors: Nisenoff M.; Gubser D.U.; Wolf S.A.; Ritter J.C.; Price G.Source: Superconductor Science and Technology, Volume 4, Number 9, 1991, pp. 449-452(4).
5. Very high resolution Photoelectron spectroscopy, Stephan Hufner(ed.), 2007.