Department of Computational and Data Sciences Indian Institute of Science, Bangalore

http://cds.iisc.ac.in QIP Research Admissions - 2018 Brochure

Research Admissions in CDS

The admission of students to Department of Computational and Data Sciences (CDS) is through two streams, (i) Computer Systems (CS) and (ii) Computational Science (CP). Based on the choice (indicated on the preference sheet), the candidate will be tested on the aptitude and suitability for the corresponding research stream. Please note that the research stream choice (either CS or CP) given by the candidate is ***binding***. Candidate should indicate only one choice of stream, in which he/she wishes to pursue their research degree. Please do not hesitate to ask questions to the interview panel regarding the research activities at CDS. Please go through this brochure carefully and fill the preference sheet (last page of the brochure).

Research Streams

Computer Systems (CS): Research areas in this stream deal with the design, implementation and evaluation of computer hardware and software. Computer Aided Design, Cloud Computing Systems, Distributed Systems, Data Sciences, Big Data Platforms, Computer Vision and Image/Video Analytics, Database Systems, Embedded System-On-Chip Architectures, High Performance Computing Systems, Machine Learning, Natural Language Processing, Deep Learning for Vision and Language, Parallel Computing are the prominent topics in which research is being carried out at CDS.

CDS faculty who work in this stream include: Jayant Haritsa, Venkatesh Babu, Anirban Chakraborty, S K Nandy, Yogesh Simmhan, Partha Pratim Talukdar and Sathish Vadhiyar (Research activities specific to each faculty/area is given in the later section under CDS research labs).

Computational Science (CP): This is an inter-disciplinary area that brings together the domain-specific knowledge of science and engineering with relevant areas of computing and mathematics. It educates and trains students to 'model' problems or 'simulate' processes varying across many disciplines in science and engineering. Some of the areas of current faculty research include quantum

computing, electromagnetics, numerical analysis, scientific computing, parallel algorithms, medical imaging, finite-element methods, photonics, and acoustics.

CDS faculty who work in this stream include: Sashikumaar Ganesan, Sekar K, Atanu Mohanty, Debnath Pal, Soumyendu Raha, Phaneendra K Yalavarthy, and Murugesan Venkatapathi.

Research activities specific to each faculty/area, who is accepting research students, is given in the later section under CDS research labs.

About the interview

The typical duration of an interview is about 20 minutes.

In the computer systems (CS) stream , the candidates will be asked questions related to previous project(s), teaching assignments, and on the following:

- **Basic Area Subjects:** Programming in C, Data Structures, and Algorithms. Candidates are expected to be prepared in all these subjects for oral examination. The level of preparation expected will be at the final year engineering undergraduate level.
- **Advanced Topics:** Topics from the following: Operating Systems, Algorithms, Distributed Systems, Machine Learning, Natural Language Processing, Signal Processing, Image Processing, Linear Algebra, Probability.

The computational science (CP) stream will have questions on the fundamentals of discrete mathematics, linear algebra, functional analysis, probability and statistics, differential equations, numerical methods, mathematical physics, electromagnetism and simple programming.

CDS Research Labs

I. Stream: Computer Systems (CS) (lists only the labs that are accepting students)

I.1 Database Systems Lab (DSL)

Query Optimization, Data Mining, XML Databases, Biological Databases, Multi-lingual Databases, and Database engine design.

Associated Faculty: Jayant R Haritsa.

I.2 Visual Computing Lab (VCL)

Visual analytics, Data association over graphs, Data fusion and consistency, Applications of computer vision and machine learning in bio-medical image analysis, video surveillance.

Associated Faculty: Anirban Charaborty.

I.3 Visual Analytics Lab (VAL)

Video Analytics, Multimedia, Image/Video Processing, Compression, Compressed Domain Processing, Computer Vision and Machine Learning.

Associated Faculty: Venkatesh Babu R.

I.4 Computer Aided Design Lab (CAD Lab)

Dynamically Reconfigurable Architectures, Dataflow and Multithreaded Computing, Virtualizations, Pervasive Computing, SoC Design Methodologies

Associated Faculty: S. K. Nandy

II. Stream: Computational Science (CP) (lists only the labs that are accepting students)

II.1 Computational Mathematics Group (CMG)

Numerical analysis, Finite element methods, Multiscale methods, Stabilization methods, Multigrid methods, Parallel algorithms with applications to Free surface and Multi-phase flows, Flows with surfactants, Impinging droplet, Bio-medical flows, Population balance systems in time-dependent domains. In-house parallel finite element package, MooNMD, for 2D, 3D incompressible Navier-Stokes and scalar equations in stationary/ moving domains.

Associated Faculty: Sashikumaar Ganesan

II.2 Structural Biology and Biocomputing Lab (SBBL)

Structural Biology and Biocomputing, Statistical Crystallography, Algorithm development, Database analysis & maintenance, World Wide Web (WWW) based internet computing

Associated Faculty: K. Sekar

II.3 Computational Electromagnetics Lab (CEL)

Computational Electrodynamics, Block Design Programs, Ultrasonic instrumentation and signal processing.

Associated Faculty: Atanu Mohanty

II.4 Biomolecular Computation Lab (BCL)

Genome-wide function annotation, interaction networks in biology, protein structure and conformation, protein-ligand and protein-protein interaction, drug discovery.

Associated Faculty: Debnath Pal

II.5 Scientific Computing Lab (SCL)

Simulation, Control and Optimization of Constrained Dynamical Systems, Stochastic and Deterministic Differential-algebraic equation systems, Mathematical Libraries, VLSI CAD applications.

Associated Faculty: Soumyendu Raha

Important Note:

Candidates with B.E./B.Tech./M.Sc./M.C.A. qualification has to choose Direct Ph.D. program.

Candidates with M.S./M.E./M.Tech. qualification can choose Ph.D. program.

Preference Sheet for Ph.D./M.Tech(Res) Research Admissions

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) [ ] Direct Ph.D. [ ] Ph.D.
4. Preferred Research Lab(s).

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

Signature: _____

Date:_____

Place:_____