Syllabus for
Course Work in Ph. D. Programme

Department of Physics
Vidyasagar University
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Syllabus for
Course Work in Ph. D. Programme in Physics

Total Marks: 200

Division of marks

Course Code	Marks
Course I	Theoretical: 40 Practical: 10 Total: 50
Course II	Theoretical: 40 Practical: 10 Total: 50
Course III (PHS)	Theoretical: 50 Total: 50
Course IV (PHS)	Theoretical: 50 Total: 50
Total	200

Structure of the Curriculum for Ph.D. Course work in Physics

Course Code	Course Name	Marks			Exam Time
		Theory	Assignment	Total	
Course I	Research Methodology	40	10	50	2 hours
Course II	Computer Application and Statistical Methods	40	10	50	2 hours
Course III (PHS)	Physics	50		50	2 hours
Course IV (PHS)	Special Topics in Physics	50		50	

Course Contents

Course Code: Course I

Course Name: Research Methodology

Marks: Theoretical – 40 + Assignment (Practical) – 10 = 50

Group A: Theoretical – 40 marks

1.1 Research: definition, importance, meaning and characteristics. Steps in research.

1.2 Research problem: identification, selection and formulation.

1.3 Sampling: definition, theory, types, techniques and steps. Sample size, advantages and limitations of sampling.

1.4 Data: definition, sources and types. Data collection methods. Limitations and cautions. Analysis of data.

1.5 Review of literature and Bibliography.

1.6 Research report: types, contents, styles and steps in drafting. Editing the final draft and Thesis writing.

Group B: Assignment writing on any one (Practical) – 10 marks

(a) Review of articles

(b) Research proposal

(c) Sample design

(d) Data analysis

Course Code: Course II

Course Name: Computer Application and Statistical Methods

Marks: Theoretical – 40 + Assignment (Practical) – 10 = 50

Group A: Theoretical – 20 marks

2.1 Operating system: latest version of WINDOWS, UNIX.

2.2 Database management System.

2.3 Office management: MS-Word, MS-Excel, MS-Power Point, and Latex.

2.4 Software Packages: MATHLAB, MATHEMATICA, Origin, etc.

2.5 Programming with C / C++ / Python

Group B: Theoretical – 20 marks

2.6 Probability distribution. Distribution Free Approach, Test for goodness for fit for a proposed distribution. Correlation of coefficient: simple linear, multiple linear, and partial. Regression; simple, multiple and stepwise. Sampling: definition, theory, types, techniques and steps.

2.7 The relevance of the research from perspective of the subject. Detailed review of state of the art. Scope of the work.

Group C: Assignment writing on any one (Practical) – 10 marks

Power point presentation on a research topic.

Course Code: Course III (PHS)

Course Name: Physics

Marks: 50

3.1 Introduction: Physical and chemical properties. Necessity of characterization.
Macroscopic properties: Optical, Electrical, dielectric, magnetic, mechanical. Microscopic properties: Chemical structure, composition, surface characterization.
Probing bulk and nano-structure – XRD, SEM, TEM, HRTEM, Neutron scattering. Phase changes, crystalline and amorphous fractions – DSC Thermo-gravimetric methods – TGA, DTA

3.2 Single crystals and their growth by different techniques
Conductivity, Photo-conductivity, Hall Effect, Thermoelectric Power in Semiconductor and their measurements. Measurement of drift mobility. Surface States.

3.3 Transistor Models: Ebers-Moll model, Gummel-Poon model.

3.4 Raman, FTIR, Optical microscopy, Photoluminescence, UVVIS, Optical Absorption and band gap determination, Photocurrent generation, optical device, quantum efficiency, photo responsivity.

3.5 Surface Science; Vacuum Technology, Vacuum based synthesis technology, Structure and topography, STM, LEED, AFM.

Course Code: Course IV (PHS)

Course Name: Special Topics in Physics

Marks: 50

4.1 Quantum Optics

4.2 IC design and simulation using PSPICE, low voltage and low power methodology of IC design.

4.3 Growth and characterization of semiconducting nanoparticles for different applications.

4.4 Optoelectronic materials for technological applications.

4.5 Low dimensional materials for energy and environmental applications.