

**INDIAN INSTITUTE OF TECHNOLOGY
DHARWAD**



॥ सा विद्या या विमुक्तये ॥

भारतीय प्रौद्योगिकी संस्थान धारवाड
Indian Institute of Technology Dharwad

Information Brochure

(For Indian Nationals)

Ph.D. Admissions

Autumn Semester 2021-22

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A. SCHEDULE OF Ph.D. ADMISSION (Tentative)

Serial No.	Description	Relevant dates
1	Last Date to apply online	10-June-2021
2	Announcement of shortlist and Online Interview Schedule (tentatively)	15-June-2021
3	Online Interview ends	02-July-2021
4	Declaration of final list of selected candidates	14-July-2021
5	Admission for waitlisted candidates starts	22-July-2021
6	Admission for waitlisted candidates ends	23- July-2021

All potential candidates are requested to visit institute website regularly for updated information about the schedule, especially in context on ongoing Coronavirus (COVID-19) related developments. **Future updates regarding the admission process will be made available on the institute website under section Academics >> Admissions >> Ph.D.**

B. APPLICATION CATEGORIES & FINANCIAL SUPPORT

IIT Dharwad admits Ph.D. candidates under the full time research scholarship or Teaching Assistantship (TA) and part-time externally sponsored research scholars. However, **each department may not have opening in all the following modes of support.** More details can be found in the Appendix section corresponding to the department.

B.1 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 the financial support as per the MHRD norms.

1. For students with M.Tech./M.E./M.Sc.(Engg.)/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 ₹31,000 for the first 2 years and enhanced rate of ₹35,000/- for the remaining 3 years and HRA as per rules.
2. To get the 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.
3. The continuation of the assistantship will be subject to the satisfactory performance of the duties assigned by the Departments as well as satisfactory academic performance.
4. As per MHRD directives, the employees on the rolls (with or without pay) of any organization are not eligible for admission under this 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.
5. Students getting assistantships from the Institute may join projects sponsored by external agencies and obtain corresponding fellowships in lieu of TA ship.

B.2 Fellowship Awardee (FA)

B.2.a. Description – FA

The financial support under this category is provided by various Govt. / Semi Govt. schemes (CSIR, UGC, DAE, DST, DBT, NBHM, etc.) and some other organizations.

A valid Junior Research fellowship (JRF) award letter from the Govt. / Semi Govt. agencies (e.g. CSIR / UGC / DAE / DST / DBT / NBHM / (confirmed) DST INSPIRE, etc.) is required for the execution of this fellowship.

The amount and duration of the fellowship will be as specified by the awarding agency. The disbursement and continuation of the fellowship will be subject to as per the norms specified by the awarding agency or specified by IIT Dharwad, as deemed fit.

B.2.b. PMRF: A brief Note on Prime Minister's Research Fellowship

The Prime Minister's Research Fellows (PMRF) Scheme has been designed for improving the quality of research in various higher educational institutions in the country. With attractive fellowships, the scheme seeks to attract the best talent into research thereby realizing the vision of development through innovation. The scheme was announced in the Budget 2018-19. The institutes which can offer PMRF include all the IITs, all the IISERs, Indian Institute of Science, Bengaluru and some of the top Central Universities/NITs that offer science and/or technology degrees. The candidates will be selected through a rigorous selection process and their performance will be reviewed suitably through a national convention.

B.3 Project Assistantship (PA)

Funded from projects sponsored by industries and government funding agencies. Under this category, candidates will be paid fellowship as per the rules & regulations of the governing project.

B.4 Externally sponsored Ph.D. (EX)

The candidates employed in recognized R&D organizations and desirous of pursuing Ph.D. programme while in employment may apply for admission as external candidates. The option of external registration is for applicants who are working in well-equipped scientific institutions, laboratories, R&D establishments and industrial organizations engaged in research based activities. Persons working in colleges/universities are not eligible under this category. After fulfilling the coursework requirement at the Institute, these candidates will be allowed to register for Ph.D. with a Supervisor (internal) from the Institute and a Co-supervisor (external) from their parent organization where they will be doing the research work. The admissions are based on the following norms:

1. The competence of these candidates will be assessed along with the regular candidates.
2. On the day of selection process, the candidate should submit a Sponsorship Certificate (Appendix A) from the organization in which he / she is employed giving an undertaking that the candidate would be released from the normal duties to fulfill the coursework requirement (and qualifier examination, if applicable). The certificate should also provide details of facilities relevant to the research programme and available to the candidate.
3. The candidate is required to be at the Institute as a full-time student for the coursework (and

qualifier examination, if applicable) of his/her Ph.D. Programme. The coursework requirement is likely to be a period of 1-2 semesters. Depending on the student's background and the programme requirements, an additional semester may be needed to complete the coursework/qualifier examination.

4. To promote interaction between the internal supervisor and external co-supervisor, meeting between them should be arranged at least once in a year in the Institute or in the sponsoring organization.
5. The Ph.D. registration of an external candidate would be reviewed at the end of each year from the date of registration in terms of his progress in courses / seminars / approved research programme by a Research Progress Committee (RPC) nominated by the concerned Department Postgraduate Committee (DPGC).
6. At the time of joining the programme, the students will have to produce a “Relieving certificate” from his / her employer that he / she has been fully relieved from normal duties during the semester(s) to complete the course work and other academic work at IIT Dharwad.

Based on the information provided by the applicants a short-list of candidates called for the selection process will be declared on the Institute website on the date specified in the schedule. Only the short-listed candidates are permitted to participate in the selection process.

C. GENERAL GUIDELINES for APPLYING ONLINE

1. Please read all the instructions given in the brochure carefully before filing up the application form.
2. Please note that the application is to be filled at one go. There is no save and proceed option. The application process flow is given below.

Keep all the documents handy >> pay the application fee through SBI e collect facility >> Note down SBI e collect reference No>> Start online application form>> Fill all particulars including SBI e collect reference No>> Take a print/ save a pdf copy of preview of completed application form >> Final submission of application form >> Note down submission ID for future reference

3. The procedure to pay the application fee is made available on the website and application form.
4. This information brochure and future updates regarding the admission process will be made available on the institute website under section Academics >> Admissions >> Ph.D.
5. You are required to submit the application form online. There are no downloadable forms available. After filling the form, you are advised to take a print and keep the same for future reference.

6. The application fee is as follows:

Gen/Gen (EWS)/OBC/ all other candidates	₹ 200/-
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Women/SC/ST/PwD category candidates	₹ 100/-
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7. **The Application Form without valid online payment details will not be considered. Application FEE is Non-Refundable.**
8. Applicants may find it convenient to keep following information handy while filling the application form online (whichever relevant):
 - Skype Id / Gmail Id for G-meet
 - Passport size photo whose size is less than 50 kb
 - Educational details from secondary school onwards
 - GATE qualification details
 - Statement of Purpose (pdf file)
 - Proof of application fee payment (pdf file)
 - List of fellowship/ awards
 - Publications
 - Any other achievements/information.
9. Amendments to the form will not be possible once the last date to apply online is over. However, amendments can be considered if the applicant resubmits the entire form without making repeat fee payment before the deadline.
10. Check your emails regularly for any communication from the institute regarding the selection process.
11. **Keep checking institute website regularly for updates regarding the selection process. Shortlisted candidates list will be uploaded on the institute website as per the schedule given above.**

Candidates (if) called for written test / interview should bring with them Photo ID Card, Printed Copy of Online Application Form, Photocopies of Academic Transcripts, Degree Certificates & Experience Certificates, Caste Certificate (if applicable), PwD Certificate (if applicable), EWS Certificate (if applicable), Thesis/Dissertation/Report/Publications and all other relevant documents.

D. INFORMATION PERTAINING TO HOSTELS

About IIT Dharwad	Kindly visit the website https://www.iitdh.ac.in/ for available facilities
Hostel Room Allocation (on sharing basis)	You will be allotted room in the hostel & the room key will be handed over on your arrival at the Institute. Each room will accommodate roughly

	two/four students (depending on the prevailing conditions) and has an attached bath & toilet.
Are hostel rooms furnished	Each student will be provided a cot, chair & study table and wardrobe. Students can purchase mattress/bedding, bucket, etc. locally. Arrangements will be made for on-campus shopping for these items.
Possession of motorized vehicle	NOT ALLOWED, however bicycle is permitted in the campus.
Climatic conditions	The weather at Dharwad is pleasant throughout the year. Generally, it will be raining in the months of June to September and weather will be windy and cold during the months of October to January. It is suggested that you carry protective clothing accordingly.

E. FEES, DEPOSITS & HOSTEL RENT

The fee applicable for admission to Ph.D. programmes (as collected during the Autumn Semester 2020-21) is provided below for reference purpose only:

S. No.	Fee Description	Amount (in INR) General/OBC/EWS	Amount (in INR) SC/ST/PwD
A. One-time payment at the time of admission			
1	Admission fee	2,200.00	2,200.00
2	Thesis fee	2500.00	2500.00
3	Medical examination	400.00	400.00
4	Provisional certificate	500.00	500.00
5	Student welfare fund	1,000.00	1,000.00
6	Modernisation & upgradation	2500.00	2500.00
7	Identity card	500.00	500.00
	Sub-total (A)	9,600.00	9,600.00
B. Per semester fee			
1^	Tuition Fee-Statutory fee	2500.00	00.00
2	Examination fee	1,000.00	1,000.00
3	Registration fee	750.00	750.00
4*	Gymkhana fee	525.00	525.00
5	Student benevolent fund	500.00	500.00
6*	Medical fee	450.00	450.00
7	Hostel room rent	-	-
8	Electricity & water charges	-	-
9	Hostel establishment charges	3,000.00	3,000.00
10	Mess establishment charges	1,550.00	1,550.00
	Sub-total (B)	10,275.00	7,775.00
C. Deposits (refundable) to be paid at the time of admission			
1	Institute security deposit	1,000.00	1,000.00
2	Library security deposit	1,000.00	1,000.00
3	Mess security deposit	1,000.00	1,000.00
	Sub-total (C)	3,000.00	3000.00
GRAND TOTAL FEE (A+B+C)		22,875.00	20,375.00

NOTE:

- All the SC/ST/PwD-Divyangjan students are exempted from payment of Tuition fee.
- The Hostel Room rent (Rs.2,000/-), Electricity & water charges (Rs.3,000/-) and Mess Fee advance (Rs.26,000/-) have not been charged presently for Autumn Semester.
- *The Gymkhana Fee & Medical Fee have been partially charged (i.e. 30% each of the actual cost).
- The reduction in fee is due to the present COVID-19 conditions and if in case the students are required to join the Institute in future (during Semester), then the reduced portion will be required to be paid on further notice (on pro-rata basis, wherever applicable).
- ^IIT Dharwad reserves the right to revise the Tuition Fee-Statutory Fee (in future).

Kindly note that the above-mentioned fee structure is applicable for TA category students. The tuition fee and other heads may differ in case of other categories (Project/FA/External etc.). The details of the applicable fee structure are available on our website at https://iitdh.ac.in/academic_circulars.php

The fee structure will also be made available to the selected candidates at the time of announcement of results for this round of admission.

F. DEPARTMENT OF MATHEMATICS

F.1 Eligibility Criteria

F.1.a. Qualifying degree

M.Sc. Mathematical Science or Computer Science (or equivalent degree), M.Phil in Mathematical Science (or equivalent degree) or M.Tech. in Engineering Physics, Computer Science, Mechanical or Electrical Engineering (or equivalent degree in Engineering).

F.1.b. Minimum score in the qualifying degree

Category	Educational qualification
General/ General (EWS)	The eligibility criteria in the qualifying degree is First Class , 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 OR (2) a minimum Cumulative Grade Point Average (CGPA) OR 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

F.1.c. In addition to above, a candidate must have one of the following

1. Valid GATE score.
2. Junior Research Fellowship in Mathematical Sciences from CSIR, UGC, DST (INSPIRE fellowship), NBHM and other externally funded candidates are encouraged to apply and they are exempted from possessing a valid GATE score.

F.1.d. Eligibility of applicants in the final phase of getting the qualifying degree

Students who are in the final phase of receiving above mentioned qualifying degree and who are likely to graduate before commencement of Spring 2021 semester of IIT Dharwad are also eligible to apply. However, if offered, the admission to those candidates would be provisional. To join an academic program at IIT Dharwad, such candidates need to furnish necessary documents regarding completion of the degree on the date of joining mentioned in the Section A above. They need to meet the criteria specified in section J.1.b above considering an updated score in the qualifying degree. In the meanwhile, the aggregate academic performance announced by the respective university till the last date for submission mentioned in section A should be used to determine eligibility for application and same to be reported in the online application.

F.1.e. 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).

F.2 Guidelines for shortlisted applicants

F.2.a. Modality of the selection process

Only the short-listed applicants are permitted to participate in the selection process. The selection process may consist of online interviews.

- Each candidate appears for a maximum of two rounds of interview. Round 1 is compulsory for everyone.
- If the faculty decides, then a candidate may go for another round of interview after the completion of the first-round interview with all candidates

Dos:

- 1) Ensure that you have participated in a mock call session before the actual interview for the applicant to ensure the audio-video set up is ready. You may skip this session. However, in case of any issue during the actual online interview time slot, IIT Dharwad will not consider a plea for any extra time or chance to again appear for the interview.
- 2) Accessing any technical resource (notes, book, internet, including peers or mentors) is not allowed during interview unless explicitly mentioned by the committee
- 3) Have paper and pen or pencil calculators handy for any rough work.
- 4) Keeping a glass of water ready may be a good idea.
- 5) In case your area has scheduled power outages please alert us ahead of time in case your interview time slot coincides with that .
- 6) Ensure that equipment is charged to avoid power issues.
- 7) It is recommended to have at least 2 GB of internet data available in your plan. Also, try to locate yourself in a place with good internet speed (at least 1.5 Mbps) for a good quality video interaction
- 8) In case you have requested any application modification requests post submission of the application, quickly (within 20-30 secs) remind the interview panel about the change.
- 9) Ensure that the place from where you are attending the interview is conducive for effective interaction online. Best Practices while in online meetings:
 - Sign in to the online client 10-15 minutes ahead of scheduled meeting time and stay signed in
 - Turn your camera on and have your camera at eye level
 - Stay muted unless you're talking to reduce background noise
 - Make sure you sit in a well lit and quiet place

- Be mindful of what's going on behind you. Think about having a solid wall/nice curtain behind you or turning on the virtual background (if available).
- Put your microphone on the mute when examiner(s) speak.

Don'ts -

1. Avoid windy noisy surroundings during interview
2. Do not record interviews in any form. Any such act will be considered as violation of the pledge you signed online and may invite punitive action from IIT Dharwad.
3. Do not ask about the schedule of the results. It is better to use interview time for other better inquiries as the results will be declared online as soon as possible.
4. Do not leave your place in front of the camera for the entire duration of the interview.
5. Take necessary care to avoid interruptions in the interview process e.g. rest-room breaks.

F.3 Research Topics

- Algebra
- Functional Analysis

F.4 Syllabus

Topics for round 1

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.

Algebra

Fundamental theorem of arithmetic, divisibility in \mathbb{Z} , congruences, Chinese Remainder Theorem, Euler's phi-function.

Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups, permutation groups, Cayley's theorem, class equations, Sylow theorems.

Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domain, principal ideal domain, Euclidean domain, Chinese Remainder Theorem.

Topics for Round 2:

Apart from the topics mentioned above, candidates selected for the second round of interview can be asked questions from some advanced topics related to their area of interest. For example, a candidate interested to pursue research in functional analysis is expected to have some knowledge in some of the following topics:

Lebesgue measure on real line, Radon Nikodym theorem, atomic measure, singular continuous measure, probability measure on real line and its distribution function.

Stone-Weierstrass theorem, L^p spaces, Banach spaces, Bounded linear functionals and dual spaces, Hahn-Banach theorem. Bounded linear operators, open-mapping theorem, closed graph theorem, uniform boundedness principle. Hilbert spaces, Riesz representation theorem. Bounded operators on a Hilbert space. The spectral theorem for compact, self-adjoint, normal (including unbounded) operators.

Similarly a candidate interested in Algebra should be able to answer questions from some of the following topics in the second round:

Fields, Finite extensions of fields, Algebraic extensions, algebraically closed field, Splitting fields, elementary Galois Theory

G. APPENDIX A

Sponsorship Certificate for PhD External Registration (EX)

(To be typed on letterhead of the Sponsoring Organization)

Name of the applicant:

Name of the sponsoring organization:

Address:

Present Designation of the applicant:

Present status of the applicant: (Permanent/Semi-permanent/Temporary)

Division where research work is proposed to be done:

Name of supervisor from the sponsoring organization:

(CV of supervisor is requested to be produced on the day of selection giving details of designation, qualification, research experience etc.)

Details of facilities relevant to the research problem which will be made available to the candidate by the organization.

Statement of proposed co-supervisor (external)

If Shri / Kum. / Smt. _____

is registered for the PhD degree, I, _____

Agree to act as his/ her research Co-supervisor along with the research Supervisor from IIT Dharwad.

Date:

Signature of proposed Co-supervisor (external)

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Statement of sponsoring authority

If Shri. / Kum./ Smt. _____

is admitted to the PhD programme, we shall allow him/her to undergo the programme of studies at IIT Dharwad.

Further, we shall fully relieve him/her from normal duties to complete the residential course work requirement (and qualifier examination, if applicable) at IIT Dharwad.

During the period of PhD studies, the candidate will be permitted to carry out his / her research work at our laboratories / organization and will be given the required facilities.

We also give our consent to _____ of our organization to be the Co-supervisor (external) of the PhD thesis, along with a faculty member of IIT Dharwad as the Supervisor.

Date:

Signature and Seal of the Sponsoring Authority

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