Department of Computer Science & Engineering

Bharti Building

SIT Building

Indian Institute of Technology Delhi
<table>
<thead>
<tr>
<th>Faculty</th>
<th>Name and Research Area</th>
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</thead>
</table>
| Saroj Kaushik | **Head, CSE**  
   Artificial Intelligence, Location Based Services         |
| Amitabha Bagchi | **Associate Professor**  
   Structural properties of networks, Algorithms, Data Structures |
| M. Balakrishnan | **Professor**  
   CAD for VLSI, Computer Architecture                       |
| Subhashis Banerjee | **Professor**  
   Computer Vision, Real-time Systems, Robotics             |
| Sorav Bansal | **Assistant Professor**  
   Operating System, Compilers                                |
| K. K. Biswas | **Emeritus Professor**  
   Computer Vision, AI                                        |
| Naveen Garg | **Professor**  
   Algorithms, Optimization                                    |
| Rahul Garg | **Professor**  
   Machine Learning, Big Data Analytics, Neuroimaging, High Performance Computing |
| Shyam Gupta | **Professor**  
   Graph Theory, Databases                                     |
| Ragesh Jaiswal | **Assistant Professor**  
   Algorithms, Complexity Analysis                             |
| Prem Kalra | **Professor**  
   Computer Graphics, 3D Animation                             |
| Amit Kumar | **Professor**  
   Algorithms, Computer Networks                               |
| Anshul Kumar | **Professor**  
   CAD for VLSI, Computer Architecture                       |
| S. Arun Kumar | **Professor**  
   Semantics and Verification                                  |
| Subodh Kumar | **Associate Professor**  
   Computer Graphics, Visualization, Geometry                  |
| S. N. Maheshwari | **Emeritus Professor**  
   Algorithms, Parallel Processing, Information Systems    |
| Mausam | **Associate Professor**  
   Artificial Intelligence, Natural Language Processing |
| Preeti R. Panda | **Professor**  
   Embedded Systems, CAD for VLSI                             |
<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Research Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kolin Paul</td>
<td>Associate Professor</td>
<td>Reconfigurable Computing, Embedded Systems</td>
</tr>
<tr>
<td>Sanjiva Prasad</td>
<td>Professor</td>
<td>Programming Languages, Concurrent Systems</td>
</tr>
<tr>
<td>Vinay Joseph Ribeiro</td>
<td>Associate Professor</td>
<td>Computer Networks</td>
</tr>
<tr>
<td>Maya Ramanath</td>
<td>Assistant Professor</td>
<td>Database and Information Retrieval Techniques for Semantic Web Data Management</td>
</tr>
<tr>
<td>Huzur Saran</td>
<td>Professor</td>
<td>High Speed Networks, Graph Theory, Algorithms</td>
</tr>
<tr>
<td>Smruti Ranjan Sarangi</td>
<td>Assistant Professor</td>
<td>Computer Architecture, Operating Systems</td>
</tr>
<tr>
<td>Aaditeshwar Seth</td>
<td>Assistant Professor</td>
<td>Computer networks, Social network analysis</td>
</tr>
<tr>
<td>Sandeep Sen</td>
<td>Professor</td>
<td>Computational Geometry, Algorithms</td>
</tr>
<tr>
<td>Parag Singla</td>
<td>Assistant Professor</td>
<td>Machine Learning, Social Network Analysis, Artificial Intelligence</td>
</tr>
<tr>
<td>Subodh Sharma, Assistant Professor</td>
<td>High Performance Computing, Concurrency, Formal Verification</td>
<td></td>
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<tr>
<td>Shweta Agrawal</td>
<td>Inspire Faculty</td>
<td>Cryptography, Information Theory</td>
</tr>
<tr>
<td>B. N. Jain</td>
<td>Visiting Professor</td>
<td>Ad-hoc Networks, Sensor Networks, High-speed Networks, Network Security</td>
</tr>
<tr>
<td>S C Gupta</td>
<td>Visiting Faculty</td>
<td>Software Engineering, Databases, Cloud Computing, Software Defined Storage and Networks.</td>
</tr>
<tr>
<td>Subhash Bhalla</td>
<td>Visiting Faculty</td>
<td>Distributed Information Systems, MGMT of voluminous data</td>
</tr>
<tr>
<td>Manik Varma</td>
<td>Adjunct Faculty</td>
<td>Machine Learning and Computer Vision</td>
</tr>
<tr>
<td>Anupam Joshi</td>
<td>Visiting Professor</td>
<td>Intelligent Networked Systems and Mobile Computing</td>
</tr>
<tr>
<td>Yogish Sabharwal</td>
<td>Adjunct Faculty</td>
<td>Optimization of HPC Challenge (HPCC)</td>
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INTRODUCTION

IIT Delhi has been active in Computer Science education and research since the early 1970s and the Department of Computer Science and Engineering was established in 1982. The department currently has 27+ faculty members (all Ph.D. from leading institutions). This number is expected to grow in the coming years. Apart from full time faculty, the Department currently has several visiting and adjunct faculty members from leading academic & research Institutions and labs.

ACADEMIC PROGRAMME

CSE department currently offers

- B.Tech. (4 yr),
- Dual Degree, M.Tech. (5 year Integrated),
- MTech (2 yrs)
- M.S.(Research)
- Ph.D.

The curricula for UG and PG were recently revised and are in line with current international trends and are compatible with ACM Curriculum. Our curricula are also used as model curricula by other Indian universities and colleges. The emphasis of the curricula is on system architecture, algorithms, networking, machine learning, performance issues and tools for applications development. The stress is more on design, methodology, analysis, and good software practices. As part of graduation requirements, undergraduate student is expected to complete a one-semester project major part-I as core and one semester project major part-II (optional) which may involve developing a subsystem that typically contributes to fulfilling the objectives of some research project. For the dual degree students, 1 year two projects (MTP1 and MTP2) are core where the students are expected to undertake a project which has significant research component. New curriculum also provides specialization in core fields of computers to UG students. Two year M.Tech.programme in CSE is of two types in revised curriculum. One is MTech with course work and other is MTech by thesis. In course work MTech, Project part-I (MTP-I) is core whereas in MTech by thesis, project part (MTP-II) is also core. The students are expected to undertake a project which has pure research component.

Admission to the programmes is highly competitive; for the undergraduate and dual degree programmes, there is a nation-wide Joint Entrance Examination (JEE) Advanced where approximately top 150,000 students (Senior Secondary School) who cleared JEE Main appear annually and candidates only from the top 300 are offered admission to the CS programmes. Similarly, applicants at the Masters/Ph.D. level, with a score of 99 percentile or better in the nation-wide GATE exam are offered admission. A significant number of currently employed computer professionals and college teachers are also enrolled in our postgraduate programmes as sponsored candidates.

The current student population in the department is about 700 (330 in Undergraduate, 150 in dual degree, 160 in Masters (MTech+MSR) and 60+ in Doctoral programmes).

RESEARCH AREAS

The faculty is engaged in quality research in diverse areas including Algorithms, CAD for Digital Systems, Computer Networks & Distributed Systems, Robotics, Vision and Graphics, Semantics of Programming Languages and Data Mining. Sponsored research projects have been carried out in many areas in the last five years. These include:

- Sensor Networks
- Computer Graphics
- Computer Vision
- Parallel Computation
- Application Specific multi-processor SOC Design
- Design Methodology for Embedded Real time Systems
- Network and OS support for Multimedia Communications
- Network and Enterprise Security
- QoS issues in High-speed Networks
- Artificial Intelligence, NLP & Location Based Services
- Data Mining
- Neuro imaging and Yogic Neuroscience
- Information Security
- Wireless Network Architecture
- Dynamic and Static approaches for Software Checking
- Software Oriented Architecture and WebServices
- Software Verification
- Information Retrieval

RESEARCH GROUPS

- Algorithms and Complexity Theory
- Architecture and Embedded Systems
- Artificial Intelligence and Machine Learning
- Computer Networks and Distributed Systems
- Databases and Data Analytics
- Graphics and Computer Vision
- Operating Systems, High Performance Computing
- Programming Languages, Semantics and Verification

1. Research Groups at glance
2. Specific Research carried out

**CAD of Digital Systems:** Design automation tools for VLSI, application specific instruction processor synthesis, hardware software co-design, high-level synthesis, and hardware specification and verification.

**Artificial Intelligence and Location based Services:** Blackboard architecture, expert systems, natural language processing, machine learning, parallel heuristic search, Location based recommendation and privacy.

**Vision and Graphics:** 2D and 3D object recognition, real-time motion tracking, image compression, image based geometric modeling, 3D graphics and animation.

**Computer Networks:** Multimedia information representation, synchronization and retrieval, and interactive communications, network security, high-speed networks, sensor networks, congestion control, wireless & mobile communications.

**Theoretical Computer Science:** Algorithmic graph theory, computational geometry, complexity theory, logic, semantics and algebraic theories of concurrency, randomized algorithms and approximate algorithms.


**Programming Languages and Formal Methods:** Design and implementation of programming languages, program analysis, Verification of Systems and pro---Process calculi and concurrency theory, Mobile Computation models, Logics--modal, temporal Theorem Programming & type systems, Fundamentals of distributed Computing.


**Data Analytics:** Semantic web data management, opinion mining, machine learning techniques for data analysis, efficient ranked retrieval of structured data, information extraction from unstructured data, news analytics, Structure and content of online social networks, analysis of user behavior in social networks, transient social networks.

**Information and Communication Technologies for Development:** Rural network measurements and content distribution, ICT for health services, community radio.

**LABORATORY FACILITIES**

Computing resources in the department include several high end servers, server clusters, data storage systems and all of these are networked and connected to more than 200PCs and workstations. Every faculty member, staff and Ph.D. student has a fully networked work-station with full access to the Internet and more than adequate long term storage space in the central repository. Every undergraduate and postgraduate student is also given full access to the Internet and the Department servers. Besides, all the laboratories in the Department also provide full access to the internet and to the central repository. Other major equipment includes EDA software, multi-million gate FPGA based prototyping and validation system, several Robot platforms etc. The PCs and workstations are connected through 10/100 mbps/slinks. The departmental network is connected to the Institute-wide network through a 1Gbps switched fiber optic line. There is 100Mbps link to the outside world.

**MAJOR LABORATORIES**

**General Computing Lab (GCL):** This laboratory supports the general purpose computing needs of most students. It houses more than 70 workstations and provides full email and internet access. The servers provide the software required for laboratories in most of the Department courses.

**Digital Hardware Design Lab:** This laboratory supports the training and project needs of the students in the area of digital hardware design. Facilities include microprocessor based system design and FPGA based design.

**Advanced Networking Lab:** Besides providing access to ERNET and internet services, the laboratory supports development of multimedia communications and applications, ATM protocol stack, wireless and mobile communications, network, security and simulation studies in high-speed networks.
Vision & Graphics Lab: The laboratory supports development efforts in two areas, namely real-time vision and graphics. The facilities include latest graphics workstations, robot manipulators, computing clusters, virtual reality and other state of the art equipment.

Philips VLSI Design Lab: The Laboratory, established in 1996 with support from Philips Semiconductors as part of VLSI Design, Tools and Technology Programme houses a state-of-the-art CAD facility consisting of several servers and work stations. P4 clients, X-terminals, plotter and VLSI design software. The CAD facility features in-house, commercial and public domain software (including Cadence and Synopsys) for VLSI synthesis and simulation.

FPGA Lab: This lab was created in 1997 to house the FPGA based design activity which started in Digital Hardware Design Lab, and grew substantially. Facilities to work with reconfigurable hardware in hardware software co-design environment have been added subsequently. The laboratory has specialized co-processor boards for implementing designs up to the complexity of six million gates.

Al & Database Lab: This Laboratory features a server supporting ORACLE and several access machines.

Verification Lab: This laboratory hosts several workstations supporting various specialized model-checking and verification tools.

Architecture, Embedded & Energy Sensitive Computing Lab: This lab state of the art workstations, and a Dell storage server for supporting research activities in high performance computer architecture and modern embedded systems.

Cyber Security Research Lab: The mandate of the cyber security lab is to carry out fundamental research in the areas of Cryptography, Computer System & Network Security and Advanced Information Systems Security. We are particularly focused on developing provably secure algorithms to meet the efficiency and security demands of emerging technology trends such as cloud computing.

Data Analytics and Machine Learning Lab: Data analytics as a field of computer science is comparatively new and is an amalgamation of other fields such as data management, information retrieval, machine learning, natural language processing, data mining and statistics. It is concerned with consuming and processing large amounts of diverse data, including, text (HTML web pages, online books, scientific publications, etc.), structured data (for example, data residing in database systems), video, audio, etc. to derive useful insights. The current focus of lab would be on processing large scale text-data and processing large scale graphs. Open Information Extraction, Coherent Large-Scale Multi-Document Summarization, AI Applications to Crowd-sourcing, Commonsense Knowledge Extraction & Natural Language Processing over Microblogs.

Cloud Computing Lab (HIPC Lab): The lab contains infrastructure facilities for research in high-performance computing, operating system and compiler design, distributed and cloud computing.

Neuroimaging Lab: This lab is equipped with high end graphics terminals for Neuroimaging data analysis. It has also acquired a very high capacity file servers and servers for storage and processing of the data. Facilities for different types psychometric testing are being developed. Eye tracking equipment is expected to be operational in the few months’ time. The research requires working with human subjects and patient population. To facilitate such research, collaborations with institutions such as All India Institute of Medical Sciences (AIIMS), National Brain Research Center (NBRC) and Institute of Nuclear Medicine and Allied Sciences (INMAS) is already in place. The lab will offer one of the best environment in the country to carry out cutting edge interdisciplinary research work bordering computational and neural sciences.

OUTREACH PROGRAMS

1. Video Courses
   - NPTEL (National Programme on Technology Enhanced Learning)) and QEEE (Quality Enhancement Engineering Education) Live Streaming
   - Participation in Remote Postgraduate Instruction Programme for Ethiopia

2. Conferences/ Workshops Organized every year -> 3 to 4

3. International Visitor Seminars annually -> 50+
SIGNIFICANT INTERNATIONAL COLLABORATION

- DST-DFG Goetingen – Algorithms Engg
- Indo-Australia, NICTA – Networking
- Indo-Brazil, UFRGS, Exploratory 3D Visualization
- Indo-Israel, Hebrew - Optimization for Video Analysis
- DST Indo-Sweden, KTH
- DST-DFG: OFFIS, Oldenberg (Low power multi-core processors)
- DST DAAD, Dortmund
- Univ of Washington, Seattle, Darpa – Document Summarization
- Coordinating Indo-Netherlands Diety Effort

4. CS&E at IIT Delhi ranked #1 CS department in India by QS Rankings (2015-16)

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<thead>
<tr>
<th>Institution</th>
<th>Ranking</th>
<th>Academic Reputation</th>
<th>Employer Reputation</th>
<th>Citations per paper</th>
<th>h-index citation</th>
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<tr>
<td>IIT D</td>
<td>51-100</td>
<td>64.0</td>
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<td>56.0</td>
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IIT Delhi leads in both research metrics
HIGHLIGHTS OF VARIOUS RESEARCH AND DEVELOPMENT ACTIVITIES

1. **Entrepreneurship development with societal impact**
   Technology- Assistech: A laboratory for innovative and affordable assistive devices for the visually impaired

2. **Gramvaani: a unique social enterprise that targets use of ICT for rural India**
3. IMPECS: Indo-German Research Center

4. Digital Heritage Preservation
5. **Baadal: Indigenous Cloud Computing Platforms**

6. **Kritikal: Technology Startup**