



Evaluative Report of The Institute of Mathematical Sciences

1. Name of the CI

The Institute of Mathematical Sciences (IMSc), Chennai

2. Year of establishment

Please see para 6 of the 'Profile'.

3. Is the CI part of the university

Yes

4. Names of programmes offered

IMSc. offers Integrated Ph.D. in Mathematics and Ph.D. in Mathematics, Physical Sciences and Life Sciences. Please see Appendix 1 of the profile.

5. Interdisciplinary programmes

Subject of research leading to Ph.D. is inter-disciplinary in many cases. In particular, discipline like 'Computational Biology' is highly interdisciplinary.

6. Courses in collaboration with other universities, industries, foreign institutions, etc.

Doctoral students can have two guides with one of them from a collaborating institution with whom HBNI has a formal MoU. For a list of collaborating institutions, please see Para 2.4.10 of 'Criteria-wise Inputs'.

7. Details of programmes discontinued, if any, with reasons

NIL

8. Examination System

Semester system

9. Participation of the department in the courses offered by other departments



This question is not applicable to IMSc. There are no rigid boundaries between the various fields of study here. Both faculty and students participate in a variety of activities across the boundaries of their fields in the form of colloquia, seminars, workshops and conferences.

10. Number of teaching posts sanctioned, filled and actual (Professors/Associate professors/ Asst. Professors/ Others)

Please see para 24 of the Profile.

11. Faculty profile with name, qualification, designation, area of specialization, experience and research under guidance

Please see Appendix 1

12. List of senior Visiting Fellows, adjunct faculty, emeritus professors :

Please see para 26 of the 'Profile'.

13. Percentage of classes taken by temporary faculty – programme-wise information :

NIL

14. Programme-wise Student Teacher Ratio :

Approximately, 1: 1 for delivering lectures for course works. For Ph.D., it is ensured that number of students per supervisor is limited to a maximum of eight.

15. Number of academic support staff (technical) and administrative staff: sanctioned, filled and actual

Please see para 24 of the 'Profile'.

16. Research thrust areas as recognized by major funding agencies

Research at IMSc is carried out in the following areas of Mathematics, Physics, Computer Science and Biology: Algebra and Algebraic geometry, Number theory, Partial differential equations, Schrodinger and Jacobi operators, Subfactors, Representation theory, Ergodic theory, Non-commutative geometry, Classical and quantum gravity, Condensed matter physics, Mathematical physics, Non-linear dynamics and complex



systems, Statistical mechanics, String theory, High energy physics, Phenomenology, Algorithms and data structures, Automata theory, Computational complexity, Distributed computing, Graph theory and combinatorics, Logics of programs, Parametrized complexity, Semantics, Symbolic computation and Computational Biology.

Funding in all these areas of R&D activities is provided by the Department of Atomic Energy.

For more details, please see para 3.1 of the 'Criteria-wise Inputs'.

17. Number of faculty with ongoing projects from a) national b) international funding agencies and c) Total grants received. Give the names of the funding agencies, project title and grants received project-wise.

Full funding is received from the Department of Atomic Energy and several of the faculty members are involved in one or more projects. Details of ongoing projects and grants for IMSc are given in Appendix 2.

18. Inter-institutional collaborative projects and associated grants received

Please see Appendix 2.

19. Projects funded by DST-FIST; UGC-SAP/CAS, DPE; DBT, ICSSR, AICTE, etc.; total grants received.

Nil.

20. Research facility / centre with

- a. state recognition
- b. national recognition
- c. international recognition

IMSc. has no formal recognition from any agency. However, the institute library is recognized by the NBHM as a Regional Library for mathematics.

21. Special research laboratories sponsored by / created by industry or corporate bodies

NIL

**22. Publications:**

Please see para 3.3 of the 'Criteria-wise inputs'.

23. Details of patents

NIL

24. Areas of consultancy and income generated

Not Applicable. Please see para 3.4 of the 'Criteria-wise Inputs'.

25. Faculty selected nationally / internationally to visit other laboratories/ institutions/ industries in India and abroad

Visits within India are very large. For visits abroad, please see Appendix 4.

26. Faculty serving in

- a) **National committees** b) **International committees** c) **Editorial Boards** d) **any other (please specify)**

Please see Appendix 3 of the 'Criteria-wise Inputs'.

27. Faculty recharging strategies (UGC, ASC, Refresher / orientation programs, workshops, training programs and similar programs).

IMSc, being a research institute, organizes and participates in many conferences and workshops, both nationally and internationally. These serve to recharge the faculty by close interaction with frontier developments.

28. Student projects :

- **percentage of students who have done in-house projects: 100%**
- **percentage of students doing projects in collaboration with other universities/ industry/ institute: 0%**

Additionally, IMSc has a strong summer program where students from all over India are selected to do directed research under the faculty. This is more a benefit to the students from outside who may lack facilities and proper direction in their own departments.



29. Awards / recognitions received at the national and international level by

- Faculty
- Doctoral / post doctoral fellows
- Students

Please see Appendix 1 of the 'Criteria-wise Inputs'.

30. Seminars/ Conferences/ Workshops organized and the source of funding (national/ international) with details of outstanding participants, if any.

Please see Appendix 5.

31. Code of ethics for research followed by IMSc.

The core ethical policy of DAE is to establish a tradition with highest ethical standards, ensuring a harmonious future for the entire humankind, where every individual can live with dignity and self-respect. In accordance with the guidelines of the DAE, adhering to highest ethical standards is one of the guiding values of IMSc. Every complaint of malpractice or plagiarism received is investigated and appropriate action is taken.

32. Student profile programme-wise

Please see para 15 and para 28 of the 'Profile.'

33. Diversity of students

Please see Para 2.1 of the 'Criteria-wise Inputs'.

34. How many students have cleared Civil Services and Defense Services examinations, NET, SET, GATE and other competitive examinations? Give details category-wise.

Please see para 1.1.3 of the 'Criteria-wise Inputs. This question is not applicable to HBNI.

35. Student progression



Students joining IMSc. for Ph.D. and integrated Ph.D. programmes go for post-doctoral research after the doctoral programmes. All of them are employed in university or research institutes in India or abroad.

36. Diversity of staff

Please see para 2.4.3 of the 'Criteria-wise Inputs.'

37. Number of faculty who were awarded M.Phil., Ph.D., D.Sc. and D.Litt. during the assessment period

Nil

38. Present details of infrastructural facilities with regard to

- a) Library: Please see para 4.2 of the 'Criteria-wise Inputs'. The Institute Library holds a total collection of 67799 books and bound periodicals as on March 31,2013. This includes an addition of 565 volumes during the current year April 2012 - March 2013. The NBHM has recognized this Institute library as the Regional Library for Mathematics. An average of about 6000 outside users in a year from colleges, universities and research institutions from different parts of the country make use of the library facilities for their academic and research information needs.

The library has a well balanced collection both print and online on the major subject areas of research such as Theoretical Physics, Mathematics and Theoretical Computer Science. The library subscribes to over 350 national and international journals. The library has access to over 3500+ online journals from major publishers such as Elsevier, American Mathematical Society, American Physical Society, Springer Verlag, World Scientific, Institute of Physics, Wiley, etc.

Library has also access to Nature online, Science Online, ACM Digital Library, SIAM Journals Archive, Duke Mathematical Journal, and JSTOR Full digital archive. It has also perpetual online access to backfile collection of journals contents from Volume 1 from some of the major publishers like Elsevier under DAE consortium, Springer, World Scientific, Wiley, deGruyter, Cambridge University Press, Turpion, IOP Publishing and Annual Reviews Electronic Backvolume collection.

Library is a member of DAE Libraries Consortium that subscribes



to SCIENCE DIRECT SERVICE of Elsevier. Library is also coordinating the MathSciNet consortium which provides online access to MathSciNet for 8 participating institutions at a deeply discounted rate in the southern region. Library is an institutional member of AMS, MALIBNET, CURRENT SCIENCE Association, and IAPT.

- b) Extensive internet facilities are available to staff and students
- d) Total number of class rooms: 5 Lecture Halls. 5 Class rooms with 3 ICT facility are also available. ICT available consists of the hardware, software, networks and media for the collection, storage, processing, transmission and presentation of information (voice, data, text, images) as well as related services.
- e) Students' laboratories No
- f) Research laboratories No

39. List of doctoral, post-doctoral students and Research Associates

Please see Appendix 6.

40. Number of post graduate students getting financial assistance from the university.

All students pursuing their Ph. D programme get financial assistance from IMSc.

41. Was any need assessment exercise undertaken before the development of new programme(s)? If so, highlight the methodology.

Please see para 1.1.2 of the 'Criteria-wise Inputs.

42. Does IMSc. obtain feedback from

- a. Faculty on curriculum as well as teaching-learning-evaluation?
If yes, how does IMSc. utilize the feedback?
- b. Students on staff, curriculum and teaching-learning-evaluation and how does IMSc. utilize the feedback?
- c. Alumni and employers on the programmes offered and how does IMSc. utilize the feedback?

Feedback from students is obtained once every year at the end of the academic session. All feedback received is analysed and presented to the faculty for deliberation and decision. Introduction of new programmes and changes in syllabus are decided as needed.

43. List the distinguished alumni of the CI (maximum 10)

The list below includes those, who received a Ph.D. based on the work done at IMSc. but prior to the setting up of HBNI.

Sl. No	Name
1.	A P Balachandran, Professor, Syracuse University, USA, Fellow of American Physical Society, Chancellors Citation for Exceptional Academic Achievement (1990)
2.	V. Balaji, Professor, Chennai Mathematical Institute, Shanti Swarup Bhatnagar Award, 2006
3.	Golam Mortuza Hossain, Asstt. Professor, IISER Kolkata INSA Young Scientist Award, 2006
4.	Dr. Geetha Srinivasa Rao, Fellow of the National Academy of Sciences, Allahabad (2000), Lifetime Award for Mathematics from the Govt. of Tamil Nadu (2010)
5.	K. Srinivasa Rao, DST Ramanujam Professor, SASTRA, TANSAs Awards for Science Popularization and Mathematics, 2000
6.	Madhavan Mukund, Professor, Chennai Mathematical Institute, Executive Director, International Olympiad in Informatics (2011-2014)
7.	P. Madhusudan, Professor, UIUC, USA, NSF CAREER Award (2008)
8.	Manu Mathur, Professor and Head of Department, S.N. Bose National Centre for Basic Sciences, Kolkata
9.	P. Ramadevi, Professor, IIT Mumbai
10.	Swarnendu Sarcar, University of Delhi

44. Give details of student enrichment programmes (special lectures/ workshops/ seminars) involving external experts.

IMSc. regularly hosts international experts to give seminars in their field of specializations. Several interaction meetings/workshops have been organized at IMSc during last five years. For instance, in 2012-2013 approximately 250 seminars/colloquia were held here. These include many public talks as well.

45. List the teaching methods adopted by the faculty for different programmes.



Besides standard class room teaching, interaction takes place through tutorial classes. A number of our courses are video-graphed and are publicly available.

46. How does IMSc ensure that programme objectives are constantly met and learning outcomes are monitored?

Every student has a monitoring/doctoral committee throughout their tenure and their progress towards programme objectives is regularly monitored.

47. Highlight the participation of students and faculty in extension activities.

Please see para 3.5 of the 'Criteria-wise Inputs'..

IMSc annually organizes a Science Day in which both students and faculty participate to bring the excitement of research to school students. In addition, faculty participate in organizing several refresher programmes for school and college teachers, both at IMSc and at other locations. Finally there are many public lectures organized that are open to the general public.

48. Give details of “beyond syllabus scholarly activities”.

The faculty is continuously engaged in research necessary for meeting the mandate of the DAE. A significant percentage of this engagement is scholarly and results in good publications in peer reviewed journals. The students and faculty give lectures very frequently in various fora like national and international symposia, workshops, awareness programmes and colloquia. They interact on a regular basis with scientist of repute from the country and from abroad. They organise high level knowledge dissemination activities like organization of advanced schools under the aegis of BRNS/ DST and other similar bodies.

49. State whether the programme/ CI is accredited/ graded by other agencies? If yes, give details.

Yes, by UGC

50. Briefly highlight the contributions of IMSc. in generating new knowledge, basic or applied.

Due to a very large volume of very high quality basic and applied research being carried out by the faculty and the students, the research output is excellent and is documented in the form of publications in international journals and conference proceedings. Notable contributions from the institute include work in cryptography (particularly elliptic curve cryptology, security theory and the application of algebraic geometry to information theory). The Institute maintains close contact with the Crypto-graphical Research Society of India and the Society for Electronic Transactions and Security to foster research in this field. The mathematics group is well known for contributions to operator algebras and non-commutative geometry. The physics group leads in research in classical and quantum optics, quantum information theory, high-temperature superconductivity, complex systems and B-physics. In particular, a very highly cited paper in quantum information theory and a sequence of international meetings in this field has helped place research in this field on the international map, while work on black hole entropy, RVB theories, graphene, the Indus script and the Kitaev model have attracted much attention. The computer science group is a leading centre in logic, automata, algorithms and computational complexity (in particular parameterized complexity).

51. Detail five major Strengths, Weaknesses, Opportunities and Challenges (SWOC) of IMSc.

Strengths

1. The quality of students is very good because of very rigorous selection process adopted.
2. After a tough selection, the initial training imparted to the students is of very high standard.
3. The quality of research and infrastructural facilities available is very good.
4. The funding is very generous.
5. Besides the students, the faculty is also very strong, nationally and internationally known and there is very strong peer pressure on both the sides to do better.

Weaknesses:

1. Ensuring very high quality sometimes leads to very low number of students in some of the disciplines.
2. Available hostel and office spaces are severely stressed at current levels of activity making further expansion challenging.



Opportunities

1. Compact size and flexible approach enables rapid response to new scientific developments.
2. The atmosphere and the breadth of faculty naturally encourages interdisciplinary research.

Challenges

1. To balance various types of responsibilities for the faculty.
2. Identifying and attracting well prepared students.
3. Strengthening post-doctoral program with high quality input.

52. Future plans of the IMSc.

1. Enhancing quality and output of our research.
2. Expanding and strengthening our doctoral programs.

List of appendices (to be made available to the assessment team during their visit)

1. IMSc: Appendix 1: Faculty profile referred to at para 11.
2. IMSc: Appendix 2: Ongoing projects referred to at para 17.
3. IMSc: Appendix 3: Not included.
4. IMSc: Appendix 4: Visits of faculties to International, Laboratories/ Institutions referred to at para 25.
5. IMSc: Appendix 5: Seminar/ Meetings/ Conferences/ Colloquia referred to at para 30.
6. IMSc: Appendix 6: List of doctoral students referred to at para 39.