



**Pt. Ravishankar Shukla University,
Raipur (C.G.), India - 492010
School of Studies in Physics and Astrophysics**

**CURRICULUM & SYLLABUS
(Based on CBCS & LOCF)**

Course Work for Ph.D. (PHYSICS)

Session: 2025-2026

Approved by Board of Studies

Dates

Name of Chairman

Name of Member's

: Physics

: 19/05/2025

: Prof. Nameeta Brahme

: Prof. D. P. Bisen

Prof. A. S. Gour

Mr. Kishor Chelak

Dr. Umashankar Bhardwaj

Mr. Chitrkant Belodhiya

Dr. Laxmi Kant

Dr. G. Nag Bhargawi

Dr. Rajiv Manohar

Dr. Vikash Gulhare

Scheme of Examination

The Course Work for Ph.D degree in Physics is a six month course after completion of P.G. degree in the subject. There shall be two compulsory papers based on the research areas of Physics. The structure of the course is given below:

S.No.	Theory Paper	Marks
1.	Research Methodology, Quantitative Methods & Computer Applications	100
2.	Review of Literature in Concerned Subject, Seminar/ Project Report	100
Total		200

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Paper – I
Research Methodology, Quantitative Methods and Computer Applications

UNIT- I

Techniques for Structural, Microscopic and Spectroscopic Characterization

X-ray diffraction: coherent scattering of X-rays, reflected intensities, experimental methods of crystallography, particle size determination.

Microscopy: Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning Transmission Electron Microscopy (STEM), Scanning Tunneling Microscopy (STM), Atomic Force Microscopy (AFM).

Spectroscopy: Fourier Transform Infrared (FTIR) and Raman spectroscopy, Nuclear Magnetic Resonance (NMR), Electron Spin Resonance (ESR).

UNIT – II

Techniques for Characterization of Solid State Ionic Materials

Solid State Ionic Materials: Characterization of ion transport properties; AC Impedance Spectroscopy (IS) for conductivity of (σ) measurements; DC polarization methods viz, Tubandt's method, Wagner's method, Transient Ionic Current (TIC) method for ionic mobility (μ), ionic transference number (t_{ion}), mobile ion concentration (n) and ionic drift velocity (v_d) measurements. Temperature dependent studies on σ , μ , n , v_d etc. and computation of respective energies.

Thermal analysis: Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC), Thermal Gravimetric Analysis (TGA).

UNIT-III

Luminescence Techniques

Basic mechanisms of Photoluminescence (PL) :- Excitation & Emission spectra, radiative & non-radiative transition, up & down conversion, Multiphonon and cross relaxation, Crystal field splitting, Energy transfer processes, Measurement techniques to study Photoluminescence response, Techniques for ML measurement, TL measurement techniques- Basic TL apparatus, Heating system, Light detection, recording and display, TL glow curve, UV-visible spectrometry.

UNIT – IV

Astronomical Techniques

Photometry: Instrumental magnitudes and colors, seeing and atmospheric effects, extinction correction. Standard photometric systems: UBV and other systems. Transformation to standard photometric systems. Absolute and differential photometry.

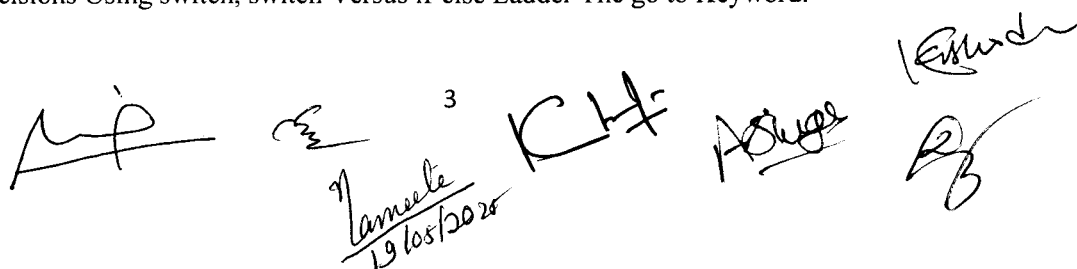
Basics of CCD data reduction: Plate scale, readout noise and gain, signal-to-noise ratio. Correction for bias, dark and flat fielding, fringing and cosmetic effects.

UNIT –V

(I) Programming in C

A comparison of learning English Language and C Language, C Instructions: Type declaration instruction, Arithmetic instruction; Tokens: Keywords, Identifiers, Variable, Integer Variables, Character Variables, Float Variables; Data Types: A logical Statements; Important statements regularly used.

Control Structures: The Decision Control Structures If Statement, If-else Statement, Use of Logical Operators, The Conditional Operators. The Loop Control Structure: Loops, the while Loop, the for Loop, the Odd Loop, the break Statement, the Continue Statement, the do-while Loop. The Case Control Structure: Decisions Using switch, switch Versus if-else Ladder The go to Keyword.


A comparison of learning English Language and C Language, C Instructions: Type declaration instruction, Arithmetic instruction; Tokens: Keywords, Identifiers, Variable, Integer Variables, Character Variables, Float Variables; Data Types: A logical Statements; Important statements regularly used.
Control Structures: The Decision Control Structures If Statement, If-else Statement, Use of Logical Operators, The Conditional Operators. The Loop Control Structure: Loops, the while Loop, the for Loop, the Odd Loop, the break Statement, the Continue Statement, the do-while Loop. The Case Control Structure: Decisions Using switch, switch Versus if-else Ladder The go to Keyword.

Recommended Text and Reference books:

1. Characterization of Materials: Wachtman J B (Butterworth-Heinemann)
2. Condensed Matter Physics by Michal P. Marder (Willy Inter. Science Pub., 2000)
3. Superionic Solids- Principle and applications by S. Chandra (NH Pub., 1980)
4. Luminescence of Solids : R Vij (Plenum Press)
5. Digital Image processing: Gonzalez R. C. and Woods R. E. (Addision-Wesley)
6. Astronomical Photometry: Henden A. A. and Kaitchuck R H (Willmann-Bell)
7. Astrophysical techniques: Kitchin C R , third edition (IOP publishing)
8. Optical Astronomical Spectroscopy: Kitchin C R (IOP Publishing).
9. Let us C by Yaswant Kanitkar
10. C Programming by Dennis Riche and Brian Karnighan
11. C Programming by Schauam Series
12. Physics through C-programming by S. Palaniswamy

Paper – II

Review of Literature in Concerned Subject, Seminar/ Project Report

Approved by Board of Studies in Physics on 19th May 2025.

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