



### List of Revised Courses

**Department : *Pure and Applied Physics***

**Program Name : *Pre Ph.D.. (Physics)***

**Academic Year : *2017-18***

### ***List of Revised Courses***

Sr. No.	Course Code	Name of the Course
01.		Research Methodology & Computer Applications
02.		Experimental, Theoretical techniques & Instrumentation in Physics Research
03.		III A: Advanced Materials
04.		III B: Spectroscopic Techniques
05.		III C: Advances in Plasma Physics
06.		III D: Advance Nuclear Physics
07.		III E: Advanced Astronomy and Astrophysics



## Minutes of Meetings (MoM) of Board of Studies (BoS)

**Academic Year : 2018-19**

**School : School of Physical Sciences**

**Department : Pure and Applied Physics**

**Date and Time : July 13, 2018 - 11:30 AM; July 18, 2018 - 5:00 PM**

**Venue : Smart Class Room**

The scheduled meetings of member of Board of Studies (BoS) of Department of Pure and Applied Physics, School of Studies of Physical Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, were held to design and discuss the Pre Ph.D. (Physics) Second year (III and IV Semesters), scheme and syllabi.

The following members were present in the meeting:

1. Prof. P K. Bajpai
2. Dr. H. S. Tewari
3. Prof. S. B. Kondawar (External Member)
4. Dr. M. N. Tripathi
5. Dr. P. Thakur
6. Dr. R. K. Pandey
7. Dr. T. G. Reddy
8. Dr. R. P. Prajapati
9. Dr. A. K. Gupta
10. Dr. M. P. Sharma
11. Dr. P. Das
12. Dr. T. Trivedi
13. Dr. S. P. Patel
14. Prof. R. Dhar (External member)

The committee discussed and approved the scheme and syllabi. The following courses were revised in the Pre Ph.D. (Physics):

- ❖ Research Methodology & Computer Applications
- ❖ Experimental, Theoretical techniques & Instrumentation in Physics Research
- ❖ III A: Advanced Materials
- ❖ III B Spectroscopic Techniques
- ❖ III C Advances in Plasma Physics
- ❖ III D: Advance Nuclear Physics
- ❖ III E: Advanced Astronomy and Astrophysics

Signature & Seal of HoD



## Scheme and Syllabus

### Course Structure Pre Ph.D. Physics Syllabus 2018-19

Course Code	level	Course name	Credit	Remarks
	School level	Research Methodology & Computer Applications	04	Common to all
	Department level	Experimental, Theoretical techniques & Instrumentation in Physics Research	04	Common to Physics Candidates
	Paper -III (Optional) Any one of the followings	III A: Advanced Materials III B Spectroscopic Techniques III C Advances in Plasma Physics III D: Advance Nuclear Physics III E: Advanced Astronomy and Astrophysics	04	Any course

w.e.f. 2018-19

Chairman

1. Prof. P.K. Bajpai

2. Dr. H.S. Jena

3. Prof. R. Dhar

4. Dr. P. Thakur

5. Dr. G.R. Jyoti

6. Dr. M.N. Tripathi

7. Dr. R.K. Pandey

8. Dr. R.P. Prasad

9. Dr. A.K. Gupta

10. Dr. M.P. Sharm

11. Dr. P. Das

12. Dr. T. Trivedi

13. Dr. S.P. Patel



## Paper I

### Research Methodology & Computer applications

**Objective-** • To acquaint the research scholars with the nature, scope and limitations of various methods of conducting educational research. • To develop an understanding of process of conducting educational research. • To develop an ability of appropriate selection, development and use of various tools of research • To acquaint the students with various techniques of sampling and to develop an ability of selecting appropriate sample for a research study.

Mode of study includes: Assigning the topic to students based on their basic background and presentation in the form of seminar which will be followed by discussion and submission of the write-up. This will be evaluated by group of teachers.

#### Unit 1: Research methodology

Definition of Research, Components of Research Problem, Various Steps in Scientific Research : Hypotheses, Research Purposes, Research Design, Literature searching Literature Survey, defining the question and formulating hypothesis/ hypothesizes, Collection of research data, tabulating and cataloging. Sampling and methods of data analysis.

#### Unit 2: Errors in measurements and statistical methods:

Types of errors; mean deviation, standard deviation and probable errors; propagation of errors with summation, difference, product and quotient Probability Theories - Conditional Probability, Poisson Distribution, Binomial Distribution and Properties of Normal Distributions, Estimates of Means and Proportions; Chi-Square Test, Association of Attributes - t-Test - Standard deviation - Co-efficient of variations. Correlation and Regression Analysis, plotting of graphs.

#### Unit3: Laboratory practices and safety guidelines:

Safe working procedure and protective environment, Laboratory safety measures, Handling radiation, Chemical hazards and their types, Safe chemical use, Proper storage and disposal of hazardous materials, Bio-hazardous and other toxic experimental materials, Maintenance of equipments.

#### Unit 4: Computer applications in scientific writing skills

Applications of Microsoft Excel, power point and origin for data processing and data analysis, research paper – presentation using power point (which include texts, graphs, pictures, tables, references etc.) (oral in power point/poster);

Curve fitting, Method of least square fit, least square fit (straight line) to linear equations and equation reducible to linear equations. Non-linear curve fitting, back ground correction and mathematical manipulation in data using origin.

Structure and Components of Research Report, Types of Report: research papers, thesis, Research Project Reports, Pictures and Graphs, citation styles, writing manuscript in Latex, Steps to better writing,

#### Unit 5: Ethics in Science:

The source of ethical issues in science: examples from different disciplines. Ethical issues in



science research and reporting: objectivity and integrity, the problem of plagiarism and related issues, international norms and standards. Scientific temper and virtues, expectations from scientific community.

IPR and Patent regime: Recording and storage/retention of recorded materials. Management and user responsibilities in proper utilization of the facilities. Socio-legal issues, originality

**Outcomes** - Research methods courses offer students the opportunity to learn the various aspects of the research process, framing useful research questions, research design, data collection, analysis, writing and presentation.

## References:

1. "How to write and Publish" by Robert A. Day and Barbara Gastel, (Cambridge University Press).
2. "Survival skills for Scientists" by Federico Rosei and Tudor Johnson, (Imperial College Press).
3. "How to Research" by Loraine Blaxter, Christina Hughes and Malcolm Tight, (Viva Books).
4. "Probability and Statistics for Engineers and Scientists" by Sheldon Ross, (Elsevier Academic Press).
5. "The Craft of Scientific Writing" by Michael Alley, (Springer).
6. "A Student's Guide to Methodology" by Peter Clough and Cathy Nutbrown, (Sage Publications).

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## Paper II

### Paper –II: Experimental, Theoretical techniques & Instrumentation in Physics Research

**Objective-** Students should have the knowledge of this course as basic techniques and different instruments are discussed here in-depth.

#### Unit I

**Synthesis of materials:** Bulk Synthesis: Solid State Route, Sol Gel, Co- precipitation, Combustion methods, thin film fabrication: spin coating, dip coating, evaporation methods, Vacuum techniques, vacuum pumps (Rotary and Diffusion pumps), vacuum gauges.

**Unit II Structural and composition characterization:** Basics of X – ray diffraction (XRD), grazing incidence and powder XRD, Scanning Electron Microscope, Energy dispersive X – ray analysis, X – ray photoelectron Spectroscopy, Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM) and Transmission Electron Microscope, electrical measurements, .

#### UNIT III Physics of nanomaterials

Quantum confinement and surface effect, 2-D, 1-D and 0-D Nano systems, Quantum dots and 1- D nanostructures, Nanocomposites of inorganic and organic systems, Self assembly hierarchic structures and advanced functional materials for applications in energy harvesting, , catalysis, sensors etc.

**UNIT IV Ion beam Technology, Accelerators in Science & Technology, Ion beam irradiation and ion implantation in physics research especially in materials science, nuclear physics and plasma physics. Basics of nuclear techniques for ion beam analysis.**

**UNIT V The electron gas without interaction; Electrons in a periodic potential., The interacting electron gas; The Hartree-Fock approximation; Quasielectrons, plasmons; The Dielectric constant of the electron gas, Ion-ion interactions; Phonons; Spin-spin interactions; Magnons; Diamagnetism; Paramagnetism.**

**Outcomes-** This is a soft core course. It deals with different experimental techniques in Physics. Studying different temperature and electrical measurements the concept of measurements for regular equipment is grown within the students. Studying the vacuum techniques and the vacuum systems students get their knowledge in that type of systems. Learning magnetic sensors, magneto resistance hall effect sensors students get knowledge about modern day techniques in Physics.



Reference Books

1. Materials Science and Engineering (John Wiley & Sons, Inc.) By William D. Callister, Jr.
2. Introduction to Ceramics, W.D. Kingery
3. Introduction to Nanoscience and Nanotechnology, K.K. Chattopadhyay and A.N. Banerjee
4. Solid State Physics; N. W. Ashcroft and N. D. Mermin.

Chaitanya

1. Prof. P.K. Bajpai  
2. Dr. H.S. Jena  
3. Prof. R. Dhar  
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