



## Information and Announcements

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### Pursuing Mathematics in India

Most of our bright students after secondary education opt for either engineering or medical education. Sometimes this is because of their and their parents' lack of knowledge about opportunities available in basic sciences. The current article lists many options available to pursue mathematics and related fields.

The scope of science in the modern world is enormous. Teaching science and doing scientific research can be a rewarding career. In particular learning mathematics teaches one to think logically and analytically. Because of this, there is a lot of demand for qualified mathematicians (with a BSc or higher degree) from various scientific institutions, industries, and business and commercial organisations.

We list a few centers of excellence for studying mathematics beyond secondary school. The information about these institutions has been gathered from their web-pages and other publicly available sources. We apologize if there are any factual errors. Web links are given for further information. There are also some universities and engineering colleges with good mathematics departments. We begin with institutions which have courses where one can join after secondary education (10+2). They all have courses at masters and research levels also.

#### **Institutes**

##### ***Indian Statistical Institute (ISI)***

It is a unique institution devoted to the research, teaching and application of statistics, and probability to natural sciences and social sciences. Founded by Professor P C Mahalanobis in Kolkata in the early 1930's, the Institute gained the status of an Institution of National Importance by an act of the Indian Parliament in 1959.

The headquarters of ISI is located in Kolkata. Additionally, there are four centres located in Delhi, Bangalore, Chennai and Tezpur (Assam). Research in Statistics, Probability, Mathematics in general and related disciplines is the primary activity of the Institute. Teaching activities are undertaken mainly in Kolkata, Delhi and Bangalore.

The ISI has been running Bachelor of Statistics (Honours), known as BStat since 1960's. It is a



well-known course. ISI, Bangalore started Bachelor of Mathematics(Honours), known as BMath in 2000.

The Indian Statistical Institute selects only a small number of students after a thorough national level written test conducted at various centers all over India, followed by an interview. For the selected students there is no tuition fee. Instead ISI gives them stipends, hostel accommodation, good library and all other facilities. And there is excellent faculty to teach. These students are taught basic courses in mathematics, probability theory, statistics, and also some aspects of computer science and physics. ISI gets exceptionally bright students and the courses have excellent track records. For example, some of the students have secured direct admissions to PhD programmes of top level universities in USA, UK, and Europe.

The ISI also offers Masters and PhD programs in Mathematics, Statistics and many other fields. All admissions are through written tests and interviews.

Details can be found at: <http://www.isical.ac.in/~deanweb/>; <http://www.isibang.ac.in/~statmath/>

### ***Chennai Mathematical Institute***

Chennai Mathematical Institute is a centre of excellence for teaching and research in the mathematical sciences. It was founded in 1989 as a part of the SPIC Science Foundation, funded by the SPIC group in Chennai. Since 1996, it has been an autonomous institution. Today, CMI is a rare example of public-private partnership in research and education in India. The Institute receives major private funding, side by side with substantial financial support from the Government of India.

The main areas of research at CMI are Mathematics, Computer Science and Physics. In addition to a vibrant PhD programme, the Institute conducts BSc programmes in Mathematics and Computer Science as well as Physics, along with MSc programmes in Mathematics and Computer Science. These teaching programmes are run in cooperation with the Institute of Mathematical Sciences (IMSc), Chennai. Since CMI has been recognized as a deemed university, it now awards degrees directly.

For details see: <http://www.cmi.ac.in/>

### ***Indian Institute of Science (IISc)***

The Indian Institute of Science (IISc), a leading institution of higher learning in many areas of science and engineering with a strong tradition of research for over a century, has opened its portals to undergraduate students by introducing a four-year Bachelor of Science (BS) Programme in 2011. The programme is designed as a blend of core science and interdisciplinary topics that will serve as a launching pad for attractive career opportunities in academia and industry.



The novelty of this programme lies in its interdisciplinary approach, strong flavour of engineering, exposure to disciplines in the humanities and social sciences, and a year-long research project. The graduates of this programme will obtain a Bachelor of Science (BS) degree with specialization in a particular discipline. Students specializing in a particular discipline will be encouraged to take courses in other disciplines, thus maintaining the strong interdisciplinary flavour of the programme.

This programme is embedded in a mature and highly sophisticated research culture which has an equally strong base in science and engineering. This research culture has evolved over the last hundred years, primarily engendered by a highly distinguished faculty and brilliant graduate students and post-doctoral fellows. The Institute has grown in an open and free academic environment where dedicated teaching, state-of-the-art laboratories, fast information networks and well-stocked libraries have come into being, aided by a flexible and enabling mode of administrative functioning. We believe that this unique academic environment is well positioned to impart high-quality training to inquisitive young minds.

Here all students take core courses in Physics, Mathematics, Chemistry, Biology, Engineering, Biology and Humanities in the first one and a half years, while specialization is introduced in later years. The students do a research project in the final two years of the course. IISc campus provides a unique vibrant academic environment for students.

For details see: <http://www.iisc.ernet.in/>

### ***Indian Institutes of Science Education and Research (IISER)***

The Government of India, through the Ministry of Human Resource Development (MHRD), has established five Indian Institutes of Science Education and Research (IISER). These institutes are located in Bhopal, Mohali, Pune, Kolkata and Thiruvananthapuram.

The IISERs represent a unique initiative in India where teaching and education are totally integrated with state-of-the-art research, nurturing both curiosity and creativity in an intellectually vibrant atmosphere of research. Each IISER is an autonomous institution awarding its own degrees. They offer integrated BS-MS and Phd programs. Here is the course pattern as given by IISER Pune: In BS-MS dual degree program, the courses offered during the first two years (semesters I to IV) of course work are meant as basic courses common and mandatory for all students and therefore are introductory in nature. But these courses are meant to give a flavor of the various approaches and analyses as well as to prepare them for advanced courses in later years of study. In the third and fourth years (semesters V–VIII), students can choose advanced courses based on their interest. The courses offered in the first two years would help them to make an informed judgment to determine their real interest and their aptitude for a given subject. Students also have the freedom to choose advanced courses from more than one discipline to achieve interdisciplinary expertise. The fifth



year will be devoted to a thesis by research which completes the requirements of the program. The admissions to BS-MS programs are after 12th and are currently through three different channels. They are Kishore Vaigyanik Protsahan Yojana (KVPY) scheme, IIT-JEE ranks and top grades in central or state boards. There are separate deadlines for applications under different channels.

See the following links and web pages of different IISERs for further information:

<http://www.iiser-admissions.in/index.php>;

[http://en.wikipedia.org/wiki/Indian\\_Institutes\\_of\\_Science\\_Education\\_and\\_Research](http://en.wikipedia.org/wiki/Indian_Institutes_of_Science_Education_and_Research)

### ***National Institute of Science Education and Research (NISER)***

This institute is recognized as a Centre of Excellence in science education and research in four basic sciences (Biology, Chemistry, Mathematics and Physics) and in related areas. The aim of this special institute is to nurture world class scientists for the country who will take up challenging research and teaching assignments in universities, R & D laboratories and various industries. NISER conducts the following programmes in science education for bright and meritorious students selected on all-India basis:

- (i) An integrated 5-year MSc programme in the core and emerging branches of Basic Sciences to students after their 10+2 Higher Secondary schooling. This in turn will be integrated with PhD programme on the one hand and employment in various R & D organizations and industry in the country on the other.
- (ii) Integrated MSc + PhD programme after BSc from other universities.
- (iii) PhD programme after MSc from other universities.

Currently students seeking admission to integrated MSc program of NISER will have to appear for National Entrance Screening Test (NEST) conducted jointly by NISER and University of Mumbai, Dept. of Atomic Science-Center for Basic Sciences.

For details check out: <http://www.niser.ac.in/>

### ***Tata Institute for Fundamental Research (TIFR)***

The Tata Institute of Fundamental Research is a National Center of the Government of India, under the umbrella of the Department of Atomic Energy, as well as a deemed university awarding degrees for master's and doctoral programs. TIFR carries out research in physics, chemistry, biology, mathematics, computer science and science education. The main campus is located in Mumbai, with additional campuses in Pune, Bangalore and Hyderabad.

Bright young students aspiring for a career of research in mathematics are invited to apply for Research Scholarships in the School of Mathematics of the Institute. With its distinguished faculty engaged in high quality research in a broad spectrum of areas, the School provides a stimulating



environment for pursuing doctoral studies. TIFR Bangalore is its Centre for Applicable Mathematics (TIFR-CAM).

For details see: <http://www.math.tifr.res.in/>; <http://math.tifrbng.res.in/>

### ***The Institute of Mathematical Sciences (IMSc)***

Founded in 1962 and based in the verdant surroundings of the CIT campus in Chennai, IMSc is a national institution which promotes fundamental research in frontier disciplines of the mathematical and physical sciences: Theoretical Computer Science, Mathematics, Theoretical Physics, as well as in many interdisciplinary fields. Around a hundred researchers, including faculty members, post-doctoral fellows and graduate students, are members of the Institute at any given time, in addition to a large number of visitors from all over the world. IMSc offers PhD and integrated PhD programmes in Mathematics.

Typically admissions to PhD are after MSc degree and for integrated PhD programme after BSc degree and initial screening is through a test conducted by the National Board for Higher Mathematics (NBHM). Exceptions are made under special cases.

For details see: <http://www.imsc.res.in/>

### ***Harish-Chandra Research Institute (HRI)***

This is an institution named after the great Indian mathematician Harish Chandra, who was a member of the Institute of Advanced Studies, Princeton (USA). It is dedicated to research in mathematics and in theoretical physics. It is located in Allahabad and is funded by the Department of Atomic Energy.

The Institute has a graduate programme leading to the PhD degree. Degrees for the programme are awarded by the Homi Bhabha National Institute. Admissions to the graduate program take place through a Joint Entrance Screening Test, which is organized in collaboration with several other institutions, and an interview. Further, the Institute offers post-doctoral fellowships, and visiting positions at various levels.

Admission conditions and procedures of HRI is similar to that of IMSc.

For details see: <http://www.hri.res.in/>

### **Fellowships and Training Programs**

One may also note that the cost involved in admission fees, tuition fees, etc., are quite low for courses in mathematics and other basic sciences. In addition, there is plenty of encouragement and financial support from the government.



**Mathematics Olympiad:** If a student in secondary school is especially interested in mathematics, he or she should consider appearing for the Mathematics Olympiad. In India it is conducted under the aegis of the National Board for Higher Mathematics and Homi-Bhabha Center for Science Education. This is the only mathematics olympiad recognised by the Government of India. The regional level tests are usually held in December at various centers all over India. Bright high-school students can also apply. Admission charges are nominal and selected students have the opportunity to compete at national and international level. The students who do well at national level are given scholarships for further study and also are given preference in admissions to some institutions.

For further information check out: <http://olympiads.hbcse.tifr.res.in/> and <http://www.isibang.ac.in/~statmath/olym.html> .

Students who have done well in the Olympiad and have continued in mathematics have usually done brilliantly in research. The Mathematics Olympiad involves solving really challenging problems in limited time, competing with other teams. However, mathematics research is a different ball game. Here you are not constrained by time and you are more interested in investigating depths of existing knowledge of mathematics and advancing the theory further rather than solving some stray problems. We are writing this to say that students who fail to do well in Mathematics Olympiad have no reason to get disheartened and to think that they are not good enough to do mathematics. That is not the case. Those who love mathematics should try getting into a good course in Mathematics irrespective of their performance in the Olympiad.

**KVPY and INSPIRE:** Students should also explore the Kishore Vaigyanik Protsahan Yojana (KVPY) and the INSPIRE programme to obtain fellowships. These are especially important while seeking admission to IISERs.

Details of these schemes can be found at <http://www.kvpy.org.in/main/> and <http://www.inspire-dst.gov.in/inspire.html> respectively.

**NBHM & CSIR:** At research levels, funding can be obtained from the Institutes listed above and also from the National Board for Higher Mathematics (NBHM), Council for Science and Industrial Research (CSIR), and the Department of Science and Technology (DST):

<http://www.nbhm.dae.gov.in/> ;

<http://csirhrdg.res.in/> ;

<http://www.dst.gov.in/scientific-programme/ser-index.htm> .

**Mathematics Training and Talent Search Program (MTTS):** These training programs are meant for students who are already learning mathematics, at least at second year undergraduate level. Mathematics teachers and researchers are also eligible. Main aims as per the organisers are: 1) To teach mathematics in an interactive way rather than the usual passive presentation. To promote



active learning, the teachers usually ask questions and try to develop the theory based on the answers and typical examples. At every level the participants are encouraged to explore, guess and formulate definitions and results. 2) To promote independent thinking in mathematics. 3) To provide a platform for the talented students so that they can interact with their peers and experts in the field. This serves two purposes: i) the participants come to know where they stand academically and what they have to do to bring out their full potential and ii) they establish a rapport with other participants and teachers which helps them shape their career in mathematics.

For details on venues, dates and other information please look into: <http://www.mts.org.in/>

**Advanced Training in Mathematics (ATM) Schools:** Under this scheme, various workshops and training programs are conducted for mathematics researchers and teachers. Currently this is being organised by the National Center for Mathematics, a joint center of IIT Bombay and TIFR. A large number of schools (workshops) are held, at different centers, all over India in various specialized fields of mathematics. There are four types of schools; these are listed below with main target audience in brackets:

- (i) Annual foundation schools I, II and III (I Year PhD students)
- (ii) Advanced instructional schools (II–V year PhD students)
- (iii) Workshop and conference (researchers) (iv) ATM school for lecturers (college and university lecturers).

Typically local hospitality and travel support is provided to selected candidates.

For further information please see: <http://www.atmschools.org/>

**Summer Fellowships:** Finally we note that, it might be possible to make short term academic visits to some of the Institutes listed above. Some of them do provide funding for short term visits. Summer research fellowships are also available from our science academies:

<http://web-japps.ias.ac.in:8080/fellowship2012/> and <http://www.ias.ac.in/initiatives.html> .

*B V Rajarama Bhat and K B Athreya*  
Editors, *Resonance*

