International Institute of Information Technology Bangalore
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http://www.iiitb.ac.in

Call for Applications for
Doctor of Philosophy and Master of Science by Research/ Master of Science (Research)
Degree Programs for July of 2016
(Advertisement published on March 10, 2016)

International Institute of Information Technology Bangalore (IIITB) invites applications for its research degree programs, namely, Doctor of Philosophy and Master of Science by Research/ Master of Science (Research) programs, for admissions in *JULY* of *2016*. Both programs have full-time as well as part-time registration options. The students admitted to these programs will be referred to as research scholars.

The funding for the fellowships for Ph.D. students will be from government agencies (the specifics will be notified by March 15, 2016), COPAS project (DeitY), and industry-sponsored fellowships from ABB and others *(Funding sources updated on March 01, 2016)*. **The funding for fellowships for Master of Science by Research will be from various sponsored projects.**

1. Research Domains:
At IIITB, there are seven research domains, which have openings for both the degree programs, except for Mathematics & Basic Sciences, which have openings exclusively for the Doctor of Philosophy program. The following table lists the research domains for which there are openings for research scholars to be admitted in July 2016. *Below-mentioned openings are applicable to both full-time and part-time registrations.*

Research Domain	Indicative Research Areas
Computer Science (CS)	Algorithms; Cryptography; Computational biology, computational sustainability, services computing, intelligent transportation systems; Optimization, Artificial Intelligence, Natural Language Processing, computer architecture, robotics; Feedback control systems; *Computational Topology (Topics added on March 10, 2016.)*
Data Sciences (DS)	Visual analytics (in GIS, healthcare, social networks, and other related applications), heterogeneous high-performance computing; Machine learning, optimization; Geometric algorithms for medical visualization, 3D Printing; Multimedia management using control theory; *Scientific data visualization using computational topology; data sciences in e-health (Topics added on March 10, 2016.)*
Electronic Systems Design (ESD)	Model Based Hardware-Software Co-Synthesis of Reconfigurable Embedded Systems; Electronic Design Automation, especially timing optimization; CNT modelling for 3D integrated circuits; Wideband antenna design; Analog-and-Mixed-Signal Circuit Design; RF Circuit Design; Implementation issues for feedback control
IT & Society (ITS)	ICT regulations and public policy, techno-economics of information network, ICT for development/health/education/agriculture, gender and ICTs, e-Governance for development, innovation systems in the ICT industry, ICT and work practices in organizations, urban systems, political economy of information, right to information in practice, digital groups and identities, governance analytics and toolkits
Mathematics & Basic Sciences (MBS)	Chemistry: Computational chemistry, electronic structure calculations, structure & energetics of van der Waals complexes

	Mathematics: Number theory; in particular, algebraic number theory, Diophantine equations, Galois module structure and elliptic curves Physics: Dynamical systems theory, complex systems and soft matter physics including complex fluids, cavitation & bubble dynamics, studies of instabilities & synchronization in nonlinear systems (both physical, biological, and polymeric systems); 3D simulations and modeling of Hydrodynamic and Magnetohydrodynamic turbulent flows (involving research in fundamental physics / astrophysics / mechanical engineering)
Networking, Communications & Signal Processing (NCSP)	Software Designed Networks; Context aware systems; Internet of Things; Network security; Computer vision and image processing for control applications; ***Medium Access Control protocol, spectrum allocation, design of energy management strategies for smart building (Topics added on March 01, 2016.)***
Software Engineering (SE)	Requirement engineering; Testing; Reverse engineering; Verification and validation; Application of program analysis, model checking, and theorem proving in software analysis; Software architecture; Software engineering issues of web based, embedded, mobile systems, IoT.

Brief description of the active research in the afore-mentioned research domains is given in item# 6.

In the case of part-time applications, applicants are requested to ensure that they can obtain appropriate IP clearance and No Objection Certificate from their employers for their academic work at IIITB, well in advance.

2. **Minimum Eligibility Criteria:**

Applicants to the Doctor of Philosophy program should **hold a masters degree**, as well as have **good academic and technical track record.**

As an admission criterion placed for Doctor of Philosophy degree by the University Grants Commission, we require applicants to take either a national entrance examination, as specified by concerned research domain, or a domain-specific entrance examination at IIITB before the interview.

<u>**Research domain-specific requirements are as follows:**</u>
- For applicants to **Computer Science, Data Sciences, Electronic Systems Design, Networking Communication & Signal Processing, and Software Engineering,** a four-year bachelors degree in engineering (B.E., B.Tech. or equivalent) is required for the Master of Science by Research/ Master of Science (Research) program; and a masters degree in engineering (M.E., M.Tech. or equivalent) is required for the Doctor of Philosophy program. Additional specific requirements are as follows:
  - ➢ **Computer Science**:
    1. Master of Science by Research/ Master of Science (Research) applicants should have a valid GATE score of at least 600;
    2. Doctor of Philosophy applicants should have written/taken GRE or GATE in the last five years.
    3. Screening/ shortlisting will be based on GATE score and other application details furnished by the applicant, followed by an interview.
  - ➢ **Data Sciences**:
    1. Applicants should have taken one of the following examinations:
       - GATE examination for Computer Science,
       - A 45-minute written examination conducted by the research domain at IIITB exclusively for applicants to Data Sciences.

- Screening/ shortlisting will be based on the afore-mentioned score and other application details furnished by the applicant, followed by an interview.
  - ➢ **Electronic Systems Design**:
    1. Applicants should have a GATE score.
    2. Screening/ shortlisting will be based on GATE score and other application details furnished by the applicant, followed by an interview.
  - ➢ **Networking, Communications & Signal Processing**:
    1. Applicants are encouraged to take GATE or GRE examination.
    2. Exceptional applicants without a GATE or GRE score may be required to take a written examination or an oral examination at IIITB, as decided by the faculty in the domain.
  - ➢ **Software Engineering**:
    1. Applicants should have a GATE or GRE score taken in the last five years.
    2. Candidates with suitable industrial or academic experience and credentials may apply without competitive exam (GATE/GRE) scores, which may be waived.

- For applicants in **Physics and Chemistry**, eligible candidates should have satisfied the following requirements:
  - The minimum qualification required is an M.Sc. in Physics or Chemistry, respectively, or a masters degree (M.Sc., M.E., M.Tech. or equivalent) in related disciplines.
  - Candidates should have appeared and qualified in a national entrance test (CSIR-UGC NET, UGC-NET, or JEST examination). This requirement may be waived for candidates with a masters degree in engineering (M.E., M.Tech. or equivalent).
  - Screening/ shortlisting will be based on the scores obtained in the afore-mentioned examinations or a written examination at IIITB, and other application details furnished by the applicant followed by an interview.

- For applicants in **Mathematics**:
  1. The minimum qualification required is a masters degree in engineering (M.Tech., M.E. or equivalent) or a masters degree in Mathematics.
  2. Candidates should have appeared and qualified in one of the two national entrance examinations: CSIR-UGC NET or NBHM. This requirement may be waived for candidates with a masters degree in engineering (M.E., M.Tech. or equivalent).
  3. Screening/ shortlisting will be based on the scores obtained in the afore-mentioned examinations or a written examination at IIITB, and other application details furnished by the applicant followed by an interview.

- For applicants in **IT & Society**:
  1. Candidates with a masters degree in any of the social sciences are eligible to apply for Master of Science by Research/ Master of Science (Research) and Doctor of Philosophy in the ITS domain.
  2. In addition, candidates with a four-year bachelors degree in engineering (B.E., B.Tech. or equivalent) can apply for the Master of Science by Research/ Master of Science (Research) program; and those with a masters degree in engineering (M.E., M.Tech. or equivalent) can apply for the Doctor of Philosophy program.
  3. Candidates are encouraged to provide a valid score in GATE, JRF, NET, GRE, or GMAT along with their applications. Those without such a score may apply as well.
  4. Shortlisted candidates may have to take a written examination at IIITB when called for interview.

3. Fellowships/Scholarships & Tuition Fees:

- For **full-time Master of Science by Research/ Master of Science (Research) students, a fellowship of INR 12,000/- per month** is available. *(Note: The fellowship amount is subject to change and will be updated by March 15, 2016.)*
- For **full-time Doctor of Philosophy students, a fellowship of INR 25,000/- per month** is available. *(Note: The fellowship amount is subject to change and will be updated by March 15, 2016.)*
- The tuition fees, as applicable for admissions in July 2015, for both the programs is **INR 30,000/- per semester** till the student completes submission of the thesis. (*Note: The tuition fees are subject to change, and the changes will be updated by March 15, 2016).*
- In addition, residential students currently pay approximately **INR 3000/- towards hostel rent per month and approximately INR 4000/- per month for food expense**. These rates are subject to revision from time to time. Other costs for books and supplies, travel, purchase of a laptop, etc., need to be factored by students depending on their individual circumstances.

4. How to Apply?

- At the admissions portal, http://iiitb.campusmetalink.com/CmlPortal/login.cml, the instructions on how to apply will be provided on registering and application fee payment. Registering on the admissions portal will give an **application ID** which is required for completing the rest of the admissions process.
- All applicants need to pay a **non-refundable application fee of INR 1000/-**. The payment is to be made via bank transfer (NEFT) using application ID generated during registration at the admissions portal. The detailed instructions on making the payment are available at the admissions brochure.
- It is mandatory for all applicants to get **two recommendation letters**.
- The application package should contain: (i) a cover letter summarizing the application (including research interests and the topic of interest), (ii) a hard-copy of the recentmost curriculum vitae (including name as per 10th grade marksheets or government-issued photo-identification document, postal address, contact mobile number, details of two recommenders/references), (iii) a self-attested copy each, of all relevant academic transcripts, (iv) two recommendation letters, (v) a self-attested copy of photo ID (proof for name given in curriculum-vitae), (vi) a statement of purpose (a 1000-word essay including research interests and relevant experience), (vii) a statement of research preparation on how the applicant has objectively prepared him/herself to undertake the demanding research program at IIITB, (viii) proof of NEFT transaction for the application fee, and (ix) if available, a list of relevant publications. ***The cover letter must clearly indicate the application ID generated from registration process. If an application package does not include the application ID, it will not be considered for further scrutiny.***
- The application package must be submitted in an envelope addressed to ``The Registrar, International Institute of Information Technology Bangalore, 26/C Electronics City, Hosur Road, Bangalore 560100, India.'', mentioning at the top ***"Attn: Research Degree Programs Admissions for July 2016"***. The envelope may be sent via post or can be dropped off in person at the reception of IIIT Bangalore.
- If the recommenders insist on single-blind recommendation letters (i.e. the applicant does not see the recommendation letter), the recommender(s) may send it directly by post to the Registrar in the aforementioned address. *However, it is the onus of the applicant to (a) inform the concerned recommender the application ID, as well as the deadline, and (b) mention in the cover letter that the recommendation letters may be expected separately.*
- Academic transcripts pertaining to all degree programs (including term/semester performance reports/grade cards) completed by the applicant will be deemed relevant. If the applicant is seeking provisional admission for Masters or Ph.D. program, as in is currently completing Bachelors or Masters degree, respectively, the applicant may state so in the cover letter.
- All queries may be sent via e-mail to the Institute: **research.admissions@iiitb.ac.in** .
- The degree program manuals are available at **http://www.iiitb.ac.in/degree-programs**
- On **Feb-11-2016**, the admissions brochure will be ready for download at **http://www.iiitb.ac.in/degree-programs** .

5. Important Dates:

Dec-01-2015: Call-for-Applications (Pre-announcement).
Jan-27-2016: Call-for-Applications (Formal Announcement).
Feb-09-2016: Online application submission begins.
Feb-11-2016: Free Admissions Brochure ready for download.
Mar-23-2016: Last date for online application submission, remittance of application fees, and receiving application packages by post.
Apr-05-2016: Notification of selected candidate for on-site evaluation.
May-03-2016: Week of written entrance examination (as required specifically by research domains) and interviews.
May-10-2016: Notification to admitted students along with admission offer letters via email.
May-24-2016: Last date for remittance of acceptance fee by the admitted candidates.
Jul-11-2016: Preparatory Term for M.Tech. program begins (optional for research scholars)
Jul-29-2016: Joining date: orientation and course registration begins.
Aug-01-2016: Classes begin for Term I (2016-17).
Aug-08-2016: Last date for add/drop courses, and course registration for the Term I closes.

6. Brief Description of Research Domains

- **COMPUTER SCIENCE (CS):** If Computer Science is about the use of computational techniques and thinking for solving problems, it stands to reason that computer science in turn can and must be applied to address the many critical problems of the 21st century, of which we may mention the need for smart machines and complex systems that can work with humans seamlessly and improve society as a whole, and sustainable development and usage of systems to make effective use of scarce and expensive resources such as energy. The tools and paradigms used to address such problems can themselves be new ones, other than merely the ones traditionally found in the repertoire of computer scientists. To this end, our work in the computer science research domain covers diverse topics dealing with theory as well as application areas, such as smart grids, supply chains and their optimization, algorithms, machine learning, cloud computing, dynamic modeling and control of servers, and renewable energy. With the tremendous rise in distributed computing applications, the issue of security and privacy in distributed applications has got tremendous attention from the research community in the past decade. A major theme of the cryptographic research at IIITB is secure distributed computing, with emphasis on secure multi-party computation (MPC) and verifiable computation, both at the theoretical as well as applied level. While we strive to be rigorous and thorough in all our research, whether theoretical or applied, we are also aware of the multi-disciplinary context and significance of our work, and strive to address issues that are relevant to society in general and industry in particular. The focus of work in Computational Topology at IIITB is towards using topological methods for improving visual representation and information extraction from scientific datasets.
  FACULTY INVOLVED: Prof. Amit Chattopadhyay, Prof. Ashish Choudhury, Prof. Meenakshi D'Souza, Prof. V. N. Muralidhara, Prof. G. N. S. Prasanna, Prof. Sachit Rao, Prof. Shrisha Rao, Prof. G. Srinivasaraghavan.

- **DATA SCIENCES (DS):** The Data Sciences research domain focuses on all aspects of data management, processing, modeling, and information retrieval. The current areas of interest include: Database Design, Information Retrieval, Network Analysis, Mining Latent Semantics, Data Mining and Data Warehousing, Knowledge Representation and Reasoning, Linked Data and Semantic Web, NoSQL Databases, Stream Data Management, Multimedia Management using Control Theory, Analytics, Graphics & Visualization, and GPU Computing, Applied Machine Learning, Computational Social Sciences, Computational Topology.
  FACULTY INVOLVED: Prof. Amit Chattopadhyay, Prof. Chandrashekar Ramanathan, Prof. Dinesh Babu Jayagopi, Prof. Jaya Sreevalsan Nair, Prof. Sachit Rao, Prof. Srinath Srinivasa, Prof. G. Srinivasaraghavan, Prof. T. K. Srikanth.

- **ELECTRONIC SYSTEMS DESIGN (ESD):** The Electronic Systems Design domain encompasses a broad range of topics covering several aspects of both, digital and analog hardware systems, implemented using FPGAs and custom fabricated VLSI circuits, design methodologies around EDA flows, verification and validation, and system prototyping; realization of real time embedded systems where both the hardware and the software components are treated agnostically based on end system requirements; embedded implementation of feedback control using variegated sensors. Emphasis is also placed on emerging technologies based on Micro and Nano-electro mechnical devices – fabrication of 2D/3D structures, characterization and system applications.
  FACULTY INVOLVED: Prof. Chetan Parikh, Prof. Madhav Rao, Prof. Sachit Rao, Prof. Srinath Naidu, Prof. Subajit Sen, Prof. Subir K. Roy.

- **INFORMATION TECHNOLOGY & SOCIETY (ITS):** The Information Technology and Society research domain at IIITB is broadly concerned with the social role of information and communications technologies (ICTs) with a focus on the policy challenges and the institutional demands posed by technological change. Teaching and research in the stream focuses on three inter-related areas. First, it seeks to understand innovation and the organization of production in the ICT industry, or how, why and where ICTs are produced. A second area of interest is in how ICTs can be used to harness the legitimacy and the powers of bureaucracies and markets to address needs in different social domains. Of special interest are the domains of governance, education, health and manufacturing. A third area is the tools and analytical techniques that can be deployed to understand the production and consumption of ICTs. These include geographical information systems, modeling, simulation and visualization. The domain encourages inter-disciplinary research and has associated faculty members with expertise in social sciences, including in economics, economic geography, sociology, development, management, governance and public administration.
  FACULTY INVOLVED: Prof. Amit Prakash, Prof. Balaji Parthasarathy, Prof. Bidisha Chaudhari, Prof. Janaki Srinivasan, Prof. Preeti Mudliar, Prof. S. Rajagopalan, Prof. V. Sridhar, Prof. Vinod Vyasalu.

- **MATHEMATICS & BASIC SCIENCES (MBS):** The research at IIITB in Chemistry, Mathematics and Physics is as follows:
  - In **CHEMISTRY**, the research at IIITB primarily is in the area of electronic structure calculations. Particularly, weak interactions (pi-pi, CH-pi etc.) present in various systems (small model systems, protein-ligand systems, DNA bases, nanotubes etc.) are investigated using quantum chemical methods (HF, MP2, CCSD(T) & DFT). Additionally, the work entails unravelling the role of such weak interactions in the field of drug-design, polymers, nano-devices and in new materials. Some of the recent research works show that pi-pi and CH-pi interactions are invariably present in the crystal structures of bio-molecules and play important role in their structure as well as functions.
    FACULTY INVOLVED: Prof. Brijesh Kumar Mishra.
  - Research in **MATHEMATICS** is principally in the area of Number Theory; in particular, Algebraic Number Theory, Galois Representations, Modular Forms, Iwasawa Theory. Diophantine Equations, Galois Module structure and Elliptic curves. Research is also conducted in the fields of Algebraic Complexity Theory and Cryptography. The following two problems are representative of the mathematics research in IIITB: Let E be an elliptic curve over number field K. For every prime P where E has good reduction at P, we get one imaginary quadratic field associated to E. We are trying to see if we can get all imaginary quadratic fields by this procedure?
    FACULTY INVOLVED: Prof. Manisha Kulkarni.
  - In **PHYSICS**, there are two sub-domains of research focus at IIITB: (a) One sub-domain of research focus is on soft condensed matter physics, complex systems & dynamical systems theory, instabilities & synchronization in nonlinear systems (both physical and biological), and macromolecular systems. Topics include bubble dynamics & cavitation, vesicular nanotubulation, polyelectrolytic solutions, combustion, phase transitions in computationally hard problems, models of sensory systems, precipitation phenomena, etc.; (b) The other sub-domain of physics research is in computational fluid mechanics, especially simulations & modeling of hydrodynamic and magnetohydrodynamic turbulent flows, reduced resistive MHD simulations, low resolution simulations of 3D-HD and MHD turbulent flows including rotation & helical forcing and 3D-anelastic HD and MHD code.

FACULTY INVOLVED: Prof. Balakrishnan Ashok, Prof. Shiva Kumar Malapaka.

- **NETWORKING, COMMUNICATION & SIGNAL PROCESSING (NCSP):** The Networking, Communication and Signal Processing research domain focuses on all aspects of networking, communications, and signal processing. The current topics of interest are: Computer networks, Network security, Wireless communication, Signal processing, Medical signal processing, Computer vision, Control of unmanned systems using image processing and computer vision.
  FACULTY INVOLVED: Prof. Debabrata Das, Prof. Dinesh Babu Jayagopi, Prof. Jyotsna Bapat, Prof. Neelam Sinha, Prof. Sachit Rao, Prof. Tricha Anjali.

- **SOFTWARE ENGINEERING (SE) :** Software engineering (SE) brings together interesting avenues of both fundamental and applied research contributing to the broad spectrum of activities involved in the creation of large, complex, industrial strength software systems having high quality, dependability and within reasonable resources. The current research covers a wide variety of areas ranging from empirical to formal aspects of SE. At IIITB, the research in SE covers both upstream (requirement and design) and downstream (testing and maintenance) SDLC activities cutting across a variety of application domains (enterprise, embedded etc). Here is a list of some of the broad areas in which our faculty members are working: Pattern oriented software engineering, software architecture, distributed software engineering, model driven software engineering (MDSE), software testing, verification and validation (V&V) of web-services and V&V of embedded software (cyber-physical systems and adaptive systems) among others.
  FACULTY INVOLVED: Prof. Chandrashekar Ramanathan, Prof. K. V. Dinesha, Prof. L. T. Jayprakash, Prof. Meenakshi D Souza, Prof. Sujit Kumar Chakrabarti.