

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 - July 2019 Admissions

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 July 2019, in the departments given below:-

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

Eligibility

- 1. Nationality: Applicant should be an Indian citizen.
- **2. Age Limit:** Applicant should be below 35 years as on May 06, 2019. 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 or equivalent in the Qualifying Master's degree (60%marks or 6.50CGPA for OBC, 55%marks or 6.00 CGPA 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 a **written screening test** followed by an interview. However, candidates with a valid fellowship such as CSIR/NET-JRF fellowships and CSIR-NET Lectureship post their ME/M Tech, will be directly called for the interview.

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 or equivalent in the Qualifying Master's degree (60%marks or 6.50CGPA for OBC, 55%marks or 6.00 CGPA 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 to be conducted at IIST.**

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 and 350 for SC/ST/PD categories), are exempted from the Ph.D. written 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 or equivalent in the Qualifying Master's degree (60%marks or 6.50CGPA for OBC, 55%marks or 6.00 CGPA 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 at IIST.

4. Candidates who have been provided research fellowships by State Government Science and Technology Scheme through competitive written test can also apply. For candidates having research fellowship by State Government without competitive written test will have to appear for written screening test conducted by IIST.

5. Candidates awaiting results:

Candidates awaiting their results in the final year/semester are also eligible to apply, provided they satisfy all the other requirements. Such applicants may be screened in for written test/interview based on the marks obtained by them until the current year/semester. Based on their written test/interview performance, these applicants may be provisionally selected, subject to the condition that they have to produce the provisional certificate of obtaining the qualifying degree with required percentage of marks by the date stipulated in their provisional admission letter. If they fail to produce the provisional/ degree certificate, transfer certificate and conduct certificate by this date, their admission offer will be withdrawn and the offer may be given to next eligible applicant in the waiting list.

A provisionally selected applicant who is awaiting his/her final certificates may be allowed to join IIST without submitting the provisional/degree certificate on the stipulated date of joining, subject to the conditions that (a) At the time of joining the applicant should have completed all the requirements for the award of the qualifying degree including all examinations, project works and viva voce, (b) The applicant should produce at the time of joining, a Course Completion Certificate issued by the competent authority in the University/Institute specifically confirming that all examinations, project works and viva voce for the qualifying degree are completed, (c) If the above condition is satisfied, the applicant can be given provisional admission with the undertaking that all pending certificates, mark sheets, degree certificates (Original or Provisional) will be submitted to IIST, latest by 31st October 2019, failing which the admission shall stand cancelled. For such applicants who are funded by IIST and provisionally admitted to the IIST Ph.D. Programme as per (c) above, no fellowship will be paid during the period before the required certificates are submitted. However, on regularization of admission following the submission of all required documents before the stipulated date, the applicant will be paid fellowship with retrospective effect from the date of joining.

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

	Research Areas for July 2019 PhD Admission					
SI. No.	Department	Department code	Research Area	Eligibility		
SI. No.	Aerospace Engineering					

		Researc	ch Areas for July	y 2019 PhD Admission
SI. No.	Department	Department code	Research Area	Eligibility
		PAE02	Computational fluid dynamics based optimisation	M.Tech. Aerospace/Mechanical/Computational Mechanics/Scientific Computing or equivalent MSc*(Mathematics) or equivalent Syllabus for Written Screening Test For M.Tech Aerospace/Mechanical 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, elementary turbulent flow. Compressible Flows: Basic concepts of compressibility, conservation equations, and one dimensional compressible flow. Fanno flow, Rayleigh flow, isentropic flows, normal and oblique shocks, Prandtl-Meyer Flow, Flow through nozzles and diffusers. For M.Tech Computational Mechanics/Scientific Computing or equivalent 1. Linear algebra (Basic matrix operations eigenvalues integration - RungeKutta time integration - Finite difference methods - stability) 3. Optimisation (Linear programming - Simplex - Optimality conditions - Gradient optimisation algorithms - barrier/penalty methods) 4. Probability (Basic notions - Regression) 5. Computer Programming (OOPS concepts - Floating point arithmetic) " *Candidates with Master's degree in Science need to satisfy the Eligibility criteria as provided in the "minimum qualifications clause No.2"

		Researc	ch Areas for July	y 2019 PhD Admission
SI. No.	Department	Department code	Research Area	Eligibility
				Masters (M Tech/ ME/ MS) in Thermal Sciences/ Thermal Engg/ Fluid Mechanics/ Engg Mechanics/ Heat Transfer/ Cryogenics/ Propulsion Engg/ Refrigeration Engg/ Turbomachines/Chemical Engg or equivalent.
				Syllabus for Written Screening Test
				Note:- Screening test has two papers. Paper 1 - Fluid mechanics is compulsory. Candidates can choose Heat Transfer or Compressible flows for Paper 2.
				Fluid Mechanics: Fluid Statics, conservation equations of mass, momentum and energy (integral and differential form) potential flow theory, viscous flow of in compressible fluids, boundary layer, elementary turbulent flow.
		PAE03	Heat Transfer and fluid flow related to space applications	Heat Transfer: Modes of heat transfer; heat conduction, resistance concept, thermal boundary layer, free and forced convective heat transfer, radiative heat transfer.
				Compressible Flows: Basic concepts of compressibility, conservation equations, and one dimensional compressible flow. Fanno flow, Rayleigh flow, isentropic flows, normal and oblique shocks, Prandtl-Meyer Flow, Flow through nozzles and diffusers.

		Researc	ch Areas for July	y 2019 PhD Admission
SI. No.	Department	Department code	Research Area	Eligibility
		PAE04	Flight Dynamics and Control of Aerial Vehicles, Design and development of autonomous Unmanned Aerial systems, System Identification for Unmanned Aerial Vehicles	M.Tech Aerospace / Mechanical or equivalent Syllabus for Written Screening Test For M.Tech Aerospace: Drag polar; takeoff and landing; steady climb & descent, absolute and service ceiling; cruise, cruise climb, endurance or loiter; load factor, turning flight, V-n diagram; Winds: head, tail ✗ winds; Static stability: Angle of attack, sideslip; roll, pitch & yaw controls; longitudinal stick fixed & free stability, horizontal tail position and size; directional stability, vertical tail position and size; dihedral stability. Wing dihedral, sweep & position; hinge moments, stick forces; Dynamic stability: Euler angles; Equations of motion; aerodynamic forces and moments, stability & control derivatives; decoupling of longitudinal and lateral-directional dynamics; longitudinal modes; lateral-directional modes. For M.Tech Mechanical: Engineering Mechanics: Free-body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations, collisions. Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance;

		Researc	ch Areas for July	y 2019 PhD Admission
SI. No.	Department	Department code	Research Area	Eligibility
2	Avionics	PAV01	Engineering Electro Magnetics	M.Tech in Electronics/Electronics and Communication Engineering/ Electrical /Communication/RF and Microwave Engineering/ Radio Physics and Electronics/Wireless Technology or equivalent Syllabus for Written Screening Test Electromagnetic Theory: Electrostatics, Magnetostatics, Ampere's Law, Faraday's law, Electromagnetic Energy – Boundary Conditions – Maxwell's Equations – Pointing Vector. Electromagnetic Waves: Wave equation & Uniform Plane waves – Plane waves in lossy and lossless mediums – Normal and oblique incidences of plane waves. Transmission Line Theory: LCR model for transmission lines – Analogy with wave equations – characteristics of lossless lines – VSWR, Impedance matching – Smith chart – Case study, Stub and Lumped Matching. Waveguides: TEM, TE, TM Waves – wave propagation in Rectangular, Circular & Planar wave guides. Microwave Passive Components and Planar Transmission Lines Antennas: Basic Radiation Mechanism, Fundamental of Radiation, Antenna parameters, Equivalent Circuit of Antennas, Antenna in receiving mode. Wire Antennas: Electrically Short or Small Dipoles, The Half-Wave Dipole, monopole antenna, Loop Antenna, Antenna Arrays – Fundamentals of Antenna Arrays , basic analysis and pattern of two element array, N-element linear array, broadside and end fire array, Pattern Multiplication Theorem, Yagi-Uda Antennas, Log Period Antenna, fundamental concept of UWB Antennas, Microstrip Antennas, Fundamentals of Horn and Reflector Antenna Fundamentals of Antenna Measurements

	Research Areas for July 2019 PhD Admission				
SI. No.	Department	Department code	Research Area	Eligibility	
1101		PES01	Astronomy & Astrophysics	Master of Science in Physics / Astronomy & Astrophysics /Space Physics / Integrated MS (Physics) / BS-MS (Physics)	
				ME/ M Tech/ MS or equivalent in Remote Sensing/ RS & GIS / Geoinformatics or equivalent field of study Syllabus for Screening Test	
3	Earth and Space Sciences	PES02	Vegetation Diversity Mapping Using Hyper Spectral And High Resolution Satellite Data	1.Remote Sensing Electromagnetic radiation, Spectral signatures, remote sensors and platforms - optical, infrared and microwave sensors, 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. 2. Geographic Information System 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. 3. Probability & Statistics 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.	

	Research Areas for July 2019 PhD Admission						
SI. No.	Department	Department code	Research Area	Eligibility			
4	Physics	PPH01	Steady states in coupled non equilibrium systems	Master of Science in Physics/Applied Physics, BS-MS in Physics/B Tech Engineering Physics with Master of Science in related areas of Physics			

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.

Inter	/iew.	T	T	T
		EAE01	Molecular Spectroscopy	MSc*-Physics or MSc*-Chemistry or BS-MS* (Physics) or BS-MS* (Chemistry) or Masters* in Optics/ Optical Engineering/ Photonics/ Applied Mechanics/ Aerospace/ Mechanical *Candidates with Master's degree in Science need to satisfy the Eligibility criteria as provided in the "minimum qualifications clause No.2"
1E	Aerospace Engineering	EAE02	Computational Fluid Dynamics, Numerical Methods for Fluid Dynamics, Computational Aeroacoustics	M.Tech or MS or equivalent in Aerospace/ Mechanical Engineering in CFD, Fluid Mechanics, Thermal Science, Aerodynamics, Propulsion areas, OR M.Sc/MS* in Physics /Mathematics with knowledge in numerical methods for fluid dynamics. *Candidates with Master's degree in Science need to satisfy the Eligibility criteria as provided in the "minimum qualifications clause No.2"
		EAE03	Aerospace Propulsion/ Combustion	M.Tech/ME/MS in Mechanical/Thermal/ Chemical/ Applied mechanics/Aerospace/Aeronautical
2E	Avionics	EAV01	Spacecraft attitude dynamics and control/ Space mission design	M.Tech/ME/MS in Control systems, Automation, Control and instrumentation, Systems and Control, Navigation guidance and control, aerospace engineering and related areas
3E	Chemistry	ECH01	Light Emitting Polymers/ Polymer Nanocomposit es	M.Sc. in Chemistry (all branches)/BS-MS (with specialization in Chemistry)/M Tech in Materials Science and Technology, Polymer Technology and allied fields.
4E	Humanities	EHS01	Cultural Studies	MA in English Language and Literature

	Research Areas for July 2019 PhD Admission					
SI. No.	Department	Department code	Research Area	Eligibility		
		EMA01	Numerical Solution of Partial Differential Equations	M.Sc in Mathematics, BS-MS in Mathematics or equivalent.		
5E	E Mathematics	EMA02	Partial Differential Equations and Applications to Control Theory	M.Sc in Mathematics, BS-MS in Mathematics or equivalent		
	Physics	EPH01	Molecular Mass Spectroscopy	M. Sc. Physics, M. Tech. Optics (or related areas in optics), BS-MS in Physics, Master of Science in Solid State Physics		
6E		EPH02	Quantum Optics and Quantum Information	M.Sc. Physics/ BS-MS in Physics/B Tech Engineering Physics with M.Tech/ Master of Science in related areas of Physics		

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:

GENERAL SELECTION PROCEDURE:

- 1) Applications will be received until May 6, 2019 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. Final decision on the eligibility of such fellowships will be taken by IIST.
- 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 written test or interview will be displayed in IIST website by May 16, 2019.
- 6) The Ph.D. written screening test will be for one and half hours, starting at 9:30 AM on May 26, 2019 (Sunday) in the cities listed below.
 - i) Thiruvananthapuram
 - ii) New Delhi
 - iii) Kolkata
 - iv) Ahmedabad
 - v) Hyderabad

^{*}For SC/ST/PD 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.

7) The written screening test for Ph.D candidates not holding eligibility through a national test for Ph.D admissions will have two parts A & B. Part A (40 marks) will comprise of questions that test both aptitude and mathematics, Part B (60 marks) will have questions related to subject area that are indicated in the syllabus. While Part A (30 minutes duration) will be conducted first for all Ph.D candidates, Part B (60 minutes duration) will be held starting from 10:15 AM and lasting one hour for different subject areas. A student applying to multiple research areas can write the corresponding subject area (Part B) of the various different research areas in the indicated time slot. The results of the written screening test will be published in IIST website on May 31, 2019.

8) Selection Criteria based on Written Screening Test & Interview:

- (i) The students who have participated in the Written Screening Test will be shortlisted if they secure a minimum of 30 % in each of Section A and Section B 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 students, i.e., SC/ST/PD and OBC 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 Written 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 Written Screening Test.
- (v) The combined mark for the PhD Written Screening Test and interview for a UR student should be 60 % and above to be selected
- (vi) For the SC/ST/PD and OBC students, the combined mark for the PhD Written Screening Test and interview should be 55 % and above.
- 9) Candidates screened in through the written test will be called for an interview to be held at IIST, Thiruvananthapuram on 10thand 11thJune, 2019
- **10)** Provisionally selected candidates list, after the interview, will be displayed in the IIST website on **June 14**, **2019**.
- 11) Outstation applicants will be reimbursed to-and-fro sleeper class train fare/bus fare by shortest route from the place mentioned in the application to Thiruvananthapuram, or actual fare paid (whichever is less) for attending the interview. The applicants are advised to make their own arrangements for their stay at Thiruvananthapuram.
- 12) No travel support will be provided for attending the written screening test.
- **13)** Admissions are governed by Ph.D Rules and Regulations of IIST. (https://www.iist.ac.in/academics/rules-regulations).

- 14) The date of the Written Screening Test and the dates of Interview will not be changed under any circumstances.
- **15)** During interview, candidates will be tested in their main research area and not restricted to the syllabus of the Written Screening Test.

HOW TO APPLY:

- **1)** Applications shall be submitted <u>online</u> at the IIST website: http://<u>admission.iist.ac.in</u>. 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 is to the extent of 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, once enabled by the system, one day after the registration, through "SBI Collect" only.
- 5) 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.
- 6) SC/ST/OBC/Persons with Disabilities (PD) applicants shall upload the relevant certificate in the website before the prescribed date.

	IMPORTANT DATES						
SI. No.	Event	Date					
1	Opening of IIST website for online submission of applications	April 18, 2019 - 1600 hrs (Thursday)					
2	Closing of IIST website for online submission of applications	May 06, 2019 - 2359 hrs (Monday)					
3	Last Date of Payment of application fee	May 07, 2019 – 2345hrs(Tuesday)					
4	Display of shortlisted candidates for Written Screening Test	May 16, 2019 – 1700hrs (Thursday)					
5	Date of written screening test	May 26, 2019 (Sunday) at 0930 hrs					
6	Publishing of Written screening test results	May 31, 2019 – 1700 hrs (Friday)					
7	Interview Dates	June 10 & 11 (Monday & Tuesday)					
8	Display of Provisionally selected candidates	June 14, 2019 - 1700 hrs (Friday)					
9	Last Date of remittance of semester fee	June 21, 2018 (Friday)					
10	Reporting date at the Institution	July 20, 2019 (Saturday)					
11	Classes begin for Ph.D Programme	July 22, 2019 (Monday)					