

# INDIAN INSTITUTE OF TECHNOLOGY DHARWAD



॥ सा विद्या या विमुक्तये ॥

भारतीय प्रौद्योगिकी संस्थान धारवाड

Indian Institute of Technology Dharwad

**Department of Mathematics**

**Information Brochure**

**Ph.D. Admissions**

**Autumn Semester (2019-20)**

## A. SCHEDULE OF Ph.D. ADMISSION

S. No.	Particulars	Dates
1	Availability of online application forms	
2	Last date for submission of completed application forms	Friday, 17/05/2019
3	Listing of shortlisted candidates for the Selection Process <sup>1</sup>	Friday, 31/05/2019
4	Date for the Selection / Examination Process	Thursday, 04/07/2019
5	Declaration of the Result of the Written Test	Thursday, 04/07/2019
6	Date for the Interview Process	Thursday, 04/07/2019
7	Display of the final result <sup>2</sup>	Monday, 08/07/2019
8	Last date for the Fee Payment	Friday, 19/07/2019
9	Date of Joining	Monday, 29/07/2019

## B. ELIGIBILITY FOR ADMISSION

Category	Educational qualification
General	The eligibility criteria in the qualifying degree is <b>First Class</b> , as specified by the candidate's Institution/University. If the Institution/University does not specify the division/class, then one of the following will be considered as the eligibility criteria: (1) A minimum of 60% marks (without round off) in aggregate <b>or</b> (2) a minimum Cumulative Grade Point Average (CGPA) <b>or</b> Cumulative Performance Index (CPI) of 6.0 on the scale of 0-10; with corresponding proportional requirements when the scales are other than on 0-10, (for example, 4.8 on a scale of 0-8).
OBC (NC)	Same as general
SC/ST/PWD	A relaxation of 5% in the qualifying degree is applicable

In addition to above, a candidate must satisfy one of the following:

1. B. Tech students having background in Engineering Physics, Computer Science, Mechanical or Electrical Engineering with valid GATE score.
2. M.Sc. in Mathematical Science or Computer Science - candidates should possess valid GATE score.
3. M.Phil. in Mathematical Science are exempted possessing valid GATE score.
4. M.Tech students with Computer Science, Mechanical or Electrical Engineering background – candidates are exempted from possessing VALID GATE score.
5. Junior Research Fellowship in Mathematical Sciences from CSIR, UGC, DST (INSPIRE fellowship), and other externally funded candidates are encouraged to apply and they are exempted from possessing valid GATE score.

<sup>1 & 2</sup> Will be announced on the institute webpage

## **C. APPLICATION CATEGORIES AND FINANCIAL SUPPORT**

The Department of Mathematics admits Ph.D. candidates under the full time research scholarship - Teaching Assistantship (TA) and Fellowship Award (FA).

### **C.1. Fellowship Awardees**

Students with valid fellowship from CSIR, UGC, DBT, ICMR, etc. can apply in this category.

### **C.2. Teaching Assistantship (TA)**

Funded by MHRD, the TAs are expected to assist in the academic/administrative work for smooth functioning of the Institute. Students under this category are entitled to financial support as per MHRD norms.

For students with MSc./M.Tech./M.E./M.Phil. or equivalent degree as the qualifying degree, the assistantship is payable for a maximum duration of 5 years or up to the thesis submission, whichever is earlier. At present, the monthly rate of assistantship is 25,000 for the first 2 years and enhanced rate of 28,000/- for the remaining period.

For students with B.Tech./B.E. or equivalent degree and students with M.Sc. or equivalent as the qualifying degree and having valid GATE score or having Junior Research fellowship (JRF) of UGC/CSIR or DST INSPIRE fellowship, the assistantship is payable for a maximum duration of 5 years or up to the thesis submission, whichever is earlier. At present, the monthly rate of assistantship is ₹25,000/- for the first two years and enhanced rate of ₹28,000/- for the remaining period.

To get Teaching Assistantship, the students concerned must assist in teaching, research and/or administrative work as assigned by the respective Academic Unit to the extent of 8 hours of work per week.

The continuation of the assistantship will be subject to satisfactory performance of the duties assigned by the Departments as well as satisfactory academic performance.

Employees on the rolls (with or without pay) of any organization are not eligible for admission under this category.

As per MHRD directives, the employees of any organizations with or without pay are not eligible for admission under TA category. Candidates selected in this category have to resign from the current job and submit a relieving letter from their employer before joining the programme. Students getting assistantships from the Institute may join projects sponsored by external agencies and obtain corresponding fellowships in lieu of TA ship.

## **D. GUIDELINES FOR THE SHORTLISTED APPLICANTS**

The following are the important guidelines of the institute to be followed by the shortlisted applicants on the day(s) of the selection process.

1. Shortlisted applicants should report to the institute on 4<sup>th</sup> of July, 2019 at 8.00 am.
2. No accommodation will be provided for the candidates during the selection process or interview.
3. Applicants should bring:
  - a. Photo ID card (any one from these: PAN/AADHAR/Driving Licence/Voter ID/Passport/Govt. issued ID/Educational Institute ID)
  - b. Printed copy of the application
  - c. Thesis/dissertation/report of M.Tech./M.E./MSc-Engineering or equivalent degree
  - d. Copy of certificates and mark-sheets
  - e. Two recent passport size photographs
  - f. Scientific calculator

### **D.1. DO NOT'S**

- a. Mobile phones are not allowed in the examination hall or in the interview room
- b. Department's decision is the final decision regarding any matter pertaining to this selection process.
- c. Institute doesn't take any responsibility of your luggage/items that you leave before entering the examination hall.

## **E. MODALITY OF THE SELECTION PROCESS**

- The selection process consists of MCQ type screening test. The duration of the exam would be 120 minutes. The syllabus for the exam is given below in the Information Brochure. Several areas are mentioned in the syllabus. Although all questions are compulsory, candidate doing well in just one of the areas also has a chance of getting selected.
- Each question will have 4 options to choose from. Only one option would be correct.
- The exam will have negative marking scheme. For MCQ questions, 1/3rd of the points allotted for that question will be deducted for wrong answers.
- Candidates who qualify in the screening test will be shortlisted for an interview. The interview will be conducted on the same day.
- Candidates should bring:
  - Printed copy of the online submitted application,
  - Government issued photo id card,
  - Date of Birth certificate,

- Degree certificate/s along with marks cards/aggregate percentage,
- Junior Research Fellowship offer letter from UGC/CSIR/INSPIRE fellowship or any other funding agencies.
- Valid GATE Score,
- Cast certificate,
- Income certificate

## **F. RESEARCH TOPICS**

- 1) Computational Mathematics and Numerical Analysis in application areas like Fluid Mechanics or Materials Science
- 2) Graph theory with a focus on structural graph theory, graph colorings, graph labelings and graph homomorphisms.

## **G. SYLLABUS FOR SCREENING TEST AND INTERVIEWS**

### **Analysis**

Elementary set theory, finite, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property, supremum, infimum. Sequences and series, convergence, limsup, liminf. Bolzano Weierstrass theorem, Heine Borel theorem. Continuity, uniform continuity, differentiability, mean value theorem. Sequences and series of functions, uniform convergence. Riemann sums and Riemann integral, Improper Integrals. Monotonic functions, types of discontinuity, functions of bounded variation, Functions of several variables, directional derivative, partial derivative, derivative as a linear transformation, inverse and implicit function theorems. Metric spaces, compactness, connectedness. Normed linear Spaces. Spaces of continuous functions as examples.

### **Linear Algebra**

Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations. Algebra of matrices, rank and determinant of matrices, linear equations. Eigenvalues and eigenvectors, Cayley Hamilton theorem. Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms. Inner product spaces, orthonormal basis. Quadratic forms, reduction and classification of quadratic forms.

### **Complex Analysis**

Algebra of complex numbers, the complex plane, polynomials, power series, transcendental functions such as exponential, trigonometric and hyperbolic functions. Analytic functions, Cauchy-Riemann equations. Contour integral, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem, Maximum modulus principle, Schwarz lemma, Open mapping theorem. Taylor series, Laurent series, calculus of residues. Conformal mappings, Mobius transformation.

### **Discrete Mathematics**

Counting, the pigeon-hole principle, principle of inclusion exclusion, derangements, recurrence relations, ramsey theory, trees, matching, connectivity, planar graphs, coloring and chromatic number, cliques, independent sets, regular graphs, bipartite graphs.