

**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.
3. 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
4. The procedure to pay the application fee is made available on the website and application form.
5. This information brochure and future updates regarding the admission process will be made available on the institute website under section Academics >> Admissions >> Ph.D.
6. 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.

7. The application fee is as follows:

Gen/Gen (EWS)/OBC/ all other candidates	₹ 200/-
Women/SC/ST/PwD category candidates	₹ 100/-

8. **The Application Form without valid online payment details will not be considered. Application FEE is Non-Refundable.**

9. 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.

10. 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.

11. Check your emails regularly for any communication from the institute regarding the selection process.

12. **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 <a href="https://www.iitdh.ac.in/">https://www.iitdh.ac.in/</a> 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
<b>A. One-time payment at the time of admission</b>			
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
	<b>Sub-total (A)</b>	<b>9,600.00</b>	<b>9,600.00</b>
<b>B. Per semester fee</b>			
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
	<b>Sub-total (B)</b>	<b>10,275.00</b>	<b>7,775.00</b>
<b>C. Deposits (refundable) to be paid at the time of admission</b>			
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
	<b>Sub-total (C)</b>	<b>3,000.00</b>	<b>3000.00</b>
<b>GRAND TOTAL FEE (A+B+C)</b>		<b>22,875.00</b>	<b>20,375.00</b>



**NOTE:**

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](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 PHYSICS**

### **F.1 Eligibility for Admission**

#### **F.1.a Qualifying Degree**

- M.Sc. or equivalent degree in Physics/Applied Physics/Photonics.
- B. Tech./B. E. or equivalent degree in Engineering Physics/Electrical Engineering/Electronics and Communications Engineering/Optics/Optoelectronics.
- M. Tech/MS in Remote Sensing/Geoinformatics/Optics/Optoelectronics/Photonics/Electrical Engineering.
- The candidates who do not have M. Tech. degree must also fulfill ONE of the following additional requirements:
  - Valid GATE Score.
  - Valid Junior Research Fellowship (JRF) of CSIR/UGC/DST INSPIRE or any other funding agencies.

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

1. For General/OBC category candidates and/or for candidates where no concession in academic performance is called for, 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:
  - a minimum of 60% marks (without round off) in aggregate. (OR)
  - 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).
2. For SC/ST/PwD category candidates, a relaxation of 5% in the qualifying degree is applicable.

### **F.2 Selection Process**

#### **F.2.a Application Categories**

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

#### **F.2.b Guidelines for shortlisted candidates**

For both TA and FA category, based on the information provided by the applicants, a short-list of candidates for the selection process will be prepared. The list 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.

**The precise guidelines related to the selection process will be intimated at the time of announcement of shortlisted candidates on Institute Website.**

### **F.2.c Screening test/Interview/Interaction**

Only the short-listed applicants are permitted to participate in the selection process. **The mode of selection process may involve a written test followed by interview which could be in person or online.** The details of which will be intimated in due course of time on the Institute Website. Applicants are advised to check the website regularly from time to time.

### **F.3. Syllabus**

1. **Quantum Mechanics-** Wave-particle duality, Uncertainty Principle, Schrodinger's equation, Simple Problems in One Dimension, Harmonic Oscillators, Hydrogen Atom, Ladder Operators. Angular Momentum Operators, Addition of Angular Momentum, Time-independent perturbation theory and applications, Variational method, Time-dependent perturbation theory and Fermi's golden rule, Identical particles, Pauli exclusion principle, spin-statistics connection.
2. **Mathematical Physics-** Linear Vector space, Scalar product, Metric spaces, Linear operator, Matrix algebra, Eigenvalues and Eigenvector, Complex analysis - Complex numbers, Analytic function, Taylor and Laurent series, Special functions (Hermite, Bessel, Laguerre and Legendre functions). Fourier series, Fourier and Laplace transforms.
3. **Classical Mechanics-** Phase space dynamics, stability analysis, Central force motions, Rigid body dynamics, moment of inertia tensor, Non-inertial frames and pseudoforces, Variational principle, Generalized coordinates, Lagrangian and Hamiltonian formalism and equations of motion. Conservation laws and cyclic coordinates, Periodic motion: small oscillations, normal modes. Special theory of relativity Lorentz transformations, relativistic kinematics and mass-energy equivalence.
4. **Electromagnetic Theory-** Electrostatics- Gauss's law and its applications, Scalar potential, Electrostatic potential energy, Multipole expansion, Conducting matter, Dielectric Matter. Boundary Value Problems, Solution of Laplace's equation: Potential theory, Uniqueness, Separation of Variables in different coordinate systems, Solution of Poisson's equation using Green's function, Method of Images. Magnetostatics, Steady currents, Biot-Savart law, Ampere law, Magnetic vector potential, Magnetic multipoles, Electrodynamics Dynamic and Quasi-static fields General EM Fields Waves in vacuum and dispersive media, Special Theory of Relativity- Galilean relativity, Einstein's relativity, Lorentz transformation Four-vectors, Relativistic Kinematics Electromagnetic quantities and Covariant Electrodynamics.
5. **Thermodynamics and Statistical Physics-** Zeroth law, First law, Second law, Carnot cycle, Clausius theorem, reversible work and heat transfer. Thermodynamic potentials, Maxwell relations, chemical potential, phase equilibria. Phase-space, micro- and macro-states. Micro-canonical, canonical and grand-canonical ensembles and partition functions. Free energy and its connection with thermodynamic quantities. Classical and quantum statistics. Blackbody radiation and Planck's distribution law.

6. **Electronics-** Semiconductor basics, diodes, transistors, transistor models, biasing, amplifiers (CE, CC, Swamped), Darlington pairs, difference amplifiers, operational amplifiers, feedback, instrumentation amplifier, filters, JFETs and MOSFETs, Digital electronics: Logic gates, Boolean algebra, Karnaugh maps, flip flops, shift registers, adders, counters, ADC and DAC.
7. **Condensed Matter Physics-** Crystal structures, reciprocal lattice, X-ray and electron diffraction. Lattice vibrations, Einstein and Debye models, phonons. Drude and Sommerfeld models. Bloch theorem, Empty lattice and nearly free electron model, tight-binding model, Density of states and Fermi surfaces. Semi classical model of electron dynamics. Concept of Effective mass.
8. **Nuclear Physics-** Basic properties of nuclei and interactions, Nuclear binding energy, Nuclear moments, Nuclear models- independent particle model, shell model, Deuteron problem, Central and tensor forces, Radioactive decay-theory of alpha decay, Fermi theory of beta decay, gamma decay, Nuclear reactions- direct and compound reactions, Elementary particles- classification, symmetries and conserved quantum numbers, quark model.
9. **Atomic and Molecular Physics-** One-electron atom: Schrodinger equation, energy levels, interaction with electromagnetic fields, transition rates, density of states, dipole approximation, Zeeman and Stark effects; Multi-electron atoms: Helium atom, central field approximation, Thomas-Fermi model of the atom, Hartree-Fock method, L-S and J-J coupling, interaction with external fields; Molecular structure: Born-Oppenheimer approximation, Electronic structure of molecules, Hydrogen molecule ion, Approximate molecular orbital (MO) theory, homo and hetero-nuclear diatomic molecules, electronic term symbols, valence bond (VB) theory of diatomic molecules, comparison of VB and MO theories; Molecular spectra: Rotational, Vibrational and Electronic spectra.
10. **Optics-** Matrix formulation for lens, mirrors and combinations, image formation, brief introduction to primary monochromatic aberrations and chromatic aberrations, Fresnel and Fraunhofer diffraction, Two and Multiple beam interference, Michelson and Fabry-Perot interferometer, line width and coherence, multilayer thin films as antireflection coatings, Linear and elliptically polarized light, polarisers and retarders; birefringence, anisotropic media, principles of magneto-optics, electro-optics and acousto-optics.

## F.4. Research Topics

### Optics, Lasers & Photonics

- Experimental design/development/characterization of coherent light sources/optical devices based on nonlinear crystals in unprecedented wavelength regimes.
- Photo-physical response and investigation of various nonlinear materials.
- Frequency Combs- Fundamental studies in optical parametric oscillators for the generation of optical frequency combs for medical applications.

## **Experimental Condensed Matter Physics**

- Superconductivity- Study of vortex dynamics, vortex phase transitions and phase diagrams in the single crystals of a variety of superconductors.
- Magnetism- Magnetic anisotropy, torque magnetometry studies in some rare-earth transition metal based permanent magnets. Study of magnetic anisotropy in rare-earth free magnets.
- Single crystal growth- Crystal growth of superconducting materials, rare-earth transition metal based permanent magnets and rare-earth free magnets.

## **Spectroscopy and Remote Sensing**

Study of various terrestrial parameters using:

- Remote Sensing: Study of optical (hyperspectral and multispectral) and microwave (Synthetic Aperture Radar) remote sensing data.
- Spectroscopy: Application of absorption and reflection spectroscopic techniques.

## **G. APPENDIX A**

### **Sponsorship Certificate for PhD External Registration (EX)**

(To be typed on letterhead of the Sponsoring Organization)

Name of the applicant:

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Name of the sponsoring organization:

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Address:

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Present Designation of the applicant:

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

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Division where research work is proposed to be done:

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Name of supervisor from the sponsoring organization:

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(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.

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**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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