Admission to Ph.D. and M. Tech. (Research), August 2024

Ref. No: IIITDWD/ACA/2024/059   **Date: 15-05-2024**

Applications are invited for admissions to the Doctor of Philosophy (Ph.D.) and M. Tech. (Research) programmes at IIIT Dharwad for the semester beginning in August 2024, under the following categories:

Ph. D. program:

1. Regular (Full-time) - Institute fellowship or self-financed or Visvesvaraya PhD Scheme
2. Sponsored (Full-time or Part-time)
3. Part-time

Note that applicants admitted under the 2nd and 3rd categories shall not receive any financial support from IIIT Dharwad. Applicants admitted under the 1st category may receive fellowship, subject to the availability of funds/grants. Note that the final decision regarding admitting a candidate will be taken by the competent authority.

M. Tech. (Research) program:

1. Regular (Full-time) - Institute fellowship or self-financed

2. Part-time – External or College Teacher

Note that applicants admitted under the 2nd category shall not receive any financial support from IIIT Dharwad. Applicants admitted under the 1st category may receive fellowship, subject to the availability of funds/grants. Note that the final decision regarding admitting a candidate will be taken by the competent authority.

Eligibility Criteria

The minimum eligibility criteria for the Ph.D. program are given below:

Ph.D. in Computer Science and Engineering / Data Science and Intelligent Systems / Electronics and Communication Engineering

To be eligible for admission, one of the following is a must:

1. Master's Degree in Engineering / Technology in relevant areas*
2. B.E. / B.Tech. / M.Sc. / Technology or an equivalent degree, in relevant areas*

B.E. / B.Tech. applicants with experience in a reputed R&D organization or a company, or those who have published papers in reputed conferences and journals, or patents are preferred.

PhD in Physics / Mathematics

Master's Degree in relevant areas* is a must.

*Minimum CGPA / CPI of 6.0 for General / OBC and 5.5 for SC/ST/all PwD category students on a scale of 1-10 or 60% for General / OBC and 55% for SC/ST/ all PwD category students marks in aggregate.

The minimum eligibility criteria for the M. Tech. (Research) program are given below:

M. Tech. (Research) in Computer Science and Engineering / Data Science and Intelligent Systems / Electronics and Communication Engineering

The minimum requirement is a B.E. / B.Tech. / M.Sc. / M.C.A. or equivalent for IT/ Engineering disciplines with a valid score in an entrance examination such as GATE/NET or national level selection process conducted by IIIT Dharwad or any other national level examination.

Minimum CGPA / CPI of 6.5 for General / OBC and 6.0 for SC/ST/ PwD category students on a scale of 10 or 60% for General / OBC and 55% for SC/ST/PwD category students marks in aggregate.

Areas of Research Interests:

Areas of Research interests include Computer Science and Engineering, Data Science and Intelligent Systems, Electronics and Communication Engineering, Physics and Mathematics encompassing the following areas, but not limited to:

Blockchain, Cloud Computing and Security, Coding Theory, Computer Networks, Computer Vision and Image Processing, Natural Language Processing, Parallel Computing, Speech Processing, Data Analytics, Internet of Things, Machine Learning, Deep Learning, Optimization, Signal Processing, Soft Computing, Social Networks, Physics, Quantum Computing, Mathematics and Statistics.

Screening Test

There will be a screening test for all the shortlisted candidates. Questions will be consisting of MCQs or/and short answer type.

Interview Process

The candidates who qualify in the screening test will be allowed to appear for the interview. The fundamental knowledge of the candidates will be tested in their respective disciplines.

The topics included in the syllabus of the screening test are as follows:

Electronics and Communication Engineering
Node and Mesh Analysis, Superposition, Thevenin's Theorem, Norton's Theorem, Time and Frequency Domain Analysis of Linear Circuits (RL, RC, RLC) Continuous-Time Signals: Fourier Series and Fourier Transform, Linear Time-Invariant Systems: Properties, Causality, Stability, Convolution, Frequency Response Diode Circuits: Clipping, Clamping, Rectifiers, BJT and MOSFET Amplifiers: Biasing, Small Signal Analysis, Op-Amp Circuits: Amplifiers, Differentiators, Integrators, Active Filters, Oscillators**,** Number Representations: Binary, Integer, Floating-Point Numbers, Combinatorial Circuits: Boolean Algebra, Logic Gates, Sequential Circuits: Latches, Flip-Flops, Counters, Data Converters: Sample and Hold Circuits, ADCs, DACs, Machine Instructions and Addressing Modes, Arithmetic Logic Unit (ALU), Data Path, Control Unit, Instruction Pipelining, Feedback Principle, Transfer Function, Block Diagram Representation, Signal Flow Graph, Digital Modulation Schemes: ASK, PSK, FSK, QAM, Bandwidth and Communication Systems.

Computer Science and Engineering
- Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs. Searching, sorting, hashing. Asymptotic worst case time and space complexity.
- Algorithm design techniques: greedy, dynamic programming and divide-and-conquer. Graph traversals, minimum spanning trees, shortest paths. Regular expressions and finite automata. Context-free grammars and push-down automata. Regular and context-free languages, pumping lemma.
- System calls, processes, threads, inter-process communication, concurrency and synchronization. Deadlock. CPU and I/O scheduling. Memory management and virtual memory. File systems. ER-model. Relational model: relational algebra, tuple calculus, SQL. Integrity constraints, normal

forms. File organization, indexing (e.g., B and B+ trees). Transactions and concurrency control.
- Concept of layering: OSI and TCP/IP Protocol Stacks; Basics of packet, circuit and virtual circuit-switching; Data link layer: framing, error detection, Medium Access Control, Ethernet bridging; Routing protocols: shortest path, flooding, distance vector and link state routing; Fragmentation and IP addressing, IPv4, CIDR notation, Basics of IP support protocols (ARP, DHCP, ICMP), Network Address Translation (NAT); Transport layer: flow control and congestion control, UDP, TCP, sockets; Application layer protocols: DNS, SMTP, HTTP, FTP, Email.

Data Science and Intelligent Systems

Probability and Statistics: Independent events, mutually exclusive events, conditional and joint probability, Bayes Theorem, and variance, mean, median, mode and standard deviation, correlation, and covariance, random variables.

Linear Algebra: Vector space, subspaces, linear dependence and independence of vectors, matrices, projection matrix, eigenvalues and eigenvectors, determinant.

Programming, Data Structures and Algorithms: Programming in Python, basic data structures: stacks, queues, linked lists, trees, hash tables; Search algorithms: linear search and binary search, basic sorting algorithms: selection sort, bubble sort and insertion sort; divide and conquer: mergesort, quicksort; introduction to graph theory; basic graph algorithms: traversals and shortest path.

Database Management: ER-model, relational model: relational algebra, tuple calculus, SQL, integrity constraints, normal form, file organization, indexing, data types, data transformation such as normalization, discretization, sampling, compression;

Machine Learning: (i) Supervised Learning: regression and classification problems, simple linear regression, multiple linear regression, ridge regression, logistic regression, k-nearest neighbour, naive Bayes classifier, linear discriminant analysis, support vector machine, decision trees, bias-variance trade-off, cross-validation methods such as leave-one-out (LOO) cross-validation, k-folds cross validation, multi-layer perceptron, feed-forward neural network; (ii) Unsupervised Learning: clustering algorithms, k-means/k-medoid, hierarchical clustering, dimensionality reduction, principal component analysis.

Physics

- **Mathematical Physics:** Vector calculus; differential equations and solutions involving special functions; complex analysis.
- **Classical Mechanics:** Lagrangian formulation; central force motion; rigid body dynamics; Hamiltonian and Hamilton's equations of motion, Hamilton-Jacobi equation.
- **Electromagnetic Theory:** Solutions of electrostatic and magnetostatic problems including boundary value problems; Maxwell's equations; electromagnetic waves.
- **Quantum Mechanics:** Postulates of quantum mechanics; uncertainty principle; Schrodinger equation; Dirac Bra-Ket notation; particle in a box; harmonic oscillator; two and three dimensional systems; hydrogen atom; angular momentum and spin.

Mathematics

Functions of two or more variables, continuity, directional derivatives, partial derivatives, total derivative, maxima and minima, saddle point, method of Lagrange's multipliers; Double and Triple integrals and their applications to area, volume and surface area; Vector Calculus: gradient, divergence and curl, Line integrals and Surface integrals, Green's theorem, Stokes' theorem, and Gauss divergence theorem. Finite dimensional vector spaces over real or complex fields; Linear transformations and their matrix representations, rank and nullity; systems of linear equations, characteristic polynomial, eigenvalues and eigenvectors, diagonalization, minimal polynomial, Cayley-Hamilton Theorem, Finite dimensional inner product spaces, Gram-Schmidt orthonormalization process, symmetric, skew-symmetric, Hermitian, skew-Hermitian, normal, orthogonal and unitary matrices; diagonalization by a unitary matrix, Jordan canonical form; bilinear and quadratic forms. Metric spaces, connectedness, compactness, completeness; Sequences and series of functions, uniform convergence, Ascoli-Arzela theorem; Weierstrass approximation theorem; contraction mapping principle, Power series; Differentiation of functions of several variables, Inverse and Implicit function theorems; Lebesgue measure on the real line, measurable functions; Lebesgue integral, Fatou's lemma, monotone

convergence theorem, dominated convergence theorem. : First order ordinary differential equations, existence and uniqueness theorems for initial value problems, linear ordinary differential equations of higher order with constant coefficients; Second order linear ordinary differential equations with variable coefficients; Cauchy-Euler equation, method of Laplace transforms for solving ordinary differential equations, series solutions (power series, Frobenius method); Legendre and Bessel functions and their orthogonal properties; Systems of linear first order ordinary differential equations, Sturm's oscillation and separation theorems, Sturm-Liouville eigenvalue problems, Planar autonomous systems of ordinary differential equations: Stability of stationary points for linear systems with constant coefficients, Linearized stability, Lyapunov functions.

Guidelines for Applicants

1. Applicants must read the instructions carefully before filling up the online application form available at the Institute's website.
2. A separate application form has to be filled if the applicants are applying in more than one discipline and more than one scheme.
3. Applicants waiting for their qualifying exam results can also apply.
4. Reservation as per the Government of India rules is applicable.
5. Applicants should complete the application form in all respects. An incomplete application will not be considered.
6. Applicants must also provide the details of at least two well-acquainted people who can provide reference letters in support of the candidature of the applicant. At least one of them must be an academician and must have taught the applicant.
7. Applicants are advised to check the Institute website and emails sent to the email address provided in their applications for all important results/announcements. All communications related to admission will be communicated through email.
8. No TA/DA will be provided to the candidates appearing for the screening test/interview.
9. Applicants called for a written test/interview should bring with them
   a. Any Photo ID card issued by the government.
   b. A printed copy of the application needs to be submitted online.
   c. Thesis/ dissertation/ report/ publications.
   d. All original certificates and mark sheets, valid GATE/ NET/SLET scorecards, and caste certificates, along with one photocopy of each.

Link for Application Form

https://forms.gle/a5pwnoPX9YnKw4A18

The deadline for submission of application is **5th June, 2024**. Shortlisted candidates will be intimated about further process, date and time over email.

Contact Information

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