

SHIV NADAR

INSTITUTION OF EMINENCE DEEMED TO BE
UNIVERSITY
DELHI NCR

DEPARTMENT OF PHYSICS

SCHOOL OF NATURAL SCIENCES

GRADUATE PROSPECTUS

Ph.D. in Physics

Monsoon 2023

<https://physics.snu.edu.in>



Contents

Overview	3
Glimpse of the department and its activities in pics	4
Faculty	8
Physics Research Infrastructure	14
About Shiv Nadar Institution of Eminence (Deemed to be University)	14
Alumni and their current affiliation	15
Ph.D. Program in Physics	17
Contact Us	22

Overview

The physics department at Shiv Nadar Institution of Eminence (SNIOE) Delhi-NCR started its activity in 2011. The mission of the department is to conduct outstanding research with national and international recognition by promoting creativity, excellence, and collaboration. The department currently focuses in the following broad areas of research:

- Experimental and Theoretical Condensed Matter Physics and Materials Physics
- Experimental and Theoretical Soft Matter Physics
- Theoretical High Energy Physics
- Mathematical and Statistical Physics
- Cosmology and Astrophysics

Our graduate program is designed to serve a wide range of research interests and extends an excellent learning and research environment to motivated and ambitious students. The department offers a vibrant and rigorous graduate program drawing on its many strengths, such as:

- It encourages and facilitates interdisciplinary research activities.
- It provides the possibility of establishing international collaborations as many of the faculty members have worked in some of the leading international research institutes and actively collaborate with the leading scientists worldwide.
- The department encourages collaborative research with industry and some of the faculty members are exploring joint research programs with renowned technological companies.
- The department hosts regular seminars, conferences, and workshops.
- Advanced experimental and computational facilities

Glimpse of the department and its activities in pics



A and B blocks where Department of Physics Labs and offices are located



R block where many Physics experimental labs are located



Panel discussion with Nobel Prize winner Prof. Haroche and eminent scientists, coordinated by Dr. Subhra Sen Gupta



Talk by Prof. Rohini Godbole



Talk by Prof. Robert Bogdanowicz from Gdansk Uni. of Technology, Poland



Talk by Prof. Sandip Trivedi from TIFR Mumbai



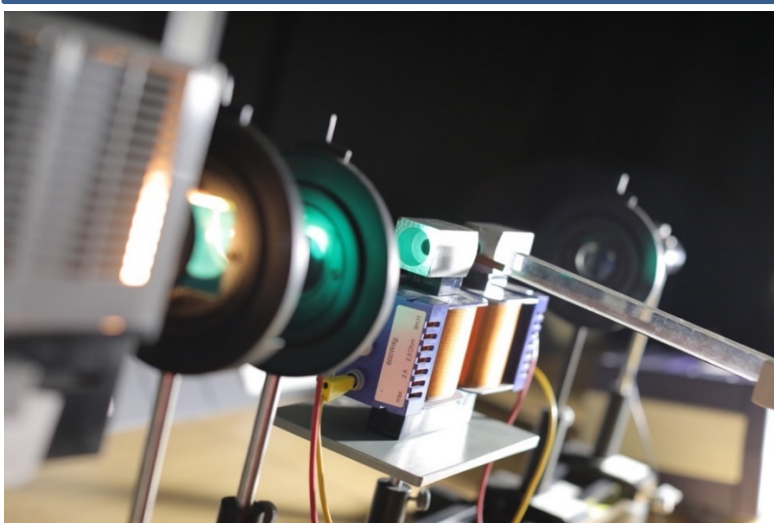
Workshop on Particle Physics, Astrophysics and Cosmology



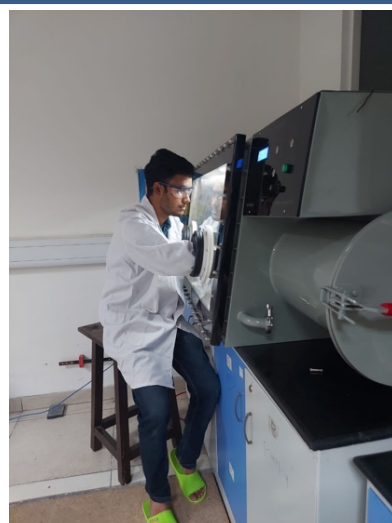
Talk at Workshop on Particle Physics, Astrophysics and Cosmology



Computational Lab



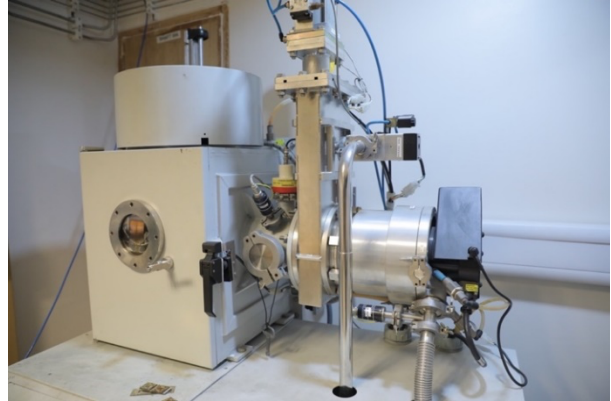
Advanced Physics Lab for UG students



Preparing samples in a glove box



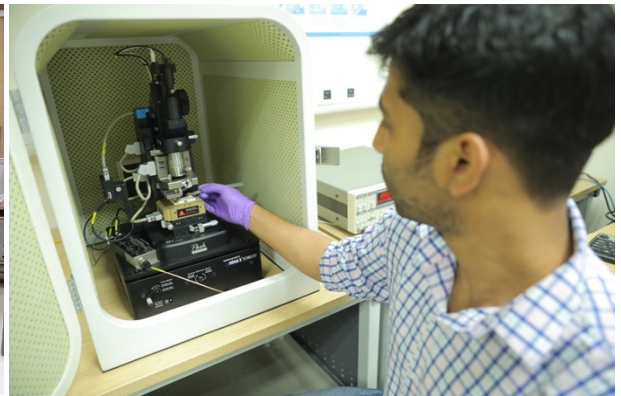
Wet Lab Fume Hoods for chemical work



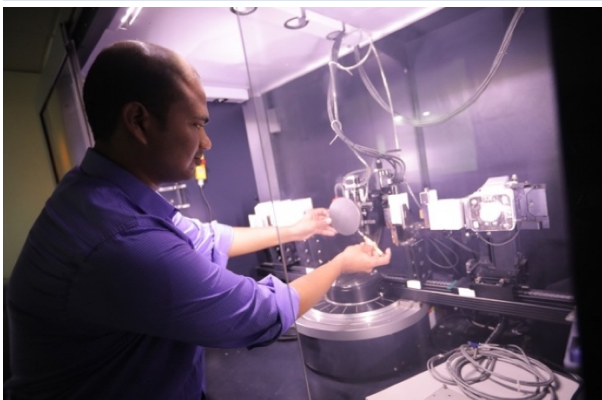
Thermal and e-Beam system for thin film deposition



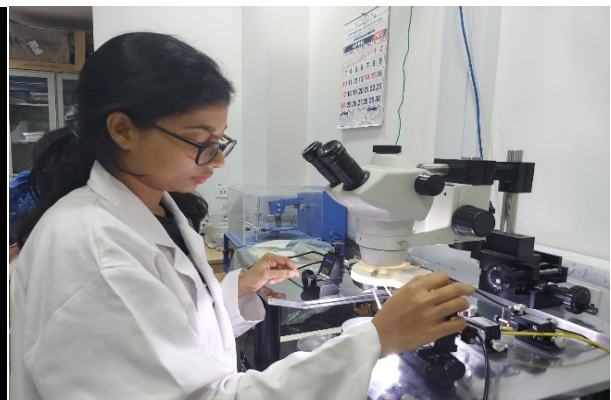
RF/DC Magnetron Sputtering system for thin film deposition



Scanning Probe Microscope



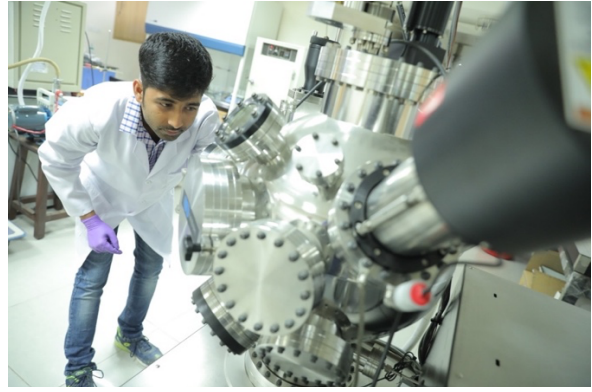
XRD for structural study



Probe Station for electrical measurement



Contact Angle Measurement system



PLD/PED for thin film deposition



SNIoE Library



Reading room of SNIoE Library



Hostel cluster and mess



Chess Park

Faculty

The SNU Physics Department comprises of faculty members who are equally passionate about their research and teaching. They are keen to bring the excitement of discovery to the classroom and in involving students in their research. Their research interests range from nanotechnology to the beginning of the universe. Many of them have worked at some of the leading international research and academic institutions and continue to be involved in collaborative research with these institutions.

Faculty Member	Qualifications	Areas of Research Interest
<p>Susanta Sinha Roy Professor and Head https://physics.snu.edu.in/people/faculty/dr-susanta-sinha-roy</p>	<p>Ph.D. from Jadavpur University</p>	<ul style="list-style-type: none"> • Thin Films and 2D Nanomaterials • Energy Storage and Sensing • Liquid Crystals • Microfluidics • Dielectric and Ferroelectric Materials
<p>Aloke Kanjilal Professor https://physics.snu.edu.in/people/faculty/dr-aloke-kanjilal</p>	<p>PhD. from Indian Institute of Technology (IIT) Delhi</p>	<ul style="list-style-type: none"> • Nonvolatile memory and artificial synaptic devices • Exotic properties at surfaces & interfaces • Hydrophobicity/hydrophilicity of patterned surfaces • Structural, chemical, electronic & transport properties of A15 & phase change material • Thin film growth of metals, transparent conducting oxides, nanocomposites, perovskites for

		<p>optoelectronic application</p> <ul style="list-style-type: none"> • Nanomaterials for photocatalytic, water splitting, and gas sensing applications • Materials under extreme environment • Defect engineering & radiation dosimetry
<p>Priya Johari Professor https://physics.snu.edu.in/people/faculty/dr-priya-johari</p>	<p>Ph.D. from Indian Institute of Technology Bombay (IITB)</p>	<ul style="list-style-type: none"> • Structural, Electronic, Optical, Mechanical, and Transport Properties • Inorganic, Organic, and Hybrid Crystals • Low-dimensional Materials • Batteries, Solar cells, Electronic and Bio-medical Devices • Interfaces/thin film Growth • Code development
<p>Samarendra Pratap Singh Professor https://physics.snu.edu.in/people/faculty/dr-samarendra-singh</p>	<p>Ph.D. from Indian Institute of Technology Kanpur (IITK)</p>	<ul style="list-style-type: none"> • Physics of Semiconductor Materials and Devices • Charge Transport and Photo-physics in Semiconductors • Organic Semiconductors and Device Applications • Photovoltaic devices, Field-effect Transistors, Light emitting devices • Applications: Biosensors,

		Neuromorphic Devices, LASERs, Printed and Flexible Electronics
Santosh Kumar Associate Professor https://physics.snu.edu.in/people/faculty/dr-santosh-kumar	Ph.D. from Jawaharlal Nehru University, New Delhi	<ul style="list-style-type: none"> • Random Matrix Theory and Its Applications • Statistical Physics of Complex Systems • Quantum Chaos • Mathematical Physics
Sajal Kumar Ghosh Associate Professor https://physics.snu.edu.in/people/faculty/dr-sajal-ghosh	Ph.D. from Raman Research Institute, Bangalore	<ul style="list-style-type: none"> • Viscoelasticity of complex fluids • Membrane biophysics • Surface wetting and dewetting • Physics of DNA macromolecules
Bhaskra Kaviraj Assistant Professor https://physics.snu.edu.in/people/faculty/dr-bhaskar-kaviraj	Ph.D. from Indian Institute of Technology Kharagpur (IITKGP)	<ul style="list-style-type: none"> • Two dimensional layered and non-layered materials • Spintronic nanodevices using materials with perpendicular magnetic anisotropy • 3. Exploring microstructural and electronic properties of nanomaterials for energy harvesting and sensing.
Subhra Sen Gupta Assistant Professor	Ph.D. from, Indian Institute of Science	<ul style="list-style-type: none"> • Electronic and Magnetic Phenomena in Condensed matter systems.

<p>https://physics.snu.edu.in/people/faculty/dr-subhra-sen-gupta</p>	<p>(IISc), Bangalore</p>	<ul style="list-style-type: none"> • Integrability and Quantum Chaos in Fermionic and Spin systems. • Applications of Random Matrix Theory to Disordered, Interacting Condensed Matter systems. • 4. Magnetic Phenomena in Compact Astrophysical Objects.
<p>Syed Mohammad Kamil Assistant Professor https://physics.snu.edu.in/people/faculty/dr-syed-kamil</p>	<p>Ph. D. from The Institute of Mathematical Sciences (IMSc), Chennai</p>	<ul style="list-style-type: none"> • Statistical Mechanics • Density functional theory • Soft Matter Theory • Mesoscopic simulation such as Dissipative Particle Dynamics(DPD)
<p>Kenji Nishiwaki Assistant Professor https://physics.snu.edu.in/people/faculty/dr-kenji-nishiwaki</p>	<p>Ph.D. from Kobe University, Kobe, Japan</p>	<ul style="list-style-type: none"> • Model building for physics beyond the Standard Model • Physics of dark matter, neutrinos, flavour and at colliders • Formulation of wave-packet quantum scattering • Applications of the gradient-flow method
<p>Arindam Chatterjee Assistant Professor https://physics.snu.edu.in/people/faculty/dr-arindam-chatterjee</p>	<p>Ph.D. from University of Bonn, Germany</p>	<ul style="list-style-type: none"> • Aspects of particle Dark Matter • Inflationary Cosmology and aftermath

		<ul style="list-style-type: none"> • Collider searches for BSM physics
<p>Mayukh Majumder Assistant Professor https://physics.snu.edu.in/people/faculty/dr-mayukh-majumder</p>	<p>Ph. D. from Saha Institute of Nuclear Physics, Kolkata</p>	<ul style="list-style-type: none"> • Topological quantum materials • Spin liquid • Frustrated magnetic systems • Ferromagnetic and antiferromagnetic quantum criticality
<p>Rana Nandi Assistant Professor https://physics.snu.edu.in/people/faculty/rana-nandi</p>	<p>Ph. D. from Saha Institute of Nuclear Physics, Kolkata</p>	<ul style="list-style-type: none"> • Physics of Neutron Stars and gravitational waves.
<p>Binson Babu Assistant Professor https://physics.snu.edu.in/people/faculty/dr-binson-babu</p>	<p>Ph.D. from Indian Institute of Science Education and Research – Thiruvananthapuram (IISR-TVM), Kerala</p>	<ul style="list-style-type: none"> • Nanomaterials for energy storage applications • Advanced electrolytes for energy storage applications • Rechargeable batteries (Metal (Li/Na/K)-ion batteries, Metal batteries, Solid-state batteries, Anode-free batteries, and Dual-ion batteries) • Hybrid-ion capacitor and Supercapacitor • Interfacial and bulk electrochemistry (In-situ/Operando/ex-situ studies)

		<ul style="list-style-type: none"> • Flexible and miniaturized energy storage devices
<p>Sucheta Mondal Assistant Professor https://physics.snu.edu.in/people/faculty/dr-sucheta-mondal</p>	<p>Ph. D. from S. N. Bose National Centre for Basic Sciences, Kolkata</p>	<ul style="list-style-type: none"> • Ultrafast magnetization dynamics • Spin-orbitronics • Straintronics • Magnonics • Graphene spintronics • Optical- and electrical switching of magnetic states • Designing of advanced spintronic devices • Magnetic data storage and recording applications
<p>Ipsita Mondal Assistant Professor https://physics.snu.edu.in/people/faculty/dr-ipsita-mandal</p>	<p>Ph. D. from Harish-Chandra Research Institute (HRI), Prayagraj</p>	<ul style="list-style-type: none"> • Unconventional superconductivity • Non-Fermi liquids (strange metals) • Semimetals • Layered heterostructures • Majorana quasiparticles • Non-Hermitian systems • Hydrodynamics of electron fluids.

The research interests of the faculty are summarized at <https://physics.snu.edu.in/research/areas-research>

Physics Research Infrastructure

Physics research Laboratories are equipped with basic research facilities, which include clean room, thermal deposition, chemical vapor deposition, pulsed electron deposition, magnetron sputtering, spin coater, ball-milling, vacuum annealing, high temperature oven, high temperature split tube furnaces, hydraulic press, glove box, microwave furnace, fume hoods, bio-safety cabinets, cryostat, XRD, AFM, Photo Luminescence, Raman Spectrometer, PPMS, Ellipsometry, FE-SEM, UV-visible-IR spectrophotometers, I-V measurement system, polarization loop-tracer, polarization microscope, fluorescence microscope, surface profiler, viscometer, thermal conductivity, contact angle, hydraulic manual coin cell Crimper, automatic battery film coating machine, electrochemical workstation and battery cycler, hydrothermal setup, and many others equipment within the school of natural science.

Computational facilities at SNS include a high performance AMD cluster consisting of 8064 cores (plus two nodes with GPU processors) delivering a theoretical peak performance of ~238 TF. Additionally, there are several stand-alone Linux workstations that are being used for teaching and research purpose. Several software for molecular modeling, molecular dynamics, quantum chemistry, statistic learning, bioinformatics and cheminformatics, are also available.

Our library, housed in a modern 5-storey building, provides online access from anywhere in the campus, to the e-books, electronic journals and databases from APS, AIP, ACS, RSC, AMS, SIAM, IOP, Springer, Elsevier, Wiley, Nature, and others.

About Shiv Nadar Institution of Eminence (Deemed to be University)

Shiv Nadar Institution of Eminence (SNIOE) is a comprehensive, multidisciplinary, research-focused and student-centric institution that is bringing a paradigm shift in higher education in India through its innovative curriculum,

Physics Graduate Prospectus

interdisciplinary focus, and cross-disciplinary thinking across a wide range of disciplines. The University is building an eco-system of knowledge to promote recognition of the inter-connectedness of ideas, systems, and environments in the world inside the campus, and those outside it. The University has 5 Schools, 23 Departments and 3 Research Centres engaged in teaching, practice, and research in disciplines as diverse as Engineering, Humanities & Social Sciences, Management, Natural Sciences, Academy of Continuing Education, Art, Design, Performing Arts, Communication, and Extended Education & Professional Development. The Schools offer Bachelor, Master’s, and Doctoral degrees along with multidisciplinary curriculum to enable students to explore subjects and disciplines that may be widely different from their chosen Majors.

- The University has recently been chosen as one of the select ten private “**Institutions of Eminence (IOE)**” by the Government of India.
- In the **NIRF** (Government's National Institutional Ranking Framework), SNU has been the youngest institution in the 'top 100' *Overall* list. SNU ranked 61 in the *University* category, and 94 '*Overall*' in NIRF 2022.
- The University has been accredited with ‘**A**’ **Grade** by the National Assessment and Accreditation Council (**NAAC**), valid for a period of 5 years from 26 November 2019.
- SNU is also among a select group of green-field institutions in the country, which were awarded the prestigious **Atal Incubation Center** grant by the Niti Aayog, Government of India, in the very first round in 2017.

Ph.D. Alumni and their current affiliation

Details of our graduated Ph.D. students and their current affiliation are given below.

Name	Year of Graduation	Current Affiliation	Current Designation
Arabinda Barman	2016	Dinhata College	Assistant Professor
Chetan Prakash Saini	2016	Jawaharlal Nehru University	Post doctoral researcher

Physics Graduate Prospectus

Shashi Shrivastava	2017	Henry Ford Health System	Research Scientist
Gourav Bhattacharya	2019	University of Ulster	Post doctoral researcher (Commonwealth Fellow)
Raja Sen	2020	Ecole Polytechnique	Postdoctoral Researcher
Sujit Deshmukh	2020	Brno university of technology	Marie-Courie Postdoctoral Fellow
Anurag Pritam	2021	AGH University of Science and Technology	Post Doctoral Researcher
Debosmita Banerjee	2021	University of Linkoping	Post Doctoral researcher
Priya Mandal	2021	University College London	Research Associate
Saheli Mitra	2021	Carnegie Mellon University	Post Doctoral Research Associate
Sangita Bhowmick	2021	Colorado State University	Postdoctoral Researcher
Dip Das	2022	Technion - Israel Institute of Technology	Postdoc Fellow
Dwaipayan Chakraborty	2022	Brown University, USA	Post-doctoral fellowship
Ritika Gupta	2022	University of Buffalo, NY, USA	Post-doctoral fellowship
Ayana Sarkar	2023	Institut Quantique of the Université de Sherbrooke (University of Sherbrooke)	Post-doctoral fellowship
Dhirendra Sahoo	2023	Prof. Mahiar hamedi Max, KTH, Royal Institute of technology	Post-doctoral fellowship
Ananya Chattaraj	2023	Indian Beamline, Photon factory, KEK Tsukuba	Post-doctoral fellowship

Ph.D. Program in Physics

The Department of Physics offers a comprehensive 5 years (Maximum) Ph.D. program in various streams of Physics. The broad areas of interest of our individual faculty have been listed earlier. Ph.D. students can also carry out their research in collaboration with faculty in other departments.

Research Advisor: Every new graduate student will be assigned a research advisor. This will be a faculty member whose research interests overlaps with that of the student. The advisor will help in initiating the student's research program.

Coursework: The aim of the coursework is to ensure that a graduate scholar has the required foundation for starting his/her research work. The coursework comprises of core, elective and research exploratory courses. Each scholar is expected to take a minimum of 12 credits per semester and teaching/research assistantship throughout the graduate program. A scholar is expected to complete five core and three elective courses according to his/her research interest during the first two semesters. The Physics Graduate Advisor will assist all the Ph.D. scholars in this process.

The Foundation				
Semester 1	PHY 506 Classical Mechanics Credit 1.5 (1.5:0:0)	PHY 507 Statistical Mechanics Credit 1.5 (1.5:0:0)	PHY 550 Condensed Matter Physics Credit 3 (3:0:0) OR PHY 560 High Energy Physics Credit 3 (3:0:0)	PHY 599 Explorations in Research Credit 3 (3:0:0)
	PHY 508 Quantum Mechanics Credit 1.5 (1.5:0:0)	PHY 509 Classical Electrodynamics Credit 1.5 (1.5:0:0)		
Semester 2	PHY 5XX* Physics Elective Credit 3 (3:0:0)	DTD 899: Ph.D. Thesis (9 credits)		
Research				
Semester 3	DTD 899: Ph.D. Thesis (12 credits)		Comprehensive Examination	
Semester 4	Advancement to Candidacy		DTD 899: Ph.D. Thesis (12 credits)	
Semester 5	DTD 899: Ph.D. Thesis (12 credits)			
Semester 6	DTD 899: Ph.D. Thesis (12 credits)			

Physics Graduate Prospectus

Semester 7	DTD 899: Ph.D. Thesis (12 credits)	Synopsis submission <i>(any time after 5th semester but within 10th semester)</i>	Thesis submission <i>(any time after 5th semester but within 10th semester)</i>
Semester 8	DTD 899: Ph.D. Thesis (12 credits)		
Semester 9	DTD 899: Ph.D. Thesis (12 credits)		
Semester 10	DTD 899: Ph.D. Thesis (12 credits)		
Doctoral Thesis Defense			
Minimum Credit Requirements: Course Work- 15 & Ph.D. Thesis - 45			

*may take non-departmental electives subject to the approval of both graduate student advisor and research advisor.

Graduate Core Courses

PHY 506: Classical Mechanics – 1.5 Credits: 3 Lectures/week
 PHY 507: Statistical Mechanics – 1.5 Credits: 3 Lectures/week
 PHY 508: Quantum Mechanics – 1.5 Credits: 3 Lectures/week
 PHY 509: Classical Electrodynamics -- 1.5 Credits: 3 Lectures/week
 PHY 599: Explorations in Research -- 3 Credits
 PTC 899: Practicum in Teaching
 DTD 899: Ph.D. Thesis

More Graduate Courses

PHY 550: Condensed Matter Physics -- 3 Credits: 3 Lectures/week
 PHY 551: Nanomaterials and Nanophysics -- 3 Credits: 3 Lectures/week
 PHY 553: Soft Matter Physics-- 3 Credits: 3 Lectures/week
 PHY 554: Advanced Statistical Physics -- 3 Credits: 3 Lectures/week
 PHY 556: Introduction to Quantum Field Theory -- 3 Credits: 3 Lectures/week
 PHY 558: Semiconductor Physics and Devices -- 3 Credits: 3 Lectures/week
 PHY 560: High Energy Physics -- 3 Credits: 3 Lectures/week
 PHY 561: Advanced High Energy Physics -- 3 Credits: 3 Lectures/week
 PHY 563: Computational and Numerical Analysis -- 3 Credits: 2 Lectures+1
 hour lab/week
 PHY 564: Advanced Simulation Techniques -- 3 Credits: 3 Lectures/week
 PHY 568: Multiferroics and Shape Memory Alloys -- 3 Credits: 2 Lectures+2
 hours lab./week
 PHY 570: Biosensors: General Principles and Advanced Sensing Techniques --
 3 Credits: 3 Lectures/week

PHY 573: Characterization of Materials -- 3 Credits: 2 Lectures/week + 2 hours lab/week

PHY 574: Characterization of Materials-I -- 3 Credits: 3 Lectures/week

PHY 575: Characterization of Materials-II -- 3 Credits: 3 Lectures/week

PHY 576: Electronic Transport in Mesoscopic Systems -- 3 Credits: 3 Lectures/week

PHY 578: Introduction to Thin Films -- 3 Credits: 3 Lectures/week

PHY 588: Fundamentals of Ion-Solid Interactions -- 3 Credits: 3 Lectures/week

PHY 589: Ion Beam Based Materials Characterization Techniques -- 3 Credits: 3 Lectures/week

Graduate Student Advisor of the Department of Physics: Dr. Priya Johari
priya.johari@snu.edu.in

Degree Requirements: To earn a Ph.D. degree in Physics the student must:

- Complete the required course-work.
- Pass the Comprehensive Examination, which consists of Qualifying Examinations and a Research Seminar, by the end of the 4th semester.
- Publish one research paper in a refereed journal before thesis submission.
- Submit and defend the doctoral thesis

Ph.D. Admission Process: All interested candidates should apply online at www.snu.edu.in. After online submission and payment of application fee, send demand draft for application fee (if online fee payment mode is not used) by speed post to the contact address given in 'Contact Us' section.

Eligibility:

- A candidate must have minimum 60% marks or equivalent grade point in 10th, 12th, B.Sc./B.Tech., and M.Sc./M.Tech.
- Applicants whose Master's results (final) are awaited can still apply if they secured at least 55% marks in their 1st year of Master's. However, those who are finally qualified must produce a proof of minimum of 60% marks or an equivalent grade point in M.Sc./M.Tech. before taking the admission in the Physics Ph.D. program.
- Applicant must have a degree in B.Sc. with a Physics major or a B.Tech. in Engineering Physics from a recognized technical institute*.

- Applicant should have a degree in M.Sc./M.Tech. in Physics, Material Science, Nanoscience, or Nanotechnology from a recognized technical institute or University.

*Master's degree is not mandatory for the applicants having a four year B.Tech. degree in Engineering Physics for taking admission in the Physics Ph.D. program.

Selection Process:

- Eligible candidates will be called for written test. The written test will be conducted in an online mode.
- Shortlisted candidates (based on written test cut-off) will be called for Interview. Interviews will be conducted at the Shiv Nadar IoE, Delhi NCR campus in Gautam Buddha Nagar District (near Greater Noida), U.P.
- While tentative dates are given below, any changes to the dates of the written test and interview will be communicated in due course.
- Candidates will be informed in advance about the platform for the online written exam.
- Syllabus: General Physics courses up to the level of M.Sc. (Classical Mechanics, Quantum Mechanics, Electrodynamics, Mathematical Physics, Condensed Matter Physics, Atomic and Molecular Physics, Nuclear and Particle Physics, Electronics, Thermal and Statistical Physics).
- Candidates with valid CSIR-NET-JRF fellowship will be exempted from the written test.

Fees and Financial Assistance:

All full-time Ph.D. students admitted into the program shall receive a doctoral award (teaching and research assistantship) consisting of full tuition-fee waiver (as per department's policy) and a monthly stipend of ₹40,000 for the first two years, and ₹45,000 for the next three years, subject to benchmarked performance. The continuation of the award is subject to satisfactory performance in the program evaluated continuously and compliance with all University regulations. Support will be available for deserving Ph.D. students to disseminate their work through conferences and publications. More details can be found at <https://snu.edu.in/admissions/graduate-programs>.

Application Fees:

You will be required to pay non-refundable application fees of **Rs. 1,200 (One Thousand Two Hundred Only)**. The application fee can be paid online during the application process.

Candidate may note that the University reserves the right to accept or reject any application based on its departmental screening criteria; hence, not all application may be shortlisted for written examination. Therefore, no requests for refund of the application fee shall be entertained whether or not the candidates are called for written examination.

Application Instructions:

All interested applicant shall apply online from the link given below or on the website. Please follow the instructions carefully.

- Fill all the mandatory fields
- **Online upload** of following document is required
 - Passport size color photograph
 - Current CV
 - All Mark sheets/Degree Certificates (10th Standard onwards)
 - Standardized Examination certificate- CSIR, UGC, GATE etc. (If applicable)
 - A Statement of Purpose

Please note that the application will not be considered without all the necessary prescribed documents and application fee.

Important Dates:

- Last date for the receipt of completed application form & application fee: **25th June 2023 (Sunday)**
- Written Tests (only for the candidates called for admission process): **3rd July 2023 (Monday)**
- Interview of the shortlisted candidates only (based on written test cut-off): **17th-18th July 2023**

Contact Us

For further details and clarifications, please write to one of the following:

Dr. Priya Johari
Graduate Advisor, Department of Physics,
School of Natural Sciences,
Email: priya.johari@snu.edu.in
Telephone: 0120-7170206

Ms. Henna Slathia
EA to the HOD Physics.
School of Natural Sciences,
Email: heena.slathia@snu.edu.in
Telephone: 0120-7170386 / +91
9569777783
