

**Department of Computational and Data Sciences (CDS)**  
**Indian Institute of Science, Bangalore**  
***Computational Science (CD-CP)***  
***PhD and M.Tech (Research) Admissions 2018***

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 5X2=10** (a) Two mandatory questions, one from polynomials, functions, plotting, etc and another is a programming question

(b) Answer any three out of four 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 based on your choice of an advanced topic and 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. Medical Imaging Group (MIG)**

Faculty: *Phaneendra Yalavarthy*; <http://cds.iisc.ac.in/faculty/yalavarthy/>

The research group works on developing computational methods/models in medical imaging. The recent focus has been towards deep learning methods for medical image reconstruction and analysis. Significant portion of the research work in the lab is dedicated towards working on clinically relevant work with an emphasis on fast imaging methods.

#### **2. Biomolecular Computation Laboratory:**

Faculty: *Debnath Pal*; [pallab.serc.iisc.ernet.in/lab.php](http://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](http://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/](http://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. ***We have a few openings for PhD students. A few exceptionally bright and highly motivated students, who are willing to convert and continue to do PhD, will be considered for the M.Tech (Res) program as well.***

## 5. Computational & Statistical Physics Lab:

Faculty: *Murugesan*; [cds.iisc.ac.in/faculty/muruges/](https://cds.iisc.ac.in/faculty/muruges/)

Members of this group broadly work on problems in computational mathematics and physics. We have also worked with industrial partners and other labs on campus in developing and understanding nanoscale materials for optical applications. We will consider students interested in the areas of quantum/statistical physics or computational mathematics.

**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).

Medical Imaging Group

Biomolecular Computation Laboratory

Structural Biology & Bio-Computing Lab

Computational Mathematics Group

Computational & Statistical Physics Lab

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

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Place: \_\_\_\_\_