

Department of Computational and Data Sciences (CDS)
Indian Institute of Science, Bangalore
Computational Science (CD-CP)
PhD and M.Tech (Research) Admissions 2017

This brochure provides information on the Research (M.Tech by research and PhD) admission process of CD-CP. Further, it describes the research laboratories in the CD-CP stream that will accept students this year, and the topics for the written and oral components of the research interview. A Preference Sheet appended at the end of this brochure must be filled and signed by you when you appear for the interview.

A. Research Streams at CDS

Research activities at CDS are categorized into two streams: *Computational Science* and *Computer systems*. Research admissions are conducted *separately* for each stream, so please refer the appropriate brochure.

B. Research Admission Process – Computational Science Stream (CD-CP)

The interview process for the Computational Science stream has two stages: Written and Oral (both conducted on the same day).

1. Written component (Duration: 30 minutes): Total Points $5 \times 2 = 10$ (a) Two mandatory questions, one from polynomials, functions, plotting, etc and another is a programming question

(b) Answer any three out of five questions asked from basic engineering mathematics on following topics: Linear Algebra/Matrices, Probability and Statistics, and Differential Equations.

2. Oral Interview: Candidates who are successful in the written component will attend an oral interview before a CDS-CP faculty committee. In the oral interview, you will be questioned on the basic subjects, and on a choice of advanced topic based on your lab preferences:

Basic Area Subjects: Programming fundamentals; Linear Algebra; Numerical Methods; Ordinary Differential Equations; Probability & Statistics. Final year undergraduate level preparation is required.

Advanced Topics: Matrix Algebra, Numerical and Functional Analysis, Numerical Solution of Differential and Differential-Algebraic Equations, Finite Element Methods, Signal Processing, Computational Biology and Structural Bioinformatics, Graph Algorithms, Structural Biology and Bioinformatics.

C. List of labs that accept students

1. Stable, Accurate, Fast, Robust Algorithms & Numerics Lab:

Faculty: *Sivaram*; cds.iisc.ac.in/faculty/sivaram/

The group works on theoretical & computational aspects of numerical analysis & linear algebra algorithms with a focus on constructing highly accurate fast stable algorithms for electromagnetics, elasticity, fluid mechanics, computational statistics, inverse problems and filtering. The overarching goal of the group is to develop robust algorithms founded in rigorous mathematics and convert them into technologies, which in-turn will be used as black-box tools for the aforementioned applications.

2. Biomolecular Computation Laboratory:

Faculty: *Debnath Pal*; pallab.serc.iisc.ernet.in/lab.php

The focus of Biomolecular Computation Lab is to understand biological function at multiple scales. Towards this goal we work at molecular level and pathway level and develop methods and algorithms to understand biochemical function better. The scope of work spans the areas of genomics, proteomics and metabolomics. We also work on biomolecules to understand sequence, structure function relationships, their interactions and dynamics. There is opportunity to do research problems in real-life projects in cancer, diabetes, neurodegeneration etc., where intensive bio-computational analysis is required.

3. Structural Biology & Bio-Computing Lab:

Faculty: *Sekar*; physics.iisc.ernet.in/~dichome/sekhome/index.html

The research group focuses on solving three-dimensional crystal structures of protein molecules using X-ray crystallography and molecular dynamics simulations. Further, we are also interested in data mining of protein sequences and structures.

4. Computational Mathematics Group:

Faculty: *Sashikumaar*; cds.iisc.ac.in/faculty/sashi/

The research group focuses on the development and advancement of robust numerical (finite element) methods and solver for solving partial differential equations (PDEs) that describe incompressible fluid flows and species concentration and/or energy in complex systems. The group also works on implementing efficient parallel algorithms for high-performance computing.

5. Computational & Statistical Physics Lab:

Faculty: *Murugesan*; cds.iisc.ac.in/faculty/muruges/

A part of this group studies light-matter interactions and optical properties of materials using numerical and analytical models. Another part works on numerical linear algebra and developing computational formulations for scientific problems in general.

6. Computational Electromagnetics Lab:

Faculty: *Atanu Mohanty*; cds.iisc.ac.in/faculty/amohanty/

This group works on computational electrodynamics, block design programs, ultrasonic instrumentation and signal processing.

Preference Sheet for Ph.D./M.Tech(Res) Research Admissions – Computational Science (CD-CP)

Carefully review the brochure and Research Lab descriptions before filling in this Preference Sheet. Choose the lab(s) whose research areas most closely match your own interests. You may choose up to three labs. Ph.D. students, if admitted, will be placed in the lab(s) chosen here, and this selection is binding.

1. Name: _____

2. Application No: _____

3. Program: (*Tick one*) M.Tech. (Research) Direct Ph.D. Ph.D.

4. External Research Program Candidate? (*Tick one*) No Yes

Rank up to three Research Labs below by their order of preference (using numbers 1,2,3).

Stable, Accurate, Fast, Robust Algorithms & Numerics Lab

Biomolecular Computation Laboratory

Structural Biology & Bio-Computing Lab

Computational Mathematics Group

Computational & Statistical Physics Lab

Computational Electromagnetics Lab

I have read and understood the brochure and the instructions before filling in this Preference Sheet.

Signature: _____

Date: _____

Place: _____