# Syllabus

# Course work

# For

# M.Phil./Ph.D. (Physics)


Department of Physics

Saurashtra University

Rajkot

**Time Schedule: Total 72 hours**

Course structure

| | Paper No. | Name of paper | Credit | Mode of Training | Contact hours | Assessment |
|---|---|---|---|---|---|---|
| 1 | 1 | Essentials of Research methodology, Review of literature, Writing of research papers and research project proposals, computer basics etc. | 03 | In Consultation with research Guide | 36 | Assignment marks out of 100 |
| 2 | 2 | Experimental techniques , Research methodology, computer fundamentals | 03 | Lectures | 36 | Assignment marks out of 100 |

1. The students will submit assignment in each of the above theory paper in the form of a detailed essay on any one topic giving references. A student is required to score minimum 55% of marks i.e. minimum 110 marks out of total 200marks for successful completion of the course work.
2. Upon successful completion of the course work, the Ph.D. students shall be eligible for registration and M.Phil students shall be eligible to submit his/her M.Phil. dissertation.

# Syllabus

# M.Phil./Ph.D. course work

## Course Structure: Total credit : 8

| | | | | |
|---|---|---|---|---|
| (i) | PAPER-1 | **Essentials of Research Methodology** | 03 CREDIT | Assignment Marks Out of 100 |
| (ii) | PAPER-2 | **Experimental techniques** | 03 CREDIT | Assignment Marks Out of 100 |
| (ii) | Laboratory training, library work/literature survey and preparation of assignments | | 02 CREDIT | ---------- |
| | | | | **Total Marks: 200** |

1. **The instructional method:**
   The mode of training shall include expert lectures/laboratory work and training/review of published research in the relevant field/data analysis/preparation of assignments and counselling in consultation with the Ph.D. guides.
2. As mentioned above, 02 credit shall be assigned for laboratory training, library work and preparation of assignments.
3. **Assessment method:**
   The students will submit assignment in each of the above theory papers in the form of detailed essay on any one topic giving relevant references. A student is required to score **minimum 55% of marks i.e. minimum 110 marks out of total marks 200** for successful completion of the course work. The assignments will be assessed by their respective M.Phil./ Ph.D. guides
4. Upon successful completion of the course work, the Ph.D. students shall be eligible to proceed for Ph.D. registration.
5. Upon successful completion of the course work, the M.Phil. students shall be eligible to submit his/her dissertation.

**M.Phil./ Ph.D. Course work**

**Credit:03**

## Paper-1

## ESSENTIALS OF RESEARCH METHODOLOGY

| | |
|---|---|
| Unit-1 | Introduction to research methodology:<br>Meaning of research, definition, characteristic features of good research, qualities of good researcher, objectives, significance of research, types of research, interdisciplinary research , research ethics, scientific method and its basic postulates |
| Unit-2 | Research process, Defining and formulating research problem, extensive research survey, development of hypothesis, preparing research design, experimental work or data collection, data analysis, testing of hypothesis, interpretation, conclusions, report writing |
| Unit-3 | Writing research papers or report, defining aim, scope and expectations of the paper, using internet for literature survey, and data base resources by identifying reputable online sources, preparing draft, plagiarism testing, revision to avoid plagiarism, polishing language and preparing final draft, distinction between research paper, article, review, report and thesis, distinction between seminar, conference, symposium, workshop |
| Unit-4 | Computer applications, MS office, software packages for data analysis, model fitting, spectral fitting, and preparing graphs, charts, specialized software etc. Preparing Power point multimedia presentations |
| Unit-5 | Preparing Research proposal, main ingredients and sequence, motivation, literature survey and background work, aim and objectives, research problem, national and international status of research problem, methodology and time frame, possible outcome of the research project, justifications for financial asistance |

**Reference books:**


1. Research Methodoly
   Mukul Gupta, Depa Gupta
   PHI learning Private limited, New Delhi
   ISBN:978-81-203-4381-8
2. Research methodology
   G. C. Ramamurthy
   Dream tech Press, ISBN: 798-81-7722-971-4
3. Research Methology
   Priti Majhi and Prafull Khatua,
   Himalaya Publishing House
   ISBN:978-93-5097-544-2
4. Writing Research Papers
   Carol Ellision
   McGraw Hill
   ISBN: 978-0-07-162990-4
5. Your Research Proposal
   Nicholas Walliman
   Sage Publications
   ISBN:978-81-321-0751-4

**M.Phil./ Ph.D. Course work**

**Credit:03**

## Paper-2

## EXPERIMENTAL TECHNIQUES IN

## MATERIALS SCIENCE AND SPACE PHYSICS

| | |
|---|---|
| Unit-1 | Methods of materials bulk synthesis, solid state reaction, ceramic technique, microwave synthesis, sol-gel method, wet-chemical methods |
| Unit-2 | Preparation of thin films, spin coating, vaccum evaporation sputtering, pulsed laser deposition, Vapor Phase Transport Methods and Thin Film Growth Hydrothermal Methods, Vapor Methods, Fundamental of Epitaxial Growth of Thin Layers |
| Unit-3 | Growth of Single Crystals, Introduction to Methods of Growth of Crystals, Czochralski Method, Bridgman and Stockbarger Methods, Zone Melting and Zone Refining Methods, Impurity Leveling, Factor, Verneuil Method, Molten Flux Method |
| Unit-4 | Characterization techniques: X-ray diffraction, EDAX, X-ray fluorescence spectroscopy, particle size determination through DLS, Scanning electron microscopy, Transmission electron microscopy, vibrational spectroscopy for molecular analysis, Raman spectroscopy, Infrared spectroscopy,UV-VIS spectroscopy, Thermal analysis, TGA-DTA, Differential Scanning calorimetry, magnetic measurements using B-H loop tracer, AC susceptibility, vibrating sample magnetometer, P-E loops for ferroelectrics, I-V characteristics, dielectric measurements using impedance analyser |
| Unit-5 | Ionospheric sounding, Ionosonde, Ionogram and its interpretation, Faraday rotation,Partial reflection, Scintillation and TEC measurements, Volume scattering, Coherence and Incoherent scatter, Incoherent scatter, radar Langmuir probe and derivatives, Impedance and resonance probe, Mass spectrometers, Air glow photometer, Atmospheric aerosols and their properties, techniques of monitoring aerosol mass & size Distributions |

**Reference Books:**


1. Elements of ZX-ray diffraction
   B. D. Cullity
   Addison Wisley
2. Materials Characterization
   Yang Leng
   Wiley-VCH, Verg GmbH & Co. KGaA
3. Chracterization of materials, Vol. 1 & 2
   Elton A. Kaufmann
   John Wiley & Sons publications
4. Introduction to Ionosphere and Magnetosphere
   J. A. Ratcliffe CUP (1972)
5. The Solar terrestrial Enviornment
   J.K Hargrover CUP (1992)
6. Physics and chemistry of the upper Atmosphere
   M. H. Rees CUP (1980)
7. Ionospheric techniques and phenomena
   G.M. Petit D Riedel Publishing Co (1978)
8. Radars for Atmospheric research
   Rottger D Riedel Publishing Co (1990)
9. The Solar-Terrestrial environment,
   J.K. Hargreaves, CUP, 1992