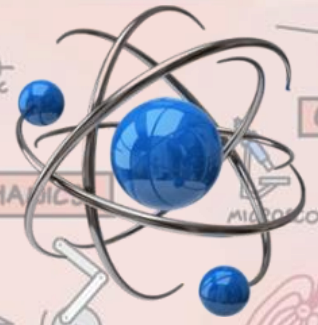
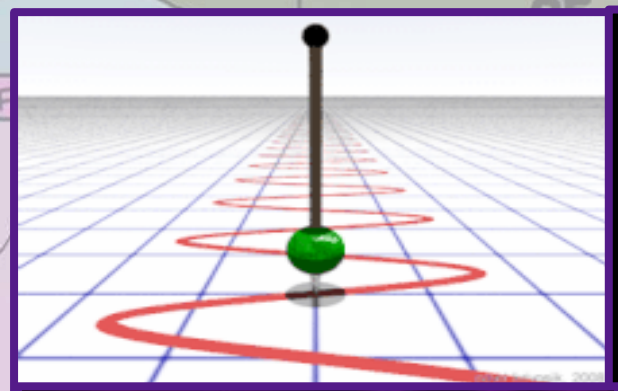
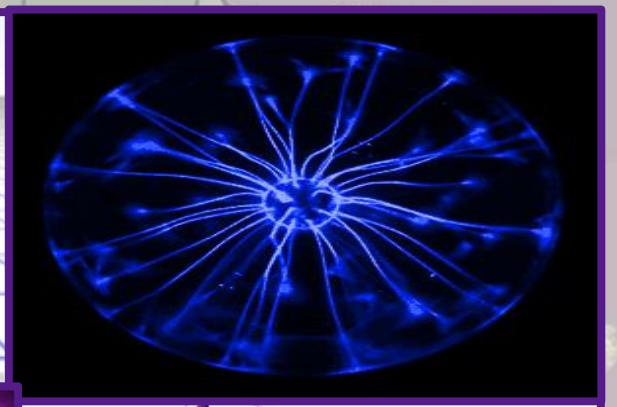
Indian Institute of Engineering Science and Technology, Shibpur

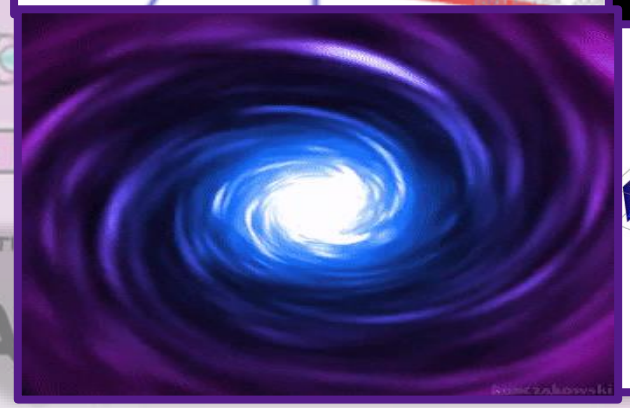
Department of Physics

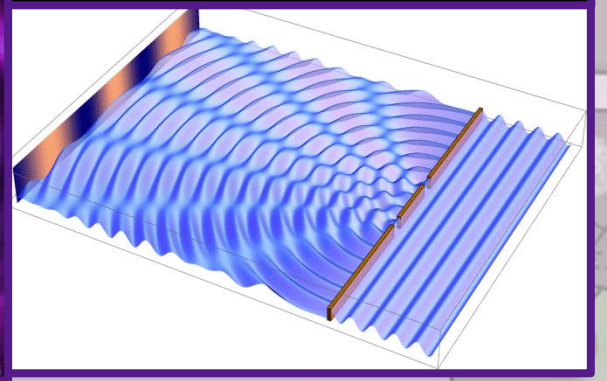


Departmental Brochure
for M.Sc. Admission
(2025-27)









Vision and Mission of Physics Department

Empowering students through transformative education and research excellence

Vision

Commitment to academic excellence

The department strives for excellent academic achievements through innovative research efforts.

Focus on modern day research

We engage in modern day research activities that advance the field of physical science.

Fostering an innovative environment

Our environment encourages creativity and collaboration among students and faculty.

Mission

Transformative educational experience

We aim to provide an education that transforms students into knowledgeable and skilled professionals.

Empowerment through knowledge and skills

Students are equipped with essential skills and knowledge vital for their careers in physical science.

Emphasis on ethical values

Our mission includes instilling ethical principles in students as part of their educational journey.

A Century of Physics Education

Exploring the evolution of the Physics Department since 1926

Started journey in 1926

The original writings of Max Planck and Albert Einstein were studied in this department as early as in the year 1926 by the two stalwarts of Indian Physics Satyendra Nath Bose and Meghnad Saha, who were the then postgraduate students of Calcutta University. They also performed their M.Sc. Practical in the laboratories of the Physics department. The then physics department had excelled under the leadership of Prof. Bruhl.

Launch of M.Sc. Program

A significant milestone was achieved in 2000 with the introduction of the M.Sc. program in Applied Physics. With the initiation of M.Sc. program, new faculty members with expertise in different areas of Physics have joined us. Research is being done in both theory and experiments in areas like cosmology, nuclear physics, high energy physics, atomic and molecular physics, condensed matter physics, fiber optics, plasma physics, and nanomaterials. Work is also being done on silicon-based materials used in light emitters, detectors, sensors, and more.

Last five years

In past five years, we have published over 100 research papers in well-known international journals and conference proceedings. The department also runs several research projects funded by organizations like DST, CSIR, and DAE. Many of our M.Sc. and PhD students carry out research collaborations with national institutes like SINP, IACS, TIFR, BARC, IPR, and CGCRI. It's worth noting that many of our former students are now involved in advanced research (both PhD and post-doctoral) at leading institutions around the world.

M.Sc. Physics

First Semester

- **1. Core Courses (4 Credit):** a) Mathematical Methods of Physics , b) Classical Mechanics and c) Quantum Mechanics -I .
- **2. Departmental Electives (3 Credit**): a) Gravitation and Astrophysics , b)Interaction of Radiation with Matters: Detection of Charged and Neutral Particles, c) Physics of Semiconductor Devices and d) LASER, Fibre Optics and their Applications .
- **3. Open Electives (3 Credit):** a)Dynamical Systems-I (PH5161) and b)Basics and Applications of Quantum Mechanics .
- **4. Lab Courses: a) 3 Credit:** General Physics Laboratory and b) 2 Credit: Computer Programming and Computational Techniques

Second Semester

- **1. Core Courses (4 Credit):** a) Electromagnetic Theory, b) Electronic Devices and Circuits and c) Quantum Mechanics - II
- **2. Departmental Electives (3 Credit):** a) Advanced Optics , b) Computational Physics and c) Plasma Physics .
- **3. Open Electives (3 Credit):** a)Principle of Detectors and Data Acquisition Systems for Radiation Detection and b)Physics and Applications of Quantum Structures .
- **4. Lab Course (2 Credit):** Basic Electronic Circuit Laboratory
- **5. Thesis/Project (4 Credit):** Term Paper
- **6. Thesis/Project (2 Credit):** Term Paper Viva

Third Semester

- **1. Core Courses (4 Credit):** a) Atomic and Molecular Physics, b) Nuclear Physics, and c) Solid State Physics .
- **2. Lab Course (3 Credit):** Advanced Laboratory .
- **3. Thesis/Project Report (8 Credit):** M.Sc. Thesis Part - I .
- **4. Thesis/Project Viva (2 Credit):** Seminar and Viva of M.Sc. Thesis Part - I

Fourth Semester

- 1. **Core Course** (4 Credit): Statistical Mechanics.
- 2. **Departmental Electives** (3 Credit): a) Physics of Materials b) Nuclear Physics and Nuclear Astrophysics, c) Field Theory and Particle Physics and d) Advanced Condensed Matter Physics.
- 3. **Laboratory Courses** (3 Credit): a)Special Laboratory for Condensed Matter Physics and b)Special Laboratory for Nuclear and Particle Physics
- 4. **Thesis/Project Report** (8 Credit): M.Sc. Thesis Part - II.
- 5. **Thesis/Project Viva** (4 Credit): Seminar and Viva of M.Sc. Thesis Part - II)

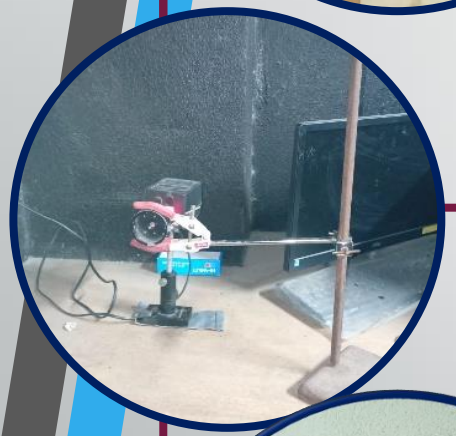
No. of enrolled Students

2020-22	18
2021-23	22
2022-24	21
2023-25	32
2024-26	31

PG Laboratory

General Physics Laboratory

B-H loop for magnetic susceptibility



Intensity pattern of single and multi slit

Band Gap using Four Probe

Basic Electronics Laboratory

Basic Electronic circuit Laboratory

Computational Laboratory

Advanced Laboratory

Faraday Effect Setup

Michelson Interferometer

Studies on Phase Transition in Ferrite Material

Special Laboratory for Condensed Matter Physics and Special Laboratory for Nuclear and Particle Physics

Studies on Phase Transition in PZT

Studies on Hall Effect

Guoy's method

Geiger Muller Counter

Expert Faculty Profiles in Physics

Dr. Krishnendu Mukherjee

Associate Professor and Head, Department of Physics

Area of work: High Energy Physics, Non-equilibrium statistical mechanics.

Prof. Mousumi Basu

Professor, Department of Physics

Area of work: Design and Optimization of optical fibers/waveguides for various nonlinear applications.

Dr. Amit Kundu

Associate professor, Department of Physics

Area of work: High Energy Physics, Physics of the Early Universe, Finite Temperature Quantum Field Theory.

Dr. Samar Jana

Associate Professor, Department of physics

Area of work : Rare earth doped efficient Optical Materials, Solid State Lighting Devices, LASER and Luminescent materials, Photoluminescence, Fluorescence, Solid State Spectroscopy.

Dr. Syed Minhaz Hossain

Associate professor, Department of Physics

Area of work : Low dimensional solid state physics, Photonics and Photovoltaics in nano scale, Electronic, optoelectronic and sensing applications of Nanostructured Silicon.

Dr. Dwipesh Majumder

Associate Professor, Department of Physics

Area of work : Strongly Correlated systems in condensed matter physics like Fractional Quantum Hall Effect, Superconductivity, Bose Einstein condensation in optical lattice

Expert Faculty Profiles in Physics

Dr. Mojammel Haque Mondal

Assistant Professor, Department of physics

Area of Work : Experimental Condensed Matter Physics, Thin films, Structural aspects of ultrathin polymer films using laboratory and syncrotrone sources

Dr. Abhijit Bisoi

Assistant Professor, Department of Physics

Area of work: Experimental Nuclear Physics, Nuclear Structure: Spectroscopic study of sd-pf shell nuclei.

Dr. Sourav Pramanik

Assistant professor, Department of Physics

Area of work: Theoretical Plasma Physics, Nonlinear wave dynamics in plasma, Wave breaking, Plasma electronics (plasma diodes and applications)

Dr. Abhijit Majumdar

Assistant Professor, Department of physics

Area of work : Plasma Surface Interaction: Thin film deposition , Plasma Bio-medical Application: Human Skin disease treatment, Spectroscopic study of polymer and metal composites, Dynamis of molecular dissociaation in ion impact collision

Dr. Manish Pal Chowdhury

Assistant Professor, Department of physics

Area of work: Carbon nanotubes, graphene, RGO, Nanomaterials, Sensors and detectors

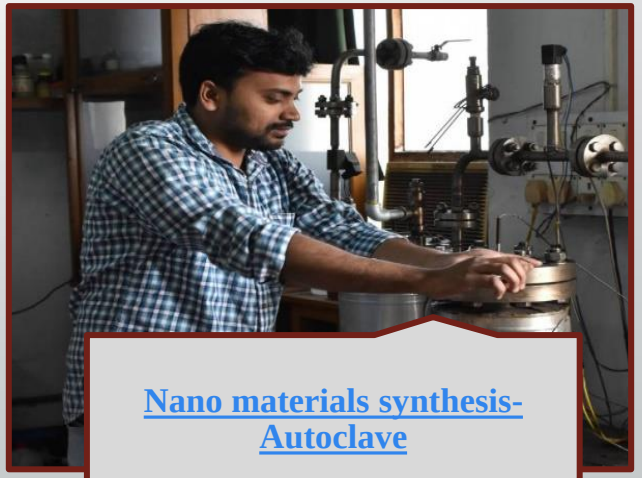
Emerging areas of research conducted in the Department of Physics

Experimental Condensed Matter Physics and Material Science

- ✓ Synthesis and characterisation of low-dimensional materials for various applications.
- ✓ Nanostructure materials like polymer nanocomposites, advanced functional materials, magnetic materials, and glass are prepared employing various routes.
- ✓ Some materials have applications in electromagnetic shielding and supercapacitors
- ✓ Photonics and photovoltaics in the nanoscale domain; nanostructured silicon for Photonics and photovoltaics in the nanoscale domain
- ✓ Synthesis and characterization of carbon nanotubes, graphene, etc, and their application towards photodetection and gas sensors
- ✓ Conducting polymer-based nanocomposites for green energy generation

Low Dimensional Solid State Physics Laboratory

Nano Materials Application Laboratory

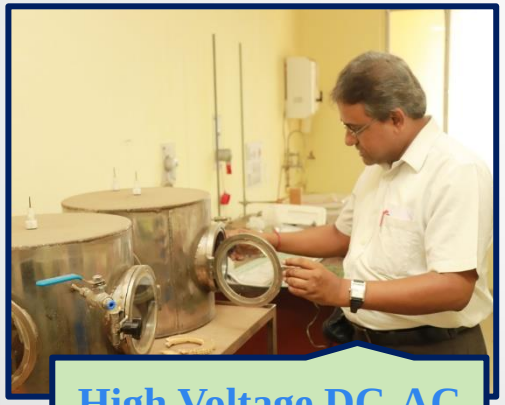


Nano materials synthesis- Autoclave

Emerging research areas

- ✓ plasma surface interaction and spectroscopic analysis of ternary carbide and nitride thin films deposited by the magnetron sputtering system
- ✓ Atmospheric pressure plasma application on human skin disease treatment
- ✓ Thin films, Structural aspects of ultrathin polymer films

Condensed Matter Physics Laboratory



High Voltage DC-AC Plasma

Dr. Syed Minhaz Hossain, Dr. Manish Pal Chowdhury, Dr. Abhijit Majumdar , Dr Mojammel Haque Mandal are actively working in this domain with their research groups. Many research scholars are working in these fields and many of them have been awarded.

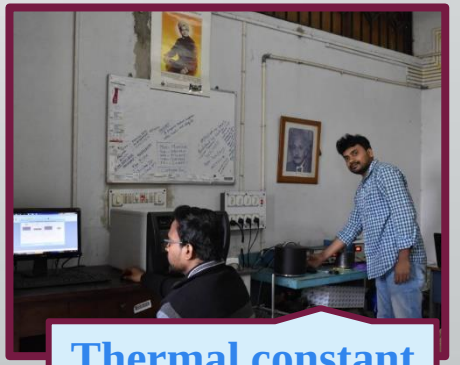
Vacuum Coating Unit

Wet Chemical Laboratory

Thermal constant analyser

Furnace Laboratory

I-V measurement setup



Thermal constant analyser

Emerging research areas

2. Theoretical Condensed Matter Physics

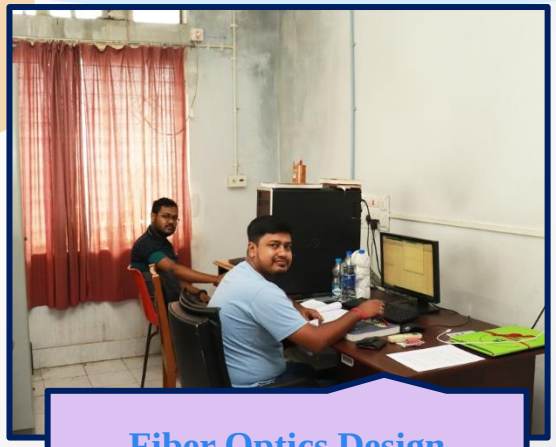
- ✓ Fractional Quantum Hall Effect, Superconductivity.
- ✓ Bose Einstein condensation in optical lattice
- ✓ The theoretical understanding of heat transport in solids

Dr. Dwipesh Majumdar & Dr. Krishnendu Mukherjee along with their students are actively working in this domain

3. Optics and Spectroscopy

- ✓ Photoluminescence, Fluorescence, Phosphorescence etc. in rare earth doped glasses and phosphors
- ✓ Design and Optimization of different single mode optical fibers and waveguides applicable for dispersion management.
- ✓ Studies on non-linear pulse propagation in optical fibers micro and nano dimensions / waveguides in the context of soliton generation, parabolic similariton generation, pulse compression, supercontinuum generation, nonlinear pulse reshaping, optical signal processing etc with an emphasis on semiconductor photonics.
- ✓ Nonlinear Silicon Photonics
- ✓ Spectroscopic characterization of Laser and Luminescent materials
- ✓ Development of rare earth optical materials for efficient Solid State Lighting device application

Prof. Mousumi Basu and Dr. Samar Jana are working in this area of research and a significant number of research scholars are working and many of them have been awarded their PhD degree.



Fiber Optics Design Laboratory

Optical and PieZoelectric Materials Laboratory with Ultrasonic Tester

CVD System

Uvis

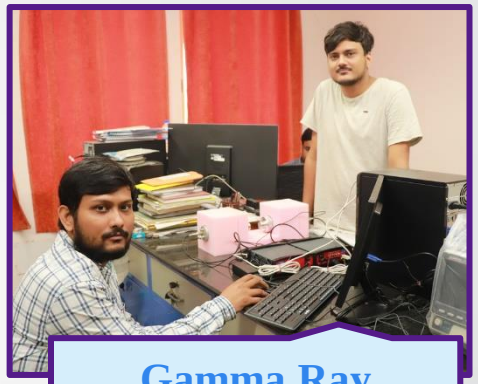
Emerging research areas

4. Nuclear Physics

Nuclear physics group mainly pursue their theoretical and experimental investigations in the field of nuclear structure and nuclear astrophysics. The experimental works have been carried out at different accelerator centres in collaboration with different institutes like, SINP, VECC, UGC-DAE-CSR-KOLKATA CENTRE, TIFR, BARC, IUAC etc. (INGA Collaboration). At present, five students are working in this research group for pursuing their PhD. Three students have already completed their PhD.

Dr. Abhijit Bisoi and Dr. Sangeeta Das are actively engaged in research in this group.

Advanced Nuclear Physics Laboratory



Gamma Ray detection system.

XRF Machine

Emerging research areas

5. High Energy and Particle Physics

- ✓ **Understanding the low energy dynamics of Non-Abelian Gauge Theory**

Dr. Krishnendu Mukherjee is working in this field along with his students.

6.Cosmology and Astrophysics:

- ✓ **Study of some aspects of the large scale structure formation in Universe using techniques of quantum field theory in out of equilibrium situation.**
- ✓ **calculations of one loop correction to cosmological correlation functions**
- ✓ **constructing model of inflation based on effective field theory approach.**

Dr. Amit Kundu and his students are working in this area of research.

7. Theoretical Plasma Physics

- ✓ **Nonlinear plasma waves and wave-instabilities**
- ✓ **Phase mixing and breaking of plasma waves**
- ✓ **Plasma diodes and its applicability in modern technology**

Dr. Sourav Pramanik is actively engaged in this research field.

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भारतीय अभियांत्रिकी विज्ञान एवं प्रौद्योगिकी संस्थान, शिवपुर

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