Department of Physics, University of Jammu

Syllabus

Course title: Research Methodology

(For the years 2024- 2027)

Course for the Programme: Ph.D.

Course Code: PSPHTC702 **Credits: 04**

Research Methodology **Marks: 100**

UNIT: 1

Research Problem: Meaning of Research, objectives, types of Research, Research Approaches, Research and scientific method, Research method, Research Process, Criteria of Good Research, Problems in Pure Science, Problems in Applied Science.

Searching the literature: Necessity for research, structure of the scientific literature, cost of experiment, suggestions for searching.

UNIT: 2

Elementary Scientific Methods: Authority in science, observation and description, cause and effect, Analysis and synthesis, Hypothesis deduction.

The Design of Experiment: Some first principles, variables, comparative versus absolute measurements, choice of sample.

Technical Communications: What is technical communication, factors to consider in the technical communication, Analyzing your audience, language and style — voice, sentence length, negatives tone, organisation and classification.

UNIT: 3

Meaning of Interpretation: Techniques of interpretation. Precautions in interpretation. Significance of report writing, different steps in report writing, Layout of research report, format and types of report, Mechanics of writing research report, White papers, lab reports, Memorandums, memos and oral presentations.

UNIT: 4

Statistical Methods: Measure of central Tendency, Arithmetic mean, median, mode, geometric mean, Harmonic mean.

Measures of Variation in Statistical Methods: The central limit theorem, Quartile Deviation, Average Deviation, Standard deviation, Coefficient of variation.

Data Presentation: The frequency distribution and histograms.

Probability distributions: Discrete and Continuous probability distributions

Important Discrete Distributions: Hypergeometric distribution, binomial distributions,

Poisson distributions.

Important Continuous Distributions: The normal distribution, exponential distribution, Gamma distribution.

UNIT: 5

Concept of Standard Error: Statistical and systematic errors. Propagation of errors, chi square test for comparing variance, chi square test of goodness of fit, conditions of the application of chi square test. Important characteristics of chi square test. Simulation: introduction, need for simulation, types of simulation.

Graphics: Preparing graphics, General info on Graphics, Creating graphics (bar line graphs, pie charts), computer images (types).

REFERENCES

- *Research Methodology: Methods and Techniques* by C.R. Kothari (New Age International Publishers).
- *Research Methodology* by R. Panneerselvam (Prentice-Hall of India).
- *Introduction to Statistical Quality Control* by Douglass and Montgomery (Wiley Publication, 4e).
- *Basic Communication Skills for Techniques* by Andrea J. Rutherford, 2e (Pearson Education Asia).

NOTE FOR STUDENTS:

The question paper will be of 100 marks. The question paper shall comprise of 10 questions (of 20 marks each) with two questions from each unit. The students have to attempt one question from each unit.

POST GRADUATE DEPARTMENT OF PHYSICS, UNIVERSITY OF JAMMU, JAMMU

Syllabus for Pre Ph.D. Programme in Condensed Matter Physics for the Session 2024-27

Course No.	:	**PSPHTC703**
Title of the course	:	**Techniques in Experimental Physics I**
No. of credit Points	:	**03**
Maximum Marks	:	**75**
Duration of Exam.	:	**3 hours**

Section A

Basic Crystallography

Why Fourteen Bravais lattices? Symmetry operations and symmetry elements, combination of symmetry elements, symmetry directions, point groups and space groups, why 32 point groups and 230 space groups? Space group notation in International Tables for Crystallography, centro-symmetric crystal structures, The Asymmetric Unit.

X-rays

The generation of X-rays, X-ray tubes, High voltage equipment and electrical precautions, the measurement of intensity, ion chambers, proportional counters and Geiger counters, scintillation counters, measurement of wavelengths of X-ray beam. X-ray Spectra – the continuous spectrum, Characteristic emission spectrum, Characteristic absorption spectrum, Absorption of X-rays, Methods of obtaining monochromatic X-rays, why we use X-rays to study the structure of a crystal?

Section B

X-ray Diffraction

Why do we use diffraction? Diffraction from a three-dimensional array of atoms, The Reciprocal Lattice and Sphere of Diffraction, atom form factors, atom displacement factors, structure factors, Braggs law, The Fourier Series, The Fourier transform, Diffraction and the Fourier transform, Diffraction by a periodic distribution, The electron density equation.

The experimental collection of X-ray diffraction data

The Laue Method, The Rotation Method, , Moving film Methods, The Powder Method, Diffractometers – the single crystal diffractometer, basic geometries used by the four circle diffractometer, determination of the orientation matrix, reflection profile and scan type, selection of data to be measured, Area detectors.

References:

1. Applied X-rays by George L.Clark (McGRAW HILL BOOK COMPANY INC.)
2. Crystals X-rays and Proteins by dennis Sherwood (Longman)
3. Introduction to X-ray Crystallography by M.M.Woolfson
4. Crystallography Applied to Solid State Physics by A.R.Verma, O.N.Srivastava (New Age Int.Pub.)
5. Crystal structure determination by Werner Massa (Springer)

Note for paper setter

The paper shall consist of 10 questions, six questions from Section A and four questions from Section B. The candidates are required to answer five questions selecting minimum two from each section.

POST GRADUATE DEPARTMENT OF PHYSICS, UNIVERSITY OF JAMMU, JAMMU

Syllabus for Pre Ph.D. Programme in Condensed Matter Physics for the Session 2024-27

Course No.	:	**PSPHTC704**
Title of the course	:	**Techniques in Experimental Physics II**
No. of credit Points	:	**03**
Maximum Marks	:	**75**
Duration of Exam.	:	**3 hours**

Section A

Interpretation of X-ray Diffraction Patterns

Steps in the derivation of structure from the diffraction pattern, Interpretation of Laue patterns, The Reciprocal Lattice in the interpretation of Laue patterns, Interpretation of Rotation patterns, The Reciprocal Lattice in the Interpretation of Rotation patterns, Limitations of rotation method, The oscillation method, X-ray goniometer patterns – The Weissenberg goniometer pattern, The Interpretation of Powder Spectra.

The Crystal Structure Solution

Determination of Space Group – determination of the Laue group, Systematic Absences, transformations, Intensity data corrections – The polarization factor, The Lorentz factor, the temperature factor, Absorption, primary extinction, secondary extinction, the Phase Problem, The techniques of solution – Direct Methods.

Section B

Refinement

The necessity for refinement, series termination, the trial structure, cyclic fourier refinement, the difference Fourier synthesis, Least-squares refinement, Weights, Crystallographic R value, location and treatment of hydrogen atoms, restricted refinement, Symmetry restrictions, Residual electron density, Rietveld refinement

Errors, interpretation and presentation of results

Wrong atom type, Disorder- site occupancy disorder, positional and orientational disorder, one- and two-dimensional disorder, twinning, false unit cells, space group errors, misplaced origins, poor atom displacement parameters.

Bond lengths, Bond angles, best planes, torsion angles, structural geometry and symmetry, The Cambridge Structural Database, Deposition of structural data in Data Bases.

References:

1. Applied X-rays by George L.Clark (McGRAW HILL BOOK COMPANY INC.)
2. Crystals X-rays and Proteins by dennis Sherwood (Longman)
3. Introduction to X-ray Crystallography by M.M.Woolfson
4. Crystallography Applied to Solid State Physics by A.R.Verma, O.N.Srivastava (New Age Int.Pub.)
5. Crystal structure determination by Werner Massa (Springer)

Note for paper setter

The paper shall consist of 10 questions, six questions from Section A and four questions from Section B. The candidates are required to answer five questions selecting minimum two from each section.

Post Graduate Department of Physics
University of Jammu, Jammu

Syllabus of Pre-Ph D Programme
Crystal Growth & Materials Research Lab
(Session 2024 – 27)

Course No.	:	**PSPHTC-703**
Title	:	**Techniques in Experimental / Theoretical Physics - I**
No. of Credit Points	:	**03**
Maximum Marks	:	**75**
Duration of Exam	:	**03 Hours**

Section A

Basics of crystal growth, preparation techniques and its application

Phase diagram, Nucleation theory, Homogeneous and Heterogeneous nucleation, Ideal crystal growth, formation of ice crystals, different types of crystal growth techniques: growth from solid, growth from vapour, growth from liquid, growth from solution, Crystal growth methods: top seeded solution growth, high temperature solution, slow evaporation, chemical vapor deposition, elementary ideas of crystals and its application.

Introduction to oxides and ceramics

Different types of oxide materials: Perovskites (manganites, titanates etc.), Ferrites, spinel ferrites, hexaferrites (M- type & U- type). Preparation techniques of ceramics: Solid state reaction, fabrication of ceramic: mixing, calcination, shaping, high temperature processing (sintering), poling and glass ceramics.

Section B

Nanomaterials and its applications

Introduction: Different types of nanomaterials - Inorganic Quantum well, Quantum wires and Quantum dots, metal cluster, metal oxide nanocrystals, semiconductor nanocrystals, assemblies of nanocrystals, core shell structure of different materials.

Synthesis of Nanomaterials and different Techniques

Top down and bottom up approaches, Solid states routes: mechanical mixing, grinding and solid solution techniques, Chemical routes: evaporation, co – precipitation, sol-gel techniques, Advanced methods: hydrothermal and solvothermal methods.

References

1. The art and science of growing crystals – J J Gilman
2. Physics and Chemistry of solids – Stephen Elloit
3. Springer Handbook of Crystal Growth: Eds: G.Dhanraj, K.Byrappa, V.Prasad, M.Dudley, Springer Verlag (2010).

Note for Paper Setter

The paper shall consist of 10 questions, six questions from Section A and four questions from Section B. The candidates are required to answer five questions selecting at least 02 questions from each section.

Post Graduate Department of Physics
University of Jammu, Jammu

Syllabus of Pre-Ph D Programme
Crystal Growth & Materials Research Lab
(Session 2024 – 27)

Course No.	:	**PSPHTC-704**
Title	:	**Techniques in Experimental / Theoretical Physics - II**
No. of Credit Points	:	**03**
Maximum Marks	:	**75**
Duration of Exam	:	**03 Hours**

Section A

Structural and morphological characterization

Structural analysis: Single crystal X- ray diffraction, Powder X- ray diffraction (PXRD), X- ray photoelectron spectroscopy (XPS), Neutron scattering.

Morphological analysis: Scanning electron microscopy (SEM), Energy dispersive X- ray spectroscopy (EDX), Transmission electron microscopy (TEM), Scanning transmission electron microscopy (STEM), Low energy electron diffraction (LEED), Atomic force microscopy (AFM).

Optical and spectroscopic characterization

Optical microscopy (OM), Fourier transforms infrared spectroscopy (FTIR), UV- Vis spectroscopy, Photoluminescence spectroscopy (PL), Raman spectroscopy, Fluorescence spectroscopy.

Section B

Electrical and Magnetic characterization

Electrical analysis: Dielectric measurement, Hall effect measurement, Four probe method.

Thermoelectric properties: Seeback effect, Peltier effect and Thomson effect.

Magnetic analysis: Electron paramagnetic resonance (EPR), Nuclear magnetic resonance (NMR), Vibrating sample magnetometer (VSM), SQUID magnetometry.

Thermal characterization

Thermal analysis: Thermo-gravimetric analysis (TGA), Differential thermal analysis (DTA), Endothermic and Exothermic reactions, Differential scanning calorimetry (DSC),

Phase changes: Crystalline and amorphous fractions.

References

1. Springer Handbook of Nanotechnology; Eds: Bharath Bhushan, Springer Verlag, 2nd Editon (2009).
2. Yang Leng, Materials Characterization: Introduction to Microscopic and Spectroscopic Methods, Wiley & Sons (2008)
3. R.A. Laudise, Growth of Single Crystals, Prentice Hall, (1973)

Note for Paper Setter

The paper shall consist of 10 questions, six questions from Section A and four questions from Section B. The candidates are required to answer five questions selecting at least 02 questions from each section.

POST GRADUATE DEPARTMENT OF PHYSICS, UNIVERSITY OF JAMMU, JAMMU

Syllabus for Pre Ph.D. Programme in Nuclear Theory for the Session 2024-27

Course No.	:	**PSPHTC703**
Title of the course	:	**Techniques in Theoretical Physics I**
No. of credit Points	:	**03**
Maximum Marks	:	**75**
Duration of Exam.	:	**3 hours**

Section A

Symmetries in Nuclear Physics

General Concept of symmetries, Translation, The Operator for Translation, Translational Invariance, Many –Particle Systems, Rotation, The Angular Momentum Operators, Expressions for Angular momentum operators, Representations of the Rotation Group, The Rotation Matrices, SU(2) and Spin, SU(3) Group Algebra, SU(3) Group for identical bosons in single oscillator shell, SU(3) Group chain, SU(3) and U(3) irreducible representations.

Angular momentum Algebra

Representation Theory, Coupling of Angular momenta, Intrinsic Angular Momentum, Evaluation of C-G coefficients, Recursion Relations for C-G coefficients Relation of D-functions with C-G coefficients, Relation of D-functions with spherical harmonics. Definition of spherical tensors, The Wigner-Eckart Theorem and its applications, 6j and 9j Symbols.

Section B

Second Quantization

General Formalism, Second Quantization for Bosons and Fermions, Representation of Operators, One-Particle and Two-Particle Operators, Evaluation of Matrix Elements for Fermions, The Particle-Hole Picture

Relativstic mean field models

Relativistic quantum mechanics : Klein-Gordon and Dirac equations and their solutions, Gamma matrices Non relativistic limit of Dirac equation; Parity inversion and time reversal, Introduction to relativistic mean field models, Formulation of the Models and applications

References:

1. Introductory Nuclear Physics by Y.R. Waghmare
2. Nuclear Models by W. Greiner and J.A. Maruhn
3. Theory of Nuclear Structure by M.K. Pal
4. Mean Field Description of Nuclei by Y.K. Gambhir
5. An Introduction to Quantum Field Theory by Michael E. Peskin and Daniel V. Schroeder

Note for paper setter

The paper shall consist of 10 questions, six questions from Section A and four questions from Section B. The candidates are required to answer five questions selecting ~~three from Section A and two from Section B.~~ atleast 02 questions from each section.

2/7/24

POST GRADUATE DEPARTMENT OF PHYSICS, UNIVERSITY OF JAMMU, JAMMU

Syllabus for Pre Ph.D. Programme in Nuclear Theory for the Session 2024-27

Course No.	:	**PSPHTC704**
Title of the course	:	**Techniques in Theoretical Physics II**
No. of credit Points	:	**03**
Maximum Marks	:	**75**
Duration of Exam.	:	**3 hours**

Section A

Microscopic Models
The Hartree-Fock approximation, The Variational Principle, The Slater determinant approximation, applications, Density matrix formulation.

Phenomenological Single Particle Models
The Spherical Shell Model, The Deformed Shell Model or Nilsson Model, The Anisotropic Harmonic Oscillator, Nilsson Hamiltonian, Quantum Numbers of the ground state in odd nuclei

Rotating Nuclei
The Rigid rotor, Angular Momentum Operators in the intrinsic system, The Symmetric Rotor, The Asymmetric Rotor

Section B

Collective Models
Semi empirical Mass Formula, Fermi Gas Model, Nuclear Surface Deformation, General parameterization, Types of Multipole Deformation, Quadrupole deformation, Symmetries in Collective space

Pairing Theory
Creation and Annihilation operators, Pairing interaction for degenerate configuration, Generalization to non-degenerate configuration, BCS formalism, Application of BCS theory to nuclei

References:

1. Shapes and Shells in Nuclear Structure by S.G. Nilsson and I. Ragnarsson
2. Nuclear Models by W. Greiner and J.A. Maruhn
3. The Nuclear Many Body Problem by Peter Ring

Note for paper setter
The paper shall consist of 10 questions, six questions from Section A and four questions from Section B. The candidates are required to answer five questions selecting ~~three from Section A and two from Section B.~~ atleast 02 questions from each section.

2/7/24

POST GRADUATE DEPARTMENT OF PHYSICS, UNIVERSITY OF JAMMU

DETAILED SYLLABUS

Techniques in Experimental/Theoretical Physics-I

Course No. PSPHTC-703 Max. Marks:75
Credits: 3

Syllabus for the examination to be held in 2025, 2026, 2027.

Section A

Introduction to relativistic heavy-ion collisions and quark-gluon plasma (QGP):
Global Observable (Multiplicity, E_T, E_t, (pseudo)Rapidity); P_T distributions (explanations of various regions and connections with particle production mechanism; Correlations and fluctuations; Flow (radial, directed, elliptic and higher order flow harmonics extraction and interpretations); Heavy quark and quarkonia suppression; strangeness enhancement; jet quenching and electromagnetic signals (photon and di-lepton).

Relativistic kinematics: Lorentz transformation: frequently used reference frames, four vector notation, rapidity and pseudo-rapidity variables, light cone variables, collision and decay, relativistic invariants

MIT Bag model, Hagedron gas, phase diagram of QCD, criteria for formation of QGP in the laboratory

Section B

Collision dynamics: Different stages of space-time evolution in heavy-ion collisions, Bjorken's model for energy density

Experiments: Classification of accelerators (principle and design of ion-sources, a general overview of past, present and future experimental facilities) Example: SPS, LHC, RHIC, FAIR.

Detectors for ionization and track measurements: Detection of charged particles, ionization chambers, proportional counters, muti-wire proportional counters (MWPC), drift chambers, Cherenkov detectors, Semiconductor detectors, silicon and (strip/pixel)

Recommended Textboo

- T Ferbal, (1991), Experimental Techniques in High Energy Nuclear and particle Physics:World Scientific, Singapore.
- G.F. Knoll, (1979), Radiation detection and measurement, John Wiley & Sons Inc, New York
- Introduction to experimental particle physics: Richard Fernow
- Techniques for nuclear and particle physics experiments: W. R. Leo
- Radiation Detection and Measurement: Glenn F. Knoll
- Gaseous Radiation detectors: Fabio Sauli
- Introduction to High-Energy Heavy-Ion Collisions, C. Y. Wong, World Scientific
- The Physics of the Quark-Gluon Plasma: Introductor Lecture, Sourav Sarkar, Helmut Satz, BikashSInha (Eds.), Springer

POST GRADUATE DEPARTMENT OF PHYSICS, UNIVERSITY OF JAMMU

DETAILED SYLLABUS

Techniques in Experimental/Theoretical Physics-II

Max. Marks:75

Course No. **PSPHTC-704**
Credits: 3

Syllabus for the examination to be held in 2025, 2026, 2027.

Section-1

Input from detectors for data analysis (analog and digital signals, data acquisition systems (DAQ), Conversion of raw detector signals into calibrated data, Hit formation and digitization; time stamping and event building, Noise suppression, pedestal subtraction, and data quality monitoring, Role of trigger systems and event selection)

Pattern recognition and track reconstruction (Concept and importance of pattern recognition in tracking detectors, Clustering and association of hits across multiple detector layers), Momentum and charge determination in magnetic field, Efficiency, resolution, and reconstruction biases.

Event reconstruction (Integration of information from various subsystems: tracking, calorimetry, and muon systems, Primary and secondary vertex reconstruction, Particle identification using dE/dx, time-of-flight, Event classification and topology reconstruction for physics analysis,
Data storage formats (ROOT trees, ntuples) and event visualization tools.

Section-II

C++ Programming Basic data types, Arrays, Pointers, Loops, Conditionals, Inputs/Outputs, File handling, Object oriented programming concepts and C++ classes

Data Analysis with ROOT Introduction, Installation, Writing of Macros, Graphs/Histograms, Fittings, ROOT Trees and handling large volumes of data, ROOT Mathematical library

Introduction to Monte Carlo Simulation Method, Random Numbers

Event generators (Role of Monte Carlo event generators in experimental particle physics, Steps in event generation, Hard scattering process (matrix element level), Parton showering, hadronization, Overview of major generators: PYTHIA, HERWIG, EPOS, HIJING, AMPT. Tuning of generators, Application in efficiency, acceptance, and background studies.

Detector simulation Purpose and importance of detector simulation, Principles of Monte Carlo–based detector response simulation, Simulation tools: GEANT4, FLUKA, and fast simulation techniques.

Books and resources

- Data Analysis Techniques for High-Energy Physics by R.Fruhwirth, M.Regler, R.K. Bock, H.Grote, D.Notz
- G.F. Knoll, (1979), Radiation detection and measurement, John Wiley & Sons Inc, New York
- W.R. Leo, *Techniques for Nuclear and Particle Physics Experiments: A How-To Approach*
- *Thomas Ferbel (ed.), Experimental Techniques in High-Energy Nuclear and Particle Physics* World Scientific, 2nd edition, 1991.
- *R.K. Bock and W. Krischer, The Data Analysis BriefBook* Springer, 1998.
- ROOT Data Analysis Framework – User's Guide
- Glen Cowan, *Statistical Data Analysis* Oxford University Press, 1998.
- *Bjarne Stroustrup, Programming: Principles and Practice Using C++ (2nd ed., Addison-Wesley, 2014)*

Department of Physics, University of Jammu

Syllabus

Course title: Techniques in Experimental Physics - I

(For the years 2024- 2027)

Course for the Programme: Ph.D.

Course no: PSPHTC703
Duration of Exam: 3 hrs

Course Credit: 3
MM: 75

Section A

Fundamentals of Electrochemical Methods

Fundamentals of Electrochemical Materials, Electrochemical basics: Redox reactions, electrode-electrolyte interface, Nernst equation, Electrical double layer, faradaic and non-faradaic processes, Overview of electrochemical cells: galvanic, electrolytic, fuel cells

Materials for Electrochemical Energy Storage, Batteries: Li-ion, Na-ion, Zn-ion, solid-state batteries, Supercapacitors: EDLCs, pseudocapacitors, hybrid systems, Role of nanostructuring and composites in improving performance, Evaluation parameters: specific capacity, energy/power density, cyclic stability

Materials for Electrochemical Sensing, Fundamentals of electrochemical sensors: potentiometric, amperometric, voltametric, Materials for sensors: metal oxides, conducting polymers, MOFs, COFs, graphene, MXenes, Sensitivity, selectivity, response time, and detection limits, Application areas: environmental, biomedical, food, industrial

Section B

Electrochemical Characterization Techniques

Electrochemical methods: Cyclic Voltammetry, EIS – Electrochemical Impedance Spectroscopy, GCD – Galvanostatic Charge–Discharge, LSV – Linear Sweep Voltammetry, DPV – Differential Pulse Voltammetry, SWV – Square Wave Voltammetry, Integration of electrochemical and spectroscopic techniques

Basic electrode fabrication and device assembly, Introduction to practical electrochemical devices, Simple electrode design and role of binders and current collectors, Performance issues: stability, durability, and degradation, Safety and environmental aspects of batteries, supercapacitors, and sensors.

Books for Reference:

- Bard, A. J., & Faulkner, L. R. – *Electrochemical Methods: Fundamentals and Applications*
- Wang, Y., & Chen, H. – *Materials for Sustainable Energy Applications*
- Scholz, F. – *Electroanalytical Methods*

NOTE FOR STUDENTS:

The question paper will be of 75 marks. The question paper shall comprise of 10 questions (of 15 marks each) with six questions from Section A and four questions from Section B. The students have to attempt atleast two questions from each section.

Department of Physics, University of Jammu

Syllabus

Course title: Techniques in Experimental Physics - II

(For the years 2024- 2027)

Course for the Programme: Ph.D.

Course no: PSPHTC704 **Course Credit: 3**

Duration of Exam: 3 hrs **MM: 75**

Section A

Fundamentals and characterizations of Nanomaterials

Definition, classification (0D, 1D, 2D, 3D), and size-dependent properties, Quantum confinement and surface-to-volume ratio effects, Common synthesis techniques: sol-gel, hydrothermal, CVD, PVD, ball milling, electrodeposition, Examples: metal oxides, carbon-based nanomaterials, perovskites, chalcogenides

Structural and Morphological Characterization, X-ray Diffraction (XRD): Phase analysis, crystallite size (Scherrer formula), lattice strain, Scanning Electron Microscopy (SEM) & Transmission Electron Microscopy (TEM): Morphology, particle size, lattice fringes, SAED, Atomic Force Microscopy (AFM): Surface topography, roughness, nanomechanical analysis

Optical and Spectroscopic Characterization, UV-Vis Spectroscopy: Band gap analysis (Tauc plot), Photoluminescence (PL): Emission characteristics and defects, FTIR and Raman Spectroscopy: Functional group and vibrational analysis, X-ray Photoelectron Spectroscopy (XPS): Elemental composition and oxidation states

Section B

Electrical measurements and Device Concepts

Electrical, Magnetic, and Hall Measurements, Hall Measurement System: Principle of Hall Effect; Measurement of carrier type, carrier concentration, and mobility; Resistivity and conductivity of thin films, Four-probe and Two-probe methods: Resistivity measurements, VSM (Vibrating Sample Magnetometry): Magnetic hysteresis, coercivity, remanence

Basic concepts of thin-film and nanomaterial-based device fabrication, Introduction to substrates, contacts, and electrode materials, Effect of nanomaterial properties on device performance, Stability, reliability, and basic safety aspects of nanomaterials, Future prospects and challenges in nanomaterial-based technologies

Books for Reference:

- Cao, G., *Nanostructures and Nanomaterials: Synthesis, Properties and Applications*
- Poole, C. P., & Owens, F. J., *Introduction to Nanotechnology*
- Cullity, B. D., *Elements of X-Ray Diffraction*
- Goldstein, J. I., *Scanning Electron Microscopy and X-ray Microanalysis*

NOTE FOR STUDENTS:

The question paper will be of 75 marks. The question paper shall comprise of 10 questions (of 15 marks each) with six questions from Section A and four questions from Section B. The students have to attempt atleast two questions from each section.

Department of Physics, University of Jammu

Syllabus

Course title: Research and Publication Ethics

(For the years 2024- 2027)

Course for the Programme: Ph.D.

Course no: PSPHTC705 **Course Credit: 2**

Duration of Exam: 2 hrs **MM: 50**

Overview: This course has total 5 units focusing on basics of philosophy of science and ethics, research integrity, publication ethics. The course is designed to provide the knowledge about the identification of research misconduct and predatory publications. Indexing and citation databases, open access publications, research metrics (citations, h-index, impact factor, etc.) and plagiarism tools are also introduced in this course.

Unit 1: Philosophy, Ethics and Scientific Conduct

Introduction to philosophy: definition, nature and scope, concept, branches. Ethics: definition, moral philosophy, nature of moral judgments and reactions.
Ethics with respect to science and research, Intellectual honesty and research integrity, Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP), Redundant publications: duplicate and overlapping publications, salami slicing; Selective reporting and misrepresentation of data

Unit 2: Publication Ethics

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 contributor ship; Identification of publication misconduct, complaints and appeals; Predatory publishers and journals practice

Unit 3: 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. Elsevier Journal Finder, Springer Journal Suggestor, etc.

Unit 4: Publication Misconduct

Subject specific ethical issues, FFP, authorship; Conflicts of interest; Complaints and appeals: examples and fraud from India and abroad; Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools

Unit 5: Databases and Research Metrics

Databases: Indexing databases; Citation databases: Web of Science, Scopus, etc.; Research Metrics; Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score; Metrics: h-index, g index, i10 index, altmetrics.

Suggested Readings

- The Ethics of Teaching and Scientific Research By Miro Todorovich; Paul Kurtz; Sidney Hook.
- Research Ethics: A Psychological Approach By Barbara H. Stanley; Joan E. Sieber; Gary B. Melton
- Research Methods in Applied Settings: An Integrated Approach to Design and Analysis By Jeffrey A. Gliner; George A. Morgan Lawrence Erlbaum Associates, 2000
- Ethics and Values in Industrial-Organizational Psychology By Joel LefkowitzLawrence Erlbaum Associates, 2003.

NOTE FOR STUDENTS:

The question paper will be of 50 marks. The question paper shall comprise of 10 questions (of 10 marks each) with two questions from each unit. The students have to attempt one question from each unit.

Minutes of the DRC meeting held on 13.05.2024 at 2:30 pm in the Department of Physics, University of Jammu, Jammu.

Present

1	Prof. Arun Bharti (Head of the Department)	Convener
2.	Prof. Naresh Padha	Member
3.	Prof. Anju Bhasin	Member
4.	Prof. Vivek K Gupta	Member
5.	Prof. K.K. Bamzai	Member
6.	Dr. Rani Devi	Member
7	Dr. Sandeep Arya	Member

Item 01

Formulation of syllabi for Pre-Ph.D. Course work as per the new statutes Dated: 15-04-2024, adopted by University of Jammu

The HOD placed before the DRC members about the new statutes for governing the Degree of Doctor of Philosophy, 2024 at University of Jammu. According to new statutes, the enrolled Ph.D. students will be required to undergo a course work comprising of minimum 03 papers such as Research Methodology (04 credits), Research and Publication Ethics (02 credits) and 01 new paper in candidate's proposed area of research (06 credits). The total credits assigned to Ph.D. course work shall be minimum of 12 credits and a maximum of 16 credits.

After thorough discussion in the DRC meeting, it was resolved that the concerned supervisors will frame the new syllabi as per the following nomenclature and credits:

S.No.	Name of the Course	Course Code	Credits
1	Reading Paper	PSPHTC701	02 Credits
2	Research Methodology	PSPHTC702	04 Credits
3	Techniques in Experimental/Theoretical Physics -I	PSPHTC703	03 Credits
4	Techniques in Experimental/Theoretical Physics -II	PSPHTC704	03 Credits
5	Research and Publication Ethics	PSPHTC705	02 Credits

Item 02

Cancellation of admission of a Pre-Ph.D. student

The Department admitted 03 candidates for the Ph.D. programme in Physics under exempted category in the month of April, 2024 in response to the notification issued by the University vide No. DRS/24/P-D Adm /6432-6512, Dated: 27-02-2024. The HOD apprised the members that the department has received an application from one of the admitted candidates Mr. Tariq Ahmed with a request to cancel his admission as he is unable to join this Ph.D. programme in the University of Jammu due to some personal reasons. The candidate has also requested for refund of his deposited fees.

After threadbare discussion, it was resolved that the admission of the candidate be cancelled and the case of refund of fee be submitted to DRS office for further clarification.