COURSES OF STUDY

M. PHIL. DEGREE UNDER SEMESTER SYSTEM IN
VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY
(Effective from July 2014)

DEPARTMENT OF PHYSICS
VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY
BURLA, SAMBALPUR- 768 018

COURSE STRUCTURE OF M.Phil. PROGRAMME (PHYSICS)

FIRST SEMESTER					
COURSE NO	COURSE TITLE	L	T	P	CREDIT
MPPH-101	Research Methodology	4	0	0	4
MPPH-102	Experimental Techniques	4	0	0	4
MPPH-103	Elective-I	4	0	0	4
MPPH-104	Elective-II	4	0	0	4
MPPH-105	Review of Journal Paper and Seminar	0	0	6	4
	TOTAL				20
SECOND SEMESTER					
COURSE NO.	COURSE TITLE	L	T	P	CREDIT
MPPH-201	Dissertation	0	0	24	16
MPPH-202	Comprehensive viva voce	0	0	0	4
	TOTAL				20

Electives for M. Phil programme:

1. PHYSICS OF ULTRASONICS
2. RELATIVISTIC QUANTUM THEORY
3. PRINCIPLES AND METHODS OF CRYSTAL GROWTH
4. ASTRO PHYSICS
5. PHYSICS OF NANOMATERIALS
6. NUMERICAL METHODS & PROGRAMMING
7. QUANTUM SOLID STATE PHYSICS
8. NUCLEAR & HIGH ENERGY PHYSICS
9. MOLECULAR QUANTUM MECHANICS
10. ENERGY PHYSICS
11. PHYSICS OF AMORPHOUS MATERIALS
12. THIN FILM TECHNOLOGY
13. NON –LINEAR DYNAMICS
14. VACUUM SCIENCE & THIN FILMS
15. LASERS PHYSICS & NON-LINEAR OPTICS
16. NUCLEAR SCIENCE & TECHNOLOGY
17. LIQUID CRYSTALS
18. SPECTROPHYSICS
19. ULTRASONICS AND CHEMICAL PHYSICS
20. PHYSICS OF SUPERCONDUCTORS

Admission procedure through open advertisement and as per university norms
Academic regulation as per university rules
Fee structure as per university norms
Duration of programme – 1 year
Academic calendar: July-2014 – June-2015

Head
Department of Physics
VSSUT, Burla

1. RESEARCH METHODOLOGY (MPPH-101) (4-0-0)

Course Objective: The objective of the course is to familiarise the students with the principle and ethics of research. Concepts and consequences of plagiarism and how to write technical papers.

Module 1:

Introduction to Research Methodology: Definition and objectives of Research. Types of research, Various steps in Research Process, Mathematical tools for analysis, Developing a research question-choics of aproblem, Literature review, Surveying, Synthesizing, Critical Analysis, Critical evaluation, interpretation, Research purposes, Ethics in Research, Citation, Impact factor,h-index, i-10 index.

Module 2:

Research report writing: Structure and component of research report, Types of reports, Lay-out of research reports, Mechanism of writing a research report, Thesis writing, scientific editing, Popular articles writing, Patent writing and filing.

Module 3:

Data collection and sampling designing: Data collection, Primary data, Secondary data, Processing and analysis of data, Measurement of relationship, Statistical measurement and significance, Random sampling, Systematic sampling, Stratified sampling, Cluster sampling and multistage sampling.

Module 4:

Quantative methods for problem solving: Probabilty, Sampling distribution, Fundamentals of statistical analysis and inference, Estimation, Hypothesis testing and application, Correlation and regression analysis, Types of study designing, Experimental designing, Error analysis.

Books for Reference

1. Donald R Cooper, Pamela S. Schindler, Business Methods, 8/e, Tata McGraw-Hill Co. Ltd., 2006
2. Kothari C.K. (2004) 2/e, Research Methodlogy, Methods and Techniques (New Age International, New Delhi).
3. Krishnswami K.N., Appa Iyer and Mathiranjan M. (2006) Management Research Methodology; Integration of Principles, Methods and Techniques(Pearson Education, New Delhi)
4. Bendar and Piersol, Random data: Analysis and Measurement Procedures, Willey Interscience, 2001.
5. Fundamentals of Research Methodology and Statistics, Yogesh Kumar Singh (New Age International Publisher)

Course Outcome: The candidates are aware of ethics and principle of research. They are able to write technical papers and concern about the plagiarism after going through the course.

2. EXPERIMENTAL TECHNIQUES - MPPH-102 (4 0 0)

Course Objectives:

With the study of the given syllabus, the student will able to understand the fundamental concepts of different experimental techniques, such as familiarize the analysis of structure-property relations, introduce advanced techniques to investigate the science behind the fabrication of smart devices and allow the student to gain expertise in some specific areas of experimental techniques.

Module 1:

Low pressure & Low temperature:

Different types of Pumps:(Rotary, sorption, oil diffusion, turbo molecular, getter and cryo pumps); Mcleod, thermoelectric (thermocouple, thermister and pirani), penning, hot cathode and Bayard Alpert gauges; partial pressure measurement; leak detection; gas flow through pipes and apertures; effective pump speed; Gas liquifiers; Cryo-fluid baths; liquid He cryostat design; closed cycle He refrigerator; low temperature measurement

Module 2:

Analytical Techniques I: XRD; DSC, TGA & DTA, Neutron Scattering

Module 3:

Analytical Techniques II:

Spectrum analyzer & Spectrophotometers (FT-IR; UV-VIS-NIR, fluorescence and Raman spectrometer),

Module 4:

Analytical Techniques III: SEM, TEM, AFM, STM, LEED, HRTEM,

Books for Reference

1. A. D. Helfrick and W. D. Cooper, Modern electronic instrumentation and measurement techniques, Prentice Hall of India (1996).
2. J. P. Bentley, Principles of measurement systems, Longman (2000).
3. G. K. White, Experimental techniques in low temperature physics, Calrendon (1993).
4. A. Roth, Vacuum technology, Elsevier (1990).
5. D. A. Skoog, F. J. Holler and T. A. Nieman, Principles of Instrumental analysis, Saunders CoI. Pub

Course Outcome: After completing this course the student shall be able to, explain the fundamental requirements and functions of instruments, identify and classify the experimental characterization for a specific analysis and design and develop devices with added advantages.

PHYSICS OF ULTRASONICS Elective-I (4 0 0)

Course Objective:

The course aims to develop fundamental and conceptual understanding of important topics in contemporary ultrasound physics at a quantitative level and its application in different field with its scientific technology.

Module 1:

Characteristics of ultrasonic waves - Propagation through matter-wave Equation, Characteristics, absorption, reflection and transmission of ultrasonic waves-acoustic impedance and intensity, ultrasonic transducers - piezoelectric, magneto restrictive transducers, electromagnetic transducers.

Module 2:

Propagation of ultrasonic waves in materials (gases, liquids, solids) – Absorption and attenuation in solids - general principles, Non-linear characterstics and Non-linear parameter.

Module 3:

Ultrasonic instrumentation - low intensity devices (Interferometer technique), pulse echo overlap and sing around technique - flaw detection, scanning methods - A, B and C scan techniques.

Module 4:

Ultrasonic propagation in pure liquids - low intensity methods for characterizing structure and interaction - high intensity waves - cavitations, emulsification and cleaning.

Books for Reference

1. Ultrasonic methods and applications, by J. Blitz Butter worth Public.& co 1971.
2. Introduction to Chemical Ultrasonics – M.J. Blandamer – Academic Press, London.
3. Ultrasonics – Bemsomcarlin – McGraw Hill.
4. Ultrasonic methods in Solid State Physics – John Truell and others; Academic Press.
5. Physical Acoustics – W.P. Mason – Academic Press
6. Science and Technology of Ultrasonics – Baldev Raj and Others – Narosa.

Course Outcome:

A conceptual understanding of the physics of ultrasound and a perspective of areas of applicability helps the students to apply in different industries and its application in development of different instruments which has practical applications in submarine to aerospace applications.

3. RELATIVISTIC QUANTUM THEORY Elective-II (4 0 0)

Course Objective: The main aim of the course is to provide deeper knowledge in quantum mechanics in general and relativistic quantum mechanics in particular in magnetic field. Various applications of this theory are discussed.

Module 1:

KG equations: concepts of positive and negative energies, probability density and energy levels in H-atom, merit and demerits of KG equation

Dirac equation: covariant formulation, transformation properties, gamma matrices, plane wave solutions, Dirac equation in an electromagnetic field.

Module 2:

Zitterbewegung, orthonormality and completeness relation for spinors, H-atom in Dirac theory, Path integral approach: propagator in path integral approach, free particle propagator

Module 3:

Lagrangian formulation for particles, Scalar field, variational principle and Noether's theorem, complex scalar field, quantization of real and complex scalar field.

Module 4:

Applications of Non Relativistic Quantum Mechanics: infinite well, finite well with constant mass and its extension to multiple well systems, single and double barrier. Quantum wire and dots: infinite deep rectangular wires, quantum boxes, density of states.

Books for Reference

1. Text book on Advanced Quantum Mechanics: J.J. Sakurai
2. Relativistic Quantum Mechanics: J.D.Bjorken & D.S. Drell
3. Quantum Mechanics and path integral: R.P. Feynman & A.R. Hibbs
4. Quantum Field Theory: C. Itzykson & J.B. Zuber
5. Quantum well, wires & dots: Paul Harrison (John Wiley & Sons Ltd.)

Course Outcome: After going through the course the students get the importance of relativistic quantum mechanics and their applications in various fields.