**Course structure, Scheme of Instructions and Examinations, Syllabus for Pre-Ph.D. Effective from Academic Year 2023 - 2024 on Words.**

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| CODE | COURSE TITLE | HPW | CREDITS | Total Marks |
|  | Research and Publication Ethics | 2 | 4 | 50 |
|  | Research methodology and Characterization Techniques | 4 | 4 | 100 |
|   | Advanced Physics (Materials Science) | 4 | 4 | 100 |
|  | Analysis of Published research papers / Scientific literature | 2 | 2 | 50 |

CHAITANYA (DEEMED TO BE UNIVERSITY)

Pre-Ph.D. (PHYSICS)

Paper-I

Research and Publication Ethics

Hours per week: 02 Credits: 02

UNIT-I:

1. Philosophy and Ethics : Introduction to Philosophy – definition – nature and scope – concept – branches – Ethics : definition – moral philosophy – nature of moral judgements and reactions.
2. Scientific Conduct: Ethics with respect to science and research – Intellectual honesty and research integrity – scientific misconducts: Falsification – Fabrication and Plagiarism – Redundant publications: Duplicate and overlapping publications – salami slicing – Selective reporting and misrepresentation of data.
3. Publication Ethics: Definition – introduction and importance – Best practices / standards setting initiatives and guidelines : COPE – WAME etc - Conflicts of interest – Publication misconduct : Definition – concept – problems that lead to unethical behavior and vice versa – types – Violation of publication ethics – authorship and contributorship – Identification of publication misconduct – complaints and appeals – Predatory publishers and journals.

UNIT – II:

1. Open Access Publishing: Open access publications and initiatives – SHERPA / RoMEO online resource to check publisher copyright & self – archiving policies – Software tool to identify predatory publications developed by SPPU – Journal finder / journal suggestion tools viz., JANE, Elsevier journal finder, Springer journal suggester, etc.
2. Publication Misconduct:
3. Group Discussions: Subject specific ethical issues - Falsification – Fabrication and Plagiarism (FFP), authorship – Conflicts of interest- Complaints and appeals : examples and fraud from India and abroad.
4. Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools.
5. Databases and Research Metrics:
6. Databases: Indexing databases – Citation databases: Web of Science, Scopus, etc.
7. Research Metrics : Impact factor of journal as per journal citation report, SNIP, SJR, IPP, Cite Score – Metrics : h – index, g index, i10 index, altmetrics.

References :

1. Bird, A. (2006). Philosophy of Science. Routledge.
2. MacIntyre, Alasdair (1967) A Short History of Ethics, London.
3. P.Chaddah, (2018) Ethics in Competitive Research : Do not get scooped: do not get plagiarized, ISBN: 978-9387480865.
4. National Academy of Science, National Academy of Engineering and Institute of Medicine. (2009). On Being a Scientist: A Guide to responsible Conduct in Research: Third Edition. National Academy Press.
5. Resnik, D.B. (2011). What is ethics in research & why is it important, National Institute of Environmental Health Sciences, 1-10. Retrieved from <https://www.niehs.nih.gov/research/resoureses/bioethics/whatis/index.cfm>.
6. Bcall, J. (2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179-179.https://doi.org/10.1038/489179a.
7. Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance (2019), ISBN: 978-81-939482-1-7, https://www.insaindia.res.in/pdf/Ethics\_Book.pdf.

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Pre-Ph.D. (PHYSICS)

Paper-II

Research Methodology and Characterization Techniques

Hours per week: 04 Credits: 04

UNIT-I:

a) Research design: Motivation and objectives of the research problem – selection of the problem – defining the problem – literature review and its importance – primary and secondary sources – reviews, treatise, monography and patents – web as a source – searching a web – identifying gap areas from literature review – research design – basic principles – need of research design – features of good design – important concepts of research design – developing of a research plan.

b) Manuscript writing and document preparation:Scientific writing, structure and components of research paper, types of reports, research papers, thesis, research project reports, citations, impact factor. Latex, different styles for science journals, bibliography, referencing, ethical issues, plagiarism.

UNIT-II:

 Data reduction and error analysis: The presentation of physical quantities with their inaccuracies, significant figures, errors; classification and propagation. Probabilitydistributions. Processingof experimental data. Graphical representation of data with errors, principles of least squares – errors and residuals, least squares fitting – straight, polynomial and arbitrary curve and composite curves.

UNIT-III:

Characterization techniques: X-ray diffractometer, indexing of powder diffraction pattern, determination of lattice parameters. ASTMdata and identification of compounds. Particle size determination from XRD. Principle and working of atomic force microscope (AFM), scanning electron microscope (SEM), transmission electron microscope (TEM), differential scanning calorimeter (DSC) and thermal gravimetric analyzer (TGA).

UNIT-IV:

Spectroscopic techniques: Principles of vibrational and electronic spectroscopy. Principle and working of Fourier transform infrared spectrometer (FTIR), LASER Raman spectrometer and UV – visible spectrophotometer. Interpretation and information derived from spectra.

NMR principle, chemical shift, NMR spectrometer, principle of ESR, total Hamiltonian, ESR spectra of free radicals and ESR spectrometer. NQR principle and NQR spectrometer. Principle of Mossbauer spectroscopy, same Mossbauer spectrometer and Mossbauer spectra.

Reference books:

1. An introduction to Research Methodology, Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002 RBSA Publishers.
2. Research Methodology: Methods and Techniques - C.R. Kothari, C.R., 1990 New Age International. 418p.
3. Mathematical Methods for Physicists(Academic Press) Arfken& Weber 6.Data reduction and error analysis for the Physical Sciences, 3e, Philip R Bevington & D.Keith Robinson. McGraw Hill (2003).
4. Advances in Material research – H. Herman
5. Methods of experimental physics Vol3; Ed.Williams.
6. Nuclear Magnetic Resonance by E.R. Andrew.
7. General aspects of NMR in solids by C.P.Slinchter.
8. Electron paramagnetic resonance of transition ions by A.Abragam and B.Bleaney.
9. Spectroscopy at radio and microwave frequencies by D. S. E. Ingram.
10. Nuclear quadruple resonance by H.G.Dehmelt.
11. Molecular Spectroscopy by Rajkumar.
12. Dielectrics by Von Hippel.
13. Dielectrics by J.C.Anderson Chapman & Hall Ltd.
14. Rietveld refinement technique by Young.
15. How to write and publish: Robert A Day and Barbara Gastel (Cambridge 2006).
16. The craft of scientific writing: Machael Alley (Springer 1996).
17. Latex A document preparation system 2e, Lamport (AW.1994).

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Pre-Ph.D.(PHYSICS)

Paper-III

Advanced Physics (Materials Science)

Hours per week: 04 Credits: 04

UNIT I

Imperfections in solids:

Point defects, vacancies and self- interstitials, impurities in solids, miscellaneous imperfections, linear defects, interfacial defects, stacking faults, volume defects.

Dislocations and strengthening mechanism:

Dislocations and plastic deformation, basic concepts, characteristics of dislocations, step systems, plastic deformation of polycrystalline materials, deformation by twinning. Mechanism of strengthening in metals – strengthening by grain size reduction, solid solution strengthening, strain hardening.

UNIT II

Semiconductor materials:

Classification of semiconductors – Elemental and compound semiconductors, direct and indirect band semiconductors, charge carriers in intrinsic and extrinsic semiconductors, the temperature variation of conductivity and carrier concentration, doping, excess carriers in semiconductors, recombination of electron – hole pairs, various recombination mechanisms. Junction capacitance, carrier concentration across the junctions.

UNIT III

Polymer materials:

Hydrocarbon molecules, polymer molecules, the chemistry of polymer molecules, molecular weight, molecular shape, molecular structure, molecular configurations, copolymers, polymer crystallinity, polymer crystals.

Mechanical and thermomechanical characteristics:

Stress – strain behaviour, deformation of semi crystalline polymers, crystallization, melting and glass transition phenomena. Thermoplastic and thermosetting polymers. Viscoelastic polymers. Deformation of elastomers, fracture of polymers, polymer additives, plastics, fibers and polymer applications.

UNIT IV

Amorphous materials:

Preparation methods of amorphous material, glass properties and glass forming, heat treating glasses, glass transition temperatures. Structure of glass, atomic ordering in glass materials. Optical properties of glasses and applications of amorphous materials.

Magnetic materials:

Exchange interaction in magnetic materials, magnetic anisotropy and magnetostriction. Antiferromagnetism and ferrimagnetism, the influence of temperature on magnetic behaviour, domains and hysteresis. Soft and hard magnetic materials and their applications. Ferrites – properties and applications. Ferrites for microwave applications – Magnetic bubbles – Magneto resistance – GMR and CMR materials – materials for spintronic devices.

Reference books:

1. Materials science and Engineering-An introduction-William D.CallisterJR.
2. Physics of semiconductor materials-S.M. Sze.
3. Physics of amorphous materials-S.R. Elliott.
4. Glass structure by spectroscopy-J. Long andC.A. Angell.
5. Introduction to magnetic materials-B.D.Cullity.

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Pre-Ph.D.(PHYSICS)

Paper-IV

Analysis of Published research papers / scientific literature

Hours per week: 02 Credits: 02

A research scholar should submit analysis of published research papers / scientific literature in the form of dissertation.

Blue print for Paper-I

(For Theory Examinations)

Course: Pre- Ph.D (Physics)

Duration: 2 Hours Max Marks: 50

Section-A

Answer any FIVE questions. Each question carries Six Marks (5 X 10= 50)

1. From I unit.
2. From I unit.
3. From II unit.
4. From II unit.
5. From III unit.
6. From III unit.
7. From IV unit.
8. From IV unit.
9. From I OR II units.
10. From III OR IV units.

Blue print for Paper-II &III

(For Theory Examinations)

Course: Pre- Ph.D (Physics)

Duration: 3 Hours Max Marks: 70

Section-A

Answer any FIVE questions. Each question carries Six Marks (6 X 5= 30)

1. From I unit.
2. From I unit.
3. From II unit.
4. From II unit.
5. From III unit.
6. From III unit.
7. From IV unit.
8. From IV unit.
9. From I OR II units.
10. From III OR IV units.

 Section-B

Answer ALL questions. Each question carries Ten Marks (4 X 10= 40)

1. A or B from Unit I
2. A or B from Unit II
3. A or B from Unit III
4. A or B from Unit IV