



INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY
(Declared as Deemed to be University under section 3 of the UGC act, 1956)
Thiruvananthapuram – 695547

IIST Ph.D. Programme – January 2021 Admission

Indian Institute of Space Science and Technology envisions basic and applied research for meeting the national R&D requirements of Science and Technology in general and the Indian Space Programme in particular. The institute provides a vibrant research atmosphere and offers doctoral and post doctoral programmes.

Applications are invited from highly motivated applicants for admission to the Ph.D. Programme starting in January 2021, in the departments given below:-

- (i) Aerospace Engineering
- (ii) Avionics
- (iii) Chemistry
- (iv) Earth and Space sciences
- (v) Humanities
- (vi) Physics

Eligibility

- 1. Nationality:** Applicant should be an Indian citizen.
- 2. Age Limit:** Applicant should be below 35 years as on 29.12.2020. Age relaxation is applicable as per Government Rules.
- 3. There is no provision for PhD admission in IIST under Self Financing Category.**

Minimum Qualifications:

1. Applicants with Master's Degree in Engineering/Technology as their highest qualifying degree

Applicants with Master's Degree in Engineering/Technology must have secured 65% marks or 7.00CGPA on a scale of 10 or equivalent in the Qualifying Master's degree (60%marks or 6.50CGPA on a scale of 10 for OBC / EWS, 55%marks or 6.00CGPA on a scale of 10 for SC/ST/PD). **They must have pursued their Master's degree on the basis of qualified GATE score.** However there is no GATE cut off score for applicants with M.Tech./M.E as the highest qualifying degree, who are applying for Ph.D. in Engineering Discipline. Applicants with Master of Science in Engineering or equivalent from leading foreign Universities with minimum CGPA 8/10 or 3.6 /4 or equivalent can be considered without GATE score.

Selection Procedure: For candidates with M.E/M.Tech.as their highest qualifying degree, selection to the PhD programme will be based on **online screening test** followed by an interview. **Interview will be conducted through Video Conference mode.** However, candidates with a valid CSIR/NET-JRForLectureship post their ME/M.Tech, will be directly called for the interview **through Video Conference mode.**

2. Applicants with Master's Degree in Science as their highest qualifying degree

Applicants must have Master's Degree in the relevant area with a minimum of 65% marks or 7.00CGPA on a scale of 10 or equivalent in the Qualifying Master's degree (60%marks or 6.50CGPA on a scale of 10 for OBC / EWS, 55%marks or 6.00 CGPA on a scale of 10 for SC/ST/PD). They must have cleared a National level eligibility test, such as a valid **UGC-CSIR-NET-JRF/Lectureship/fellowship or NBHM/JEST/GATE** and State Government Science and Technology Scheme, in the relevant disciplines.

Selection Procedure: For candidates applying with their Master's degree in Sciences as their qualifying degree and having a valid score card/certificate in any of the National level eligibility tests listed above, **selection to the programme will be based on an interview through Video Conference mode.**

Applicants applying with their JEST score should have secured a rank within the first 300.

Candidates applying with a valid GATE score in a Science discipline, having a minimum score of 500 for General Category (450 for OBC / EWS and 350 for SC/ST/PD categories), are exempted from the Ph.D. online screening test conducted by IIST. Applicants having GATE score in Science disciplines less than indicated cut-off above will not be considered for Ph.D. Admission.

3. Applicants with Master's Degree in Humanities/Management/Social Sciences as their highest qualifying degree

Applicants must have Master's Degree in the relevant area of Humanities/Management / Social Sciences with a minimum of 65% marks or 7.00CGPA on a scale of 10 or equivalent in the Qualifying Master's degree (60%marks or 6.50CGPA on a scale of 10 for OBC / EWS, 55%marks or 6.00 CGPA on a scale of 10 for SC/ST/PD). They must have cleared a national level eligibility test, such as a valid UGC-NET-JRF fellowship/State Government Science and Technology Scheme or similar fellowship schemes of Central/State Governments.

Selection Procedure: For candidates applying with their Master's degree in Humanities/Management/Social Sciences as their qualifying degree and having a valid score card/certificate in any of the National level eligibility tests listed above, selection to the programme will be based on an interview to be conducted **through Video Conference mode**

4. Candidates, who have been provided research fellowships by State Government Science and Technology Scheme/DST-INSPIRE etc, are eligible to apply If they have already cleared a National level eligibility test, such as a valid **UGC-CSIR-NET Lectureship or JEST/GATE**. A valid GATE score of minimum 500 for General Category (450 for OBC / EWS and 350 for SC/ST/PD categories) in a Science discipline or JEST rank within the first 300 is required.

Applicants who are employed in Government/Semi Government/PSUs/Autonomous Bodies should produce a “No Objection Certificate (NOC)” from the current employer at the time of Interview.

Applicants who hold External Fellowships, meeting Table 2 requirements, can also apply for research areas listed in Table 1 provided they meet the eligibility requirements.

Table 1(Funded by IIST)

Research Areas for January 2021 PhD Admission

Sl. No	Department	Department code	Research Area	Eligibility
1	Aerospace Engineering	PAE01	Aerodynamics, Gas Dynamics, Aeroacoustics, Flow Instability	<p>ME/M.Tech/MS in Aerospace /Aeronautical / Mechanical / Applied Mechanics / Chemical/ any other specialization related to fluid and thermal or equivalent</p> <p><u>Written Test Pattern and Syllabus:</u></p> <p>Written test consist of questions from</p> <p>a) Fluid mechanics (compulsory)</p> <p>b) Compressible flow</p> <p>or</p> <p>Thermodynamics & Heat transfer.</p> <p>Candidates can choose either Compressible flow or Thermodynamics & Heat transfer.</p> <p><u>Syllabus for Written Screening Test:</u></p> <p>Fluid Mechanics: Fluid Statics, conservation equations of mass, momentum and energy (integral and differential form) potential flow theory, viscous flow of incompressible fluids, boundary layer, flow separation, elementary turbulent flow.</p> <p>Compressible Flows: Basic concepts of compressibility, conservation equations, isentropic flow, Fanno flow, Rayleigh flow, normal and oblique shocks, Prandtl-Meyer Flow, Flow through nozzles and diffusers.</p> <p>Thermodynamics & Heat Transfer:Behavior of ideal and real gases, thermodynamics I and II law, thermodynamic relations, ideal gas mixtures; steady and unsteady heat conduction, thermal boundary layer, free and forced convective heat</p>

				transfer, radiative heat transfer.
2	Avionics	PAV01	Reinforcement Learning and Control	<p>M.Tech / M.E / M.S or equivalent in Electronics/Electronics and Communication/Electrical/Electrical and Electronics/Communication/Communication Networks/Telecommunication/Signal Processing/Machine learning/Computer Science/Control-Systems/System-Science/Data-analytics or equivalent.</p> <p>Desirable: (Good demonstrable programming skills in C/C++/Python/Matlab) and/or (Good demonstrable mathematical and analytical skills) and/or (Prior research/industry experience)</p> <p><u>Syllabus for screening test</u></p> <p>Mathematical background for reinforcement learning and control: Linear Algebra: Vector space, basis, linear dependence and independence, matrix algebra, eigen values and eigen vectors, rank, solution of linear equations – existence and uniqueness. Calculus: Differentiability, Continuity, Mean value theorems, theorems of integral calculus, evaluation of definite and improper integrals, partial derivatives, maxima and minima. Probability: Axioms of probability, probability space, properties of probability, Random variables and distributions, Random processes and their properties, filtering of random processes via linear time invariant systems.</p> <p>Signals, systems, and control systems: Continuous-time signals: Fourier series and Fourier transform, sampling theorem and applications. Discrete-time signals: DTFT, DFT, z-transform, discrete-time processing of continuous-time signals. LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeroes, frequency response, group delay, phase delay. Feedback principle; Transfer function; Block diagram representation; Signal flow graph; Transient and steady-state analysis of LTI systems</p> <p>Basic knowledge in programming principles, data structures, and algorithms (questions will be based on pseudo-code and not a</p>

				<p>specific programming language).</p> <p>ME / M.Tech / MSc (Engg.) or equivalent in Electrical Engineering / Power Electronics / Power Electronics and Drives / Industrial Electronics / Power Systems or equivalent area.</p> <p><u>Syllabus for screening test</u></p> <p>Electric Circuits, Systems Network analysis, and theorems, Transient response, Sinusoidal steady-state analysis, Resonance, Power and power factor in ac circuits. Mathematical modeling and representation of systems, Feedback principle, transfer function, Block diagrams, Transient and Steady-state analysis of linear time invariant systems, Nyquist criteria, Bode plots, Root loci, Stability analysis, P, PI and PID controllers.</p> <p>Electrical Machines Transformers: equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency; DC machines: separately excited, series and shunt, motoring and generating mode of operation and their characteristics, starting and speed control of dc motors; Induction motors: principle of operation, types, torque-speed characteristics, no-load and blocked rotor tests, equivalent circuit, starting and speed control; Synchronous machines: cylindrical and salient pole machines, performance, regulation and parallel operation of generators, starting of synchronous motor, characteristics; Types of losses and efficiency calculations of electric machines.</p> <p>Power Electronics and Drives Characteristics of semiconductor power devices: Diode, MOSFET, IGBT; DC to DC conversion: Buck, Boost and Buck-Boost converters; Single and three phase configuration of uncontrolled rectifiers, Bidirectional ac to dc voltage source converters, Issues of line current harmonics, Power factor, Distortion factor of ac to dc converters, Single phase and three phase inverters, Sinusoidal pulse width modulation, inverters, control of electric drives (DC machine speed control, induction machine speed control), and basics of grid-connected</p>
		PAV02	Power Electronics and Drives	

				converters.
3	Earth and Space Sciences	PES01	Atmospheric Science	<p>M.Sc/MTech (Meteorology), M.Sc/MTech (Atmospheric Science), M.Sc/MTech (Oceanography), M.Sc (Physics) or M.Tech (Earth System Science) or any equivalent subject</p> <p><u>Syllabus for screening test (for candidates who have completed MTech).</u></p> <p><u>Screening test not required for MSc candidates</u></p> <p>Thermal structure of the atmosphere and its composition, Radiation Balance and Laws, Wind Belts, Monsoon, Climate, Atmospheric Thermodynamics. Hydrostatic equilibrium, variation of pressure with height, geopotential, Tropical convection. Aerosols, Cloud Physics and Precipitation.</p> <p>Fundamental equations. Eulerian and Lagrangian description, Pressure gradient, gravity, centrifugal and Coriolis forces, continuity equation in Cartesian and isobaric coordinates, Scale analysis, inertial flow, cyclostrophic, geostrophic and gradient winds, thermal wind, circulation and vorticity. planetary vorticity, absolute vorticity, potential vorticity, atmospheric boundary layer, surface layer, Ekman layer, Atmospheric turbulence, Atmospheric Waves, sound waves, gravity waves, Rossby waves</p> <p>Tropical meteorology: Trade wind inversion, ITCZ; monsoon trough, tropical cyclones, their structure and development theory; monsoon depressions; Climate variability and forcings; Madden-Julian oscillation(MJO), ENSO, QBO (quasi-biennial oscillation), Primitive equations of Numerical Weather Prediction. General Circulation and Climate Modelling.</p>
		PES02	Multi-source Remote Sensing Data for Species Discrimination	<p>Master degree in Remote Sensing/ RS & GIS /Geoinformatics/Computer Science/ Image Processing/ Applied Geography or equivalent field of study with master degree project carried out in remote sensing and GIS</p> <p><u>Syllabus for written test</u></p> <p>1. Remote Sensing</p> <p>Electromagnetic radiation, Spectral signatures, remote sensors and platforms - optical, infrared and microwave sensors,</p>

				<p>active remote sensing techniques: LIDAR and Microwave remote sensing, data formats, interpretation, radiometric and geometric distortions and corrections, image transformations, filtering and image noise reduction, multispectral image analyses - supervised & unsupervised classification, separability measures, post-classification analysis, hyperspectral image processing - applications.</p> <p>2. Geographic Information System</p> <p>Data types and models- Spatial data quality - Scale - Coordinate systems, Map projections - Input / output techniques, Editing, Topology, Database structure - Analysis: vector and raster overlay, spatial interpolation –Spatial Auto correlation, Variogram, Kriging, network - optimization of path, Facility location, 3D analysis – Delaunay triangulation, Digital elevation model, Surface analysis - Geovisualization - OpenGIS, WebGIS.</p> <p>3. Probability & Statistics</p> <p>Probability: discrete and continuous random variable, probability distribution, binomial, Poisson distribution, multivariate distribution, hyper geometric distribution, frequency interpretation of probability, random numbers, population and samples, exploratory data analysis - central limit theorem, sampling distributions of mean and variance, covariance, point estimation, confidence interval, tests of hypotheses, sampling methods, design of experiments, curve fitting by the method of least squares, chi-square test, contingency tables, inference based on the least square estimators, correlation, linear and multiple regression, polynomial regression.</p>
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Table 2 : External Fellowship Holders

Candidates having a valid fellowship from Government agencies such as DST, CSIR, NBHM, UGC and State Government Science and Technology Scheme etc. may also apply for Ph.D. admission in various departments in IIST in the areas given below. Such candidates will be selected based on an Interview.

Sl. No	Department	Department code	Research Area	Eligibility
1	Aerospace	EAE01	Biological Heat	Masters (M Sc/M Tech/MS) in Computational Biology/Biomedical Sciences/Life

	Engineering		Transfer	Sciences/Biological Sciences/Bioinformatics/Thermal Sciences/Applied Mechanics or related areas
2	Avionics	EAV01 (External Project)	Small – Spacecraft Mission Design	B.E/B.Tech – Avionics, Electronics and Communication, Aerospace Engineering, Computer Science & Engineering; AND M.S./M.E./M.Tech – Control Systems, Computer Science and Engineering, and related areas or Bsc, MSc Physics, Dual degree Physics [related areas]
3	Chemistry	ECH01	Nanomaterials for EMI shielding and Energy Storage Applications	M.Sc or BS-MS in Chemistry or equivalent / M.Sc in Polymer Science or Biopolymers or equivalent
		ECH02	Inorganic Materials for High Temperature Applications	M.Sc or BS-MS in Chemistry or equivalent
		ECH03	Chemical Screening Platform Using Drosophilla for Drug Discovery.	BS-MS/MSc in Chemical/ Biological/Pharmaceutical Sciences/Masters in Biochemistry/Biotechnology or equivalent
4	Earth and Space Sciences	EES01	Imaging spectroscopy / big data analytics for precision environmental monitoring applications	Masters degree in Environmental Sciences / Agriculture / Soil science / Water resources / Oceanography / Meteorology / Physics / Mathematics / Statistics / Hydrology / Climate change studies or equivalent
5	Humanities	EHS01	Cultural Studies, Digital Humanities, Gender Studies	MA in English Language and Literature or equivalent
		EHS02	Economics (Technology Diffusion & Development, Development Economics)	MA or MSc in Economics / Analytical Economics / Developmental Economics / Quantitative Economics / Agriculture Economics / Business Economics / Financial Economics / Behavioural Economics or Post graduate degree in any areas related to Economics
6	Physics	EPH01	Theoretical Physics, Nonlinear Dynamics	M.Sc/Int. M.Sc/BS-MS in Physics/Applied Physics or any equivalent

		EPH02	Atomic Layer Deposition	MSc in Physics / Material Science / Nanoscience / Nanotechnology/Electronics/ or M.Tech in Solid State Technology / Nanotechnology/ Electronics /Material Science / Photonics/ Material Engineering / Instrumentation Or MS in Solid State Physics / Material Science/ Nanoscience / Nanotechnology/Photonics
		EPH03	Experimental Condensed Matter Physics	M.Sc. in Physics, BS-MS in Physics / B.Tech in Engineering Physics with M.Sc./M.Tech in related areas of condensed matter/Solid State physics.
		EPH04	Atomic and Molecular Physics, Molecular Physics of Interplanetary Ionosphere	M. Sc. in Physics / M. Sc. in electronics / Int. M. Sc. in physics / BS-MS in Physics / BS-MS in Applied Physics / B. Tech. Engineering Physics and Master degree in Solid State Physics or Optical Engineering

RESEARCH FELLOWSHIP:

- 1) All scholars selected to the programme specializations listed in Table 1 shall receive a fellowship of Rs.31000/- per month. (Research Scholars selected with UGC/CSIR/NET-JRF/NBHM and State Government Science and Technology Scheme etc., shall draw fellowship from the concerned organizations). For all research scholars with external fellowship, the concerned rules and regulations apply.
- 2) The fellowship will be enhanced to Rs.35,000/- per month based on a performance review after two years of Research.
- 3) The scholars will be required to assist the Departments in tutorials, practical training in labs or similar academic activities normally limited to 6 hours per week.
- 4) The scholars will have to pay applicable fees as well as charges for the services provided by the Institute like boarding/lodging/medical facilities etc., as per IIST rules.
- 5) For those who receive fellowship from agencies such as DST, CSIR, NBHM, UGC and candidates who have been provided research fellowship by State Government Science and Technology Scheme through competitive written test etc., the Institute will not bear the fellowship of the student if the same is stopped due to any reasons by the concerned agency.
- 6) The Institute is completely residential and will provide accommodation to all the regular Ph.D students. However, in the event of shortage of rooms in the hostels, preference will be given for room allotment to candidates whose fellowships are borne by the Institute.

FEE STRUCTURE:
(To be paid at the beginning of every semester)

SI No	Description	Full Time
1	Tuition Fee/Statutory Semester Fee	1,500/-*
2	Student Amenities Fee	1,350/-
3	Hostel Charges	4,500/-**
4	Establishment Charges	4,000/-
5	Medical Charges	800/-
	Total	12,150/-
6	Registration Fee (One-Time)	1,000/-
7	Thesis Submission Fee (One-Time)	1,000/-
8	Re-Registration Fee (If any)	1,500/-

Note:

*For **SC/ST/PT** Tuition Fee/Statutory Semester Fee is exempted.

**Students of Ph.D programmes can purchase food coupons for Canteen Services separately.

*** Based on decisions of Board of Management, fees could be revised during the study period.

GENERAL SELECTION PROCEDURE:

- 1) Applications will be received through on-line only.
- 2) Candidates having fellowship from funding agencies such as DST, CSIR, NBHM, UGC, State Government Science and Technology Scheme etc, applying to research areas in Table 2 may also apply for other research areas in Table 1, if eligible.
- 3) Candidates are advised to visit the individual department profile for more details on the respective areas of research.
- 4) Candidates with valid fellowship from Government funding agencies shall upload a scanned copy of the fellowship award letter.
- 5) A short-list of applicants for Online screening test or interview will be displayed in IIST website by **06.01.2021**
- 6) Online Screening Test will be held on 10.01.2021
- 7) **Selection Criteria based on Online screening test & Interview:**
 - (i) The candidates who have participated in the Online screening test will be shortlisted if they secure a minimum of 30 % in each of Section A, (Section A comprises questions based on GATE Aptitude and Mathematics) and Section B (the research area) and a combined mark of 50 % and above for Section A and Section B together.

(ii) There will be a relaxation of 5 % for SC/ST/PD and OBC / EWS students, i.e., SC/ST/PD and OBC / EWS students require a combined mark of 45 % and above for Section A and Section B together, while the minimum is 30% in each of the Section A and B respectively.

(iii) There will be a 70 % weightage for the PhD Online screening test and 30 % weightage for the interview.

(iv) A student securing less than 10 marks out of 30 marks in the interview will not be selected irrespective of category and irrespective of the performance in the Online screening test.

(v) The combined mark for the PhD Online screening test and interview for a UR student should be 60 % and above to be selected

(vi) For the SC/ST/PD and OBC / EWS students, the combined mark for the PhD Online screening test and interview should be 55 % and above.

Candidates screened in through the online screening test will be called for an interview **through Video Conference mode.**

- 8) Provisionally selected candidates list, after the interview, will be displayed in the IIST website; the date **will be announced later.**
- 9) Admissions are governed by Ph.D Rules and Regulations of IIST. (<https://www.iist.ac.in/academics/rules-regulations>).
- 10) **The date of the Online screening test will not be changed under any circumstances.**
- 11) During interview, candidates will be tested in their main research area and not restricted to the syllabus of the Online screening test.

HOW TO APPLY:

- 1) Applications shall be submitted **online** at the IIST website: <http://admission.iist.ac.in>. Applications received online only will be considered.
- 2) The applicants will not be allowed to make any changes in their registration profile once submitted. Hence utmost care should be taken by the applicants while filling their profile
- 3) Application fee for General/EWS/OBC candidates who are male is Rs. 700/- per Department (for SC/ST/PD and Women applicants - Rs.350/- per Department). If the applicant is eligible and wishes to apply for more than one Research Area in the same Department, he/she need not pay any additional application fee. The application fee is non-refundable. Applicants, who wish to apply to multiple

departments, will have to pay the appropriate application fee (sum of the application fee for each department).

- 4) The application fee shall be paid through online after the course registration only.
- 5) SC/ST/OBC / EWS/Persons with Disabilities (PD) applicants shall upload the relevant certificate in the website before the prescribed date.
- 6) **Applicants who are employed in Government/Semi Government/PSUs/ Autonomous Bodies need to produce a “No Objection Certificate (NOC)” from the current employer at the time of Interview.**

IMPORTANT DATES		
Sl. No.	Event	Date
1	Opening of IIST website for online submission of applications	December 09, 2020 - 1500 hrs (Wednesday)
2	Closing of IIST website for online submission of applications (for IIST Funded)	December 29, 2020 – 2359 hrs (Tuesday)
3	Closing of IIST website for online submission of applications (for Externally Funded)	January 6, 2021 – 2359 hrs (Wednesday)
4	Display of shortlisted candidates for Test	January 06, 2021 – 1700 hrs (Wednesday)
5	Date of online screening test	January 10, 2021 (Sunday)
6	Publishing of screening test results	January 13, 2021 – 1700 hrs (Wednesday)
7	Interview Dates	January 18 - 19, 2021
8	Classes begin for Ph.D Programme	25 January 2021