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Overview

The Department of Mathematics at SNU offers programs and courses that highlight the interdisciplinary and the multidisciplinary nature of the university. Its academic programs provide a solid base for careers in both academia and industry. There is a great demand for mathematicians in various sectors: investment banks, insurance companies, financial institutions, engineering consultancies, medical research, bioinformatics, software, computer security, and defense. Well trained students are also sought by universities all over the world for their research programs.

The following distinguishing features are common to all our programs:

- Accessibility to students from diverse backgrounds
- Melting of the artificial barriers between pure and applied mathematics and between mathematics and other disciplines.
- Exposure to leading mathematicians, scientists and thinkers from India and abroad.

The department offers the following degree programs at the graduate level:

- M.Sc. in Mathematics
- Ph.D. in Mathematics

The department has a close relationship with research centers at SNU; especially the Institute for Innovations and Inventions with Mathematics and IT (IIIMIT) and the Big Data Analytics Center (BDAC) which are currently headed by mathematics faculty. We have regular seminars, and have hosted national conferences and programs such as

- The Northern Regional Conference of the National Initiative in Mathematics Education (2011, co-hosted with Ambedkar University, Delhi).
- The Annual Foundation School for PhD students (2015, sponsored by the National Centre for Mathematics).
- The Advanced Instructional School in Operator Theory (2016, sponsored by the National Centre for Mathematics).

Research is further supported by facilities such as individual laptops/desktops for faculty, a 30-PC computer lab with Mathematica and Matlab, a generous library budget for books, and subscriptions to diverse journals. In 2015, we were awarded a five-year grant under the DST-FIST scheme for developing a Research Computer Lab and a Department Library. The department has institutional membership in the American Mathematical Society (AMS) and the Society for Industrial and Applied Mathematics (SIAM), the two leading societies for pure and applied mathematics.
All graduate programs at SNU are managed and coordinated by the office of the **Dean of Research and Graduate Studies**. The overall goals of graduate study at SNU are:

1. Provide scholars with a discovery-driven intellectual environment
2. Develop scholars for leadership positions in academic and research focused organizations
3. Encourage the development of interdisciplinary research orientation focused on tackling intellectually and socially relevant problems
4. Train scholars in academic and research publishing processes
5. Hone scholars’ teaching abilities

The SNU Graduate Prospectus ([www.snu.edu.in/pdf/SNU_GraduateProspectus.pdf](http://www.snu.edu.in/pdf/SNU_GraduateProspectus.pdf)) contains an overview of the graduate programs of the university and the rules governing them.
Faculty

The members of the faculty of mathematics at SNU have studied or worked at leading institutions. Their mathematical interests vary across areas such as functional and harmonic analysis, representation theory, differential geometry, number theory, encryption, game theory, graph theory, category theory, differential equations, signal processing, computational methods, statistics, mathematical finance, mathematical biology, and medical imaging.

<table>
<thead>
<tr>
<th>Faculty Member</th>
<th>Qualifications</th>
<th>Areas of Interest</th>
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<tbody>
<tr>
<td><strong>Sanjeev Agrawal</strong></td>
<td>PhD Delhi, MA Oxford</td>
<td>Functional Analysis, Operator Theory, Error Correcting Codes, Encryption</td>
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<tr>
<td>Professor; Undergraduate Advisor</td>
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<tr>
<td><strong>Sudeepo Bhattacharya</strong></td>
<td>PhD Nagpur, MSc Nagpur</td>
<td>Complexity, Game theory, Network Theory, Mathematical Modeling</td>
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<tr>
<td>Associate Professor</td>
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<tr>
<td><strong>Samit Bhattacharyya</strong></td>
<td>PhD Calcutta, MSc Calcutta</td>
<td>Applied Mathematics and Computational Biology</td>
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<tr>
<td>Assistant Professor</td>
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<tr>
<td><strong>Debashish Bose</strong></td>
<td>PhD IIT Kanpur, MSc IIT Kanpur</td>
<td>Harmonic Analysis, Number Theory, Combinatorics, Percolation</td>
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<tr>
<td>Assistant Professor</td>
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<tr>
<td><strong>Suma Ghosh</strong></td>
<td>PhD Calcutta, MSc Burdwan</td>
<td>Mathematical Biology, Nonlinear Dynamics, Optimal Control Theory</td>
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<tr>
<td>Assistant Professor</td>
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<tr>
<td><strong>Priyanka Grover</strong></td>
<td>PhD ISI Delhi, MSc University Delhi</td>
<td>Matrix Analysis, Operator Theory</td>
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<tr>
<td>Assistant Professor, DST-Inspire Fellow</td>
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<tr>
<td><strong>Neha Gupta</strong></td>
<td>PhD Warwick, MSc Warwick</td>
<td>Quantum Groups, Category Theory</td>
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<tr>
<td>Assistant Professor</td>
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<tr>
<td><strong>Amber Habib</strong></td>
<td>PhD Berkeley, MS (Int) IIT Kanpur</td>
<td>Representation Theory, Mathematical Finance</td>
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<tr>
<td>Professor &amp; Head</td>
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<tr>
<td><strong>R Krishnan</strong></td>
<td>PhD IMSc, MS (Int) IIT Kanpur</td>
<td>Analytic and Transcendental Number Theory</td>
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<tr>
<td>Assistant Professor</td>
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<tr>
<td><strong>Ajit Kumar</strong></td>
<td>PhD Houston, MS Houston</td>
<td>Partial Differential Equations, Finite Element Method</td>
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<tr>
<td>Assistant Professor</td>
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<tr>
<td><strong>Pradip Kumar</strong></td>
<td>PhD HRI, MSc IIT Kanpur</td>
<td>Symplectic Geometry, Global Analysis</td>
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<td>Assistant Professor</td>
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<tr>
<td><strong>Sneh Lata</strong></td>
<td>PhD Houston, MS Houston</td>
<td>Frame theory, Operator Theory and Function Theory</td>
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<tr>
<td>Assistant Professor; Graduate Advisor</td>
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<tr>
<td><strong>A Satyanarayana Reddy</strong></td>
<td>PhD IIT Kanpur, MSc Andhra University</td>
<td>Algebraic Graph Theory, Discrete Mathematics, Algebraic Number Theory</td>
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<tr>
<td>Assistant Professor</td>
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<tr>
<td><strong>Niteesh Sahni</strong></td>
<td>PhD Delhi, MSc Delhi</td>
<td>Functional Analysis, Operator Theory, Dynamical Systems</td>
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<tr>
<td>Assistant Professor</td>
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<tr>
<td><strong>Charu Sharma</strong></td>
<td>MS Houston</td>
<td>Bioinformatics, Computational Finance</td>
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<tr>
<td>Assistant Professor</td>
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<tr>
<td><strong>Santosh Singh</strong></td>
<td>PhD IIT Kanpur, MA Agra University</td>
<td>Medical image analysis, Image reconstruction, Computational photography, Light field and Optimization techniques</td>
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</table>
Some major journals in which our faculty members have published:

- Proceedings of the American Mathematical Society
- Proceedings of the National Academy of Sciences, USA
- Studia Mathematica
- Journal of Functional Analysis
- Linear Algebra and its Applications
- Forum Mathematicum
- Journal of Number Theory
- Indiana University Mathematics Journal
- Journal of Theoretical Biology
- Bulletin of Mathematical Biology
- Stochastic Analysis and Applications
- Proceedings of the Indian Academy of Sciences

M.Sc. in Mathematics

Our two-year M.Sc. program epitomizes SNU's development of innovative offerings that open new avenues for students. Our students acquire the training, the exposure, and the creative thinking needed to develop new mathematics and to take on challenges such as detecting cancer, managing financial risk, modeling complex systems, etc. At the same time our students are well exposed to the rigour of mathematics. The M.Sc. degree can be used to provide the base for a Ph.D. in mathematics and its applications, or a career in industry.

- **Duration:** Four semesters, extendable by two semesters.
- **Eligibility:** A B.A./B.Sc./B.S./B.Tech. Degree in Mathematics/Physics/Science/Engineering or similar disciplines with overall marks of at least 50% (or equivalent grade). Final year students can apply on the basis of their earlier marks. Please write to us in case you have a different background or are uncertain about your eligibility for any reason. (Contact details are given at the end of this prospectus)
- **Admission:** Admission is through a written test and interview. The syllabus for the written test is described in the Admission Process section.
- **Core courses:** These include the standard graduate level courses in Algebra, Analysis, Differential Equations, Statistics, etc.
- **Electives:** The department offers a wide range of elective courses such as – Cryptography, Error Correcting Codes, Functional Analysis, Graph Theory, Number Theory, Differential Geometry, Dynamical Systems, Numerical Differential Equations, Optimization, Computational Economics, Formal Languages and Automata Theory, etc.
- **Project:** The second year includes a two-semester Project that can take various forms – such as a reading seminar in a special topic, or participation in a multi-disciplinary team working on an application of mathematics.
- **Degree Requirements:** The student must
1. Complete 16 graduate courses of level 600 and above, totaling a minimum of 64 credits. Up to two of these courses may be replaced by level 500 courses, or by courses from other departments. All exceptions require the prior approval of the Graduate Advisor.

2. Maintain a CGPA of 5.0 (i.e. an average grade of C-). A student who does not have a CGPA of at least 5.0 at the start of the 3rd semester will be asked to leave the program.

- **Integration with Ph.D.:** M.Sc. Mathematics graduates from SNU who take admission in our Ph.D. program can have a reduced amount of course-work, thus creating the opportunity to finish their Ph.D. earlier.

- **Fees and Financial Aid:** All students of M.Sc. Mathematics receive financial aid in the form of a teaching assistantship. Continuation of the assistantship is contingent on satisfactory performance in the program evaluated continuously, and compliance with all University regulations. Further, it is only offered for the regular duration of the M.Sc. program (i.e. four semesters). Please visit the SNU website for details of fees and the teaching assistantship.

**Ph.D. in Mathematics**

The faculty members of the Department of Mathematics at SNU have research interests over wide areas of pure and applied mathematics. The broad areas of interest of our individual faculty have been listed earlier. Some sample areas where we are particularly interested in recruiting research students are:

- Harmonic Analysis and its connections with Number Theory, Combinatorics and Probability
- Functional Analysis: Hardy spaces with application to interpolation and Geo-Physics, Orthogonality in normed linear spaces
- Matrix Analysis
- Differential Geometry, specifically Symplectic and Complex Geometry
- Mathematical Biology: Ecological modelling, Infectious disease modelling
- Game Theory: Evolution of Cooperation, Finite Automata, applications in Infectious Disease Modeling
- Network Theory and its applications in Ecology, Archaeology
- Linear Algebra and applications to Graph Theory
- Category Theory and Quantum Groups
- Computational Mechanics: computer-based modeling of phenomena with PDEs
- Computer vision, medical imaging and machine learning

Ph.D. students can also carry out their research in collaboration with faculty in other departments or research centres such as IIIMIT, BDAC and the Centre for Informatics.

The detailed SNU Ph.D. Regulations can be obtained from the webpage [www.snu.edu.in/admission/postgraduate.aspx](http://www.snu.edu.in/admission/postgraduate.aspx). A summary of the Mathematics Ph.D. program is given below:
- **Duration**: Six to ten semesters.
- **Admission**: Admission is through a written test and interview. The written test is described in the Admission Process section.
- **Course-Work**: The student must register for the following, in consultation with the Graduate Advisor:
  - Three courses of 4 credits each in the first semester.
  - Research Methodology course spanning the first two semesters.
  - Coursework in the second semester will depend on performance in the first semester.
  - Continuation of fellowship requires a minimum GPA of 7.0 from the best 12 credits in the first year.
- **Degree Requirements**: To earn a Ph.D. degree 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.
- **Eligibility**: A Master's Degree in Mathematics or related disciplines with overall marks of at least 60% (or equivalent grade). Please enquire in case you are uncertain about your eligibility for any reason. Candidates who have qualified for CSIR-UGC NET-JRF, GATE-JRF, JEST or NBHM Fellowship are preferred.
- **Fees and Financial Aid**: All students admitted to our Ph.D. program receive a Research/Teaching Assistantship as well as significant Tuition and Hostel Fee waivers. Please consult the SNU website for details.

Continuation of the assistantship is contingent on satisfactory performance in the program evaluated continuously, and compliance with all University regulations. Further, the scholarship is only offered for the regular duration of the Ph.D. program (i.e. eight semesters).

**Admission Process**

All interested candidates should apply online at [www.snu.edu.in](http://www.snu.edu.in). After online submission and payment of application fee, print the completed form and send by speed post to the University at the following address:

**EA to the Head**  
Department of Mathematics  
School of Natural Sciences  
Shiv Nadar University P.O.  
NH-91, Teshil Dadri  
District Gautam Buddha Nagar, UP 201314, India.
The printed form should be accompanied by the following documents:

- At least one sealed reference letter in support of the application
- Demand Draft for application fee (If online fee payment mode is not used)

Admissions to both M.Sc. and Ph.D. are by a written test and interview conducted at SNU. The key dates for both M.Sc. and Ph.D. admissions are:

<table>
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<tr>
<th>Last date for receipt of application form by SNU:</th>
<th>Announcement of shortlist for written test and interview:</th>
<th>Written test and interview:</th>
<th>Monsoon Semester begins:</th>
</tr>
</thead>
</table>

The written tests are described below.

**Written Test for Admission to M.Sc.**

The written test will consist of both multiple-choice and descriptive questions. There will be an element of choice available. The questions will range over the following topics:

**Real analysis:** Elementary set theory, real number system, sequences and series, monotone sequences, convergence, Cauchy sequences and completeness, Bolzano-Weierstrass theorem, continuity, uniform continuity, differentiability, Taylor expansions, mean value theorems, sequences and series of functions, uniform convergence, power series, Riemann integration, and Fundamental theorem of Calculus.

**Linear algebra:** Vector spaces, subspaces, basis, dimension, direct sum, matrices, determinants, linear transformations, rank, nullity, systems of linear equations, eigenvalues and eigenvectors.

**Algebra:** Groups, Lagrange’s theorem, normal subgroups, cyclic groups, homomorphism and isomorphism of groups.

**Ordinary differential equations:** General and particular solutions of a differential equation, formation of differential equations, first order first degree differential equations and their classification, separation of variables, integrating factors and linear equations.

**Probability and Statistics:** Permutations and combinations, principle of inclusion and exclusion, mathematical induction, combinatorial probability, independent events, total probability, conditional probability, Bayes’ theorem, binomial, Poisson, normal distributions, mean and variance, Chebyshev’s inequality, Stirling’s approximation, joint distribution, laws of large numbers, central limit theorem.
Written Test for Admission to PhD

The written test will be in two parts, consisting of multiple-choice and descriptive questions respectively.

The multiple-choice portion will contain Masters level questions from the fundamental areas of Linear Algebra, Algebra, Real Analysis, Metric Spaces, Complex Analysis, Numerical Analysis, Ordinary Differential Equations, Combinatorics, and Probability.

The descriptive questions will be selected from the above as well as specialized topics such as Functional Analysis, Harmonic Analysis, Differential Geometry, Partial Differential Equations, Number Theory, and Graph Theory. As these may not have been studied by all students, the applicant will be allowed to choose between questions.

Contact Us

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

Prof Amber Habib  Prof Sneh Lata
Head  Graduate Advisor
Department of Mathematics  Department of Mathematics
amber.habib@snu.edu.in  sneh.lata@snu.edu.in

The SNU website is www.snu.edu.in.