

Information and Announcements



Integrated Ph.D Programme in Biological, Chemical and Physical Sciences at Indian Institute of Science

Genesis

The integrated Ph.D Programme in Biological, Chemical and Physical Sciences was born out of the recommendations of the Forward Planning Committee of the Institute which examined the future of scientific research and education at the Institute of Science. It was felt that in spite of the major drainoff from science that takes place at the +2 stage, there still exists a large pool of bright, interested students at the B.Sc. level from which a few can be drawn into an Integrated Ph.D. programme in the sciences with the prospect of Ph.D. graduation within a period of 5-6 years. The Integrated Ph.D. programme in Chemical Sciences was started in the academic year 1990-91, followed by Physical Sciences in the year 1991-92 and Biological Sciences in the year 1992-93.

Introduction

The programme represents a novel attempt at training and developing high quality professional scientists in India. The basic idea is to

induct a small number of talented, strongly motivated young students at the B.Sc. level and impart to them sound, well-balanced science training (biology, chemistry and physics) in an atmosphere of contemporary, active research.

About the Programme

The Institute now offers the Integrated Ph.D. Programme in Biological, Chemical and Physical Sciences for candidates with first class B.Sc. degree who have a flair and aptitude to pursue research in any one of these programmes. The programme consists of flexible course work with emphasis on research-oriented laboratory projects to impart training in laboratory skills and techniques, followed by advanced research with special emphasis on an interdisciplinary approach. The course work is carefully designed to provide basic education in any one of the branches of science (biology, chemistry, physics) and the formal training needed for quality professional research; it also provides wide scope for self-learning. The laboratory programme is of an internship-type where there are ample



opportunities to learn and avail of personal training in all aspects of advanced laboratory techniques. Students are expected to take advantage of the computer network of the Institute including Internet to access the world of scientific knowledge. The programme includes tutorial classes, problem solving sessions, faculty advisory system and a multitude of avenues for carrying out research in various science disciplines. All candidates admitted to the programme are awarded an interim MS degree at the end of three years after successful completion of course work and the comprehensive examination. The students are qualified to appear for the UGC/CSIR/NET after successful completion of the course work and project. The admission procedures, graduation requirements and other details about the programme are given below.

1 **Biological Sciences**

Participating Departments/Centres: Biochemistry, Ecological Sciences, Genetic Engineering, Reproductive Biology & Molecular Endocrinology, Developmental Biology & Genetics, Molecular Biophysics, and Microbiology & Cell Biology.

Areas of Research: Biomembranes - physical and physiological studies; structure-function of nucleic acids; gene structure and function in prokaryotes and eukaryotes; microbial genetics; sex determination; recombinant DNA technology; molecular virology and mechanisms of disease processes; enzymology, protein chemistry and engineering; cellular and applied

immunology; molecular endocrinology and reproductive biology; conformation of biomolecules and biopolymers; protein and virus crystallography; structural and computational biology; mathematical ecology; human ecology; behaviour and sociobiology; conservation ecology; plant molecular biology and development.

Eligibility: First class (as declared by the university) B.Sc. in physical, chemical or biological sciences (including pharmaceutical, veterinary and agricultural sciences) with chemistry as one of the subjects at the B.Sc. level, and mathematics or physics at the PUC/plus 2 level.

1 **Chemical Sciences**

Participating Departments: Organic Chemistry, Inorganic & Physical Chemistry, Solid State & Structural Chemistry and Materials Research Centre.

Areas of Research: Ultrafast chemical dynamics; theoretical chemistry; surface chemistry and catalysis; solid state chemistry; amorphous materials; ceramics, thin films; chemistry of super-conductors; synthetic organic chemistry; physical organic chemistry; biomimetic chemistry and bio-organic chemistry; organometallic chemistry; chemistry of transition & non-transition metals; chemistry of polymers.

Eligibility: First class (as declared by the university) B.Sc. with chemistry as one of the main subjects, and mathematics at the PUC/plus 2 level.



1 Physical Sciences

Participating Department: Physics

Areas of Research: Physics of disordered systems; high-temperature superconductivity; strongly correlated electron systems; low-temperature physics; complex fluids; low dimensional conductors; quasicrystals; magnetic resonance; Raman spectroscopy; point contact and tunneling spectroscopies; structure and function of biomolecules; physics of semiconductors; phase transitions; dynamics of complex systems; plasma physics; solar, stellar and galactic astrophysics; quantum field theory; classical and quantum optics; computational physics.

Eligibility: First class (as declared by the university) B.Sc. with physics as a main subject.

Selection Procedure

The selection of candidates for admission is solely on the basis of their performance in the entrance test followed by an interview. The candidates selected based on their entrance test performance, appear for an interview at the

Institute. The entrance test is held at 14 centres located in various parts of the country and the candidates have to answer any one paper of 3 hours duration. The advertisement for admission to this programme appears in all the major newspapers in February/March every year.

Entrance Test

Candidates have to choose an appropriate paper among the following for admission to the chosen Ph.D. programme (biological/chemical/physical sciences): 1. Biological Sciences; 2. Chemical Sciences; 3. Physical Sciences.

Each question paper consists of two parts (Part I & Part II). Part I carries 30 marks. The questions in Part I are of the objective type and cover general 'scientific aptitude' in physics, chemistry, mathematics and biology. Part I of the question paper is common to all the papers and is compulsory.

Part II carries 70 marks and contains problems and questions requiring short answers. Candidates are required to indicate their choice of the paper in the application form and the answer book. **Changes are not permitted.**

<i>For admission to Integrated Ph.D</i>	<i>Paper to be answered</i>
1 Physical Sciences	Physical Sciences
1 Chemical or Biological Sciences	Chemical Sciences or Biological Sciences or Physical Sciences



Financial Support

All the students admitted to the Integrated Ph.D Programme receive some financial support in the form of scholarship for the first two years. The students are eligible for scholarship of Rs.2500 per month from the beginning of the third year.

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Introductory Summer School on Astronomy and Astrophysics

The Introductory School on Astronomy and Astrophysics, proposed to be held during May 29 - June 8, 1996, at Pune, is designed to introduce the students of physics, mathematics, electronics engineering and technology to the ex-

isting fields of astronomy and astrophysics (A&A). No previous knowledge of A&A is necessary. Although familiarity with the basic principles of mathematics and physics will be required.

How to apply

In plain paper, in the following format: 1. name; 2. sex; 3. date of birth; 4. address for communication; 5. qualifications (standard X onwards) with institution/year/subjects/class/grade/percentage of marks obtained; 6. short write-up giving motivation for applying for the school; 7. previous summer schools attended, if any; 8. names and addresses of two referees (these referees should be teachers/project guides, etc.); and 9. signature with date.

The applicants should request the above

referees to send their confidential assessments/recommendations in separate envelopes. Applications and referee reports should reach the *Coordinator, Core Programmes, IUCAA, Post Bag 4, Ganeshkhind, Pune 411 007*, [phone: (0212) 351414, fax: (0212) 350760] by March 14, 1996.

The selected candidates will be informed by April 15, 1996. They will be provided travel, board and lodging for the duration of the school.



The School will be funded by the Department of Science and Technology (DST), New Delhi, and hosted by Inter University Centre for Astronomy and Astrophysics (IUCAA) and National Centre for Radio Astrophysics (NCRA) of the Tata Institute of Fundamental Research, Pune.

It is expected that about 35 students will participate in this programme. The programme of the school will consist of lectures, covering fundamentals of A&A as well as recent developments in the field. In addition, participants will take part in individual projects under suitable guidance. The lecturers for the School will be

drawn from the leading A&A centres in the country, so that the participants will get an exposure to the work being done in these fields. There is a possibility for a few motivated students to spend an additional week at IUCAA / NCRA after the school.

¹ *Eligibility:* Students completing their 1st year M.Sc., (physics/applied mathematics/astronomy/electronics) or 3rd year B.E./B.Tech. in 1996 can apply. Exceptionally bright and motivated students completing their B.Sc. (Physics) in 1996 may also apply.



Murray Gell-Mann's discovery ... As an undergraduate at Yale, I had managed to get high grades in science and math courses without always understanding the point of what I was learning. In most cases, it seemed, what was required was merely to regurgitate on examinations what one had been fed in class. My views changed when I attended one of the sessions of the Harvard-MIT theoretical seminar. I had thought of the seminar as some sort of glorified class. In fact, it was not a class at all, but a serious discussion group on subjects in theoretical physics, particularly the physics of atomic nuclei and elementary particles. Professors, post-docs, and graduate students from both institutions attended; one theorist would lecture and then there would be a general discussion of the topic he had presented. I was unable to appreciate such scientific activity properly because my way of thinking was still circumscribed by notions of classes and grades and pleasing the teacher. (from *The Quark and the Jaguar: Adventures in the Simple and the Complex*. 1994)

