



## **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 of 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.**