



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 2021 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 2021, in the departments given below:-

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

Eligibility

1. Nationality: Applicant should be an Indian citizen.

2. Age Limit: Applicant should be below 35 years as on 24.06.2021. Age relaxation is applicable as per Government Rules.

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 7.00 CGPA on a scale of 10 or equivalent in the Qualifying Master's degree (60% marks or 6.50 CGPA 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 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-JRF or Lectureship 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 7.00 CGPA on a scale of 10 or equivalent in the Qualifying Master's degree (60% marks or 6.50 CGPA 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 valid 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. 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 valid 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 3 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 July 2021 PhD Admission			
Department of Aerospace Engineering			
Sl. No.	Department code	Research Area	Eligibility
1	PAE01	Computational Fluid Dynamics, Computational Aeroacoustics	M.E./ MTech / M.S or equivalent degree in Mechanical / Aerospace / Aerodynamics/ Thermal and Propulsion/ Applied Mechanics/ Fluid Mechanics/ Thermal Sciences/ Engineering or equivalent areas
<p><u>Syllabus for screening test for PAE01</u></p> <p>Basic Fluid Mechanics: Conservation laws: Mass, momentum and energy (Integral and differential form); Dimensional analysis and dynamic similarity; Potential flow theory: sources, sinks, doublets, line vortex and their superposition. Elementary ideas of viscous flows including boundary layers.</p> <p>Compressible Flows: Basic concepts of compressibility, One-dimensional compressible flows, Isentropic flows, Fanno flow, Rayleigh flow; Normal and oblique shocks, Prandtl-Meyer flow; Flow through nozzles and diffusers.</p>			
2	PAE02	Structural Engineering/ Structural Mechanics	M.E./ M.Tech / M.S or equivalent degree in Structural Engineering / Engineering Structures/Machine Design/ Applied Mechanics / Aerospace or equivalent areas or Allied Areas with Solid Mechanics / Structural Mechanics background
<p><u>Syllabus for screening test for PAE02</u></p> <p>Engineering Mechanics: System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Frictions and its applications; virtual work; impulse and momentum (linear and angular), kinematics and dynamics of particles & of rigid bodies in plane motion and energy formulations, collisions.</p> <p>Solid Mechanics: Stress and strain, Hooke's law, Elastic constants, Poisson's ratio, Mohr's circle for plane stress and plane strain, thin cylinders, Trusses and frames; Bending moment and shear force in beams; Simple stress and strain relationships; Simple bending theory, flexural and shear stresses, shear centre; Uniform torsion, Transformation of stress; buckling of column, combined and direct bending stresses, Deflection of beams; torsion of circular shafts, energy methods; Free Vibrations of damped and undamped SDOF system.</p>			
3	PAE03	Micronozzles for Satellite Propulsion	M.E./ M.Tech / M.S or equivalent degree in Mechanical/ Aerospace/ Aerodynamics/ Thermal and Propulsion/ Applied Mechanics/ Fluid Mechanics/Thermal Sciences/ Engineering or equivalent areas
4	PAE04	Direct Contact Condensation/ Multiphase flows	
5	PAE05	Supersonic Combustion	
<p><u>Syllabus for screening test for PAE03, PAE04 & PAE05</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, basics on turbulent flow.</p> <p>Heat Transfer: Modes of heat transfer; heat conduction, thermal resistance concept, thermal boundary layer, free and forced convective heat transfer</p> <p>Thermodynamics: Basic concepts, First and second law of thermodynamics, properties of pure substances, thermodynamic relations, thermodynamic cycles</p>			

Department of Avionics			
1	PAV01	Computer Networks, 6G Wireless Networks, 6G- Satellite network integration	M.E./ M.Tech / M.S or equivalent degree in Computer Science / Computer Science and Engineering / Computer Science and Automation / Information Technology with B.E./ B.Tech or equivalent degree in Computer Science / Computer Science and Engineering / Electronics and Communication Engineering / Information Technology or equivalent areas.
<p><u>Syllabus for screening test for PAV01</u></p> <p>Selected topics from “Programming and Data Structures” and “Computer Networks” from GATE (CS) 2020 syllabus. Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs. Concept of layering. LAN technologies (Ethernet). Flow and error control techniques, switching. IPv4/IPv6, routers and routing algorithms (distance vector, link state). TCP/UDP and sockets, congestion control. Application layer protocols (DNS, SMTP, POP, FTP, HTTP). Basics of Wi-Fi.</p>			
2	PAV02	Spacecraft Dynamics and Control	M.Tech / M.E / M.S or equivalent degree in Control Systems / Guidance, Navigation and Control/ Instrumentation and Control/ Automation/Aerospace/ Aeronautics Engineering and related areas with B.E/B.Tech in Avionics/Electronics and Communications/ Electrical and Electronics / Aerospace / Mechanical engineering or equivalent areas
<p><u>Syllabus for screening test for PAV02</u></p> <p>Control Systems: Open loop and closed loop (feedback) systems and stability analysis of these systems. Transfer functions of systems; transient and steady state analysis of LTI control systems and frequency response. Tools and techniques for LTI control system analysis: root loci, Routh-Hurwitz criterion, Bode and Nyquist plots. Elements of lead, lag compensation, Proportional-Integral-Derivative (PID) control. State variable representation and solution of state equation of LTI control systems.</p>			
3	PAV03	Analog and RF IC Design	M.Tech / M.E / M.S or equivalent degree in VLSI / Microelectronics / RF Engineering / Electronics and Communication Engineering / Electronics engineering or equivalent areas.
<p><u>Syllabus for screening test for PAV03</u></p> <p>Network analysis - RL, RC, RLC circuits - time domain and frequency domain analysis Analog circuits - BJT, MOSFET circuits and amplifier topologies, frequency response, op-amp circuits RF and Microwave engineering - Basic S parameters Signals and systems - poles and zeros, s-plane, z-plane analysis of systems, fourier, laplace and z-transforms</p>			
4	PAV04	Sensors, Interface Electronics and Instrumentation	M. Tech/M. E./ M.S or equivalent degree in Applied Electronics and Instrumentation/ Electronics and Communication/

			Instrumentation and Control/ Instrumentation & Signal Processing / VLSI / Embedded Systems / Electrical Engineering or equivalent areas.
<p><u>Syllabus for screening test for PAV04</u></p> <p>Resistive, Capacitive, Inductive Sensors, Temperature sensors, Displacement and Speed Measurement, Photodiodes. Analog electronic circuits, Characteristics and applications of diode, Zener diode, BJT and MOSFET; amplifier circuits, Operational amplifiers and typical OPAMP-based circuits, Instrumentation Amplifiers, Filter circuits, Integrators and Differentiators, Precision Rectifiers, Signal Conditioning Circuits for Sensors. Static and Dynamic characteristics of Instruments/Sensors, Bridge Circuits Fundamentals of Digital Electronics; Time, frequency, phase Measurement, Digital Voltmeters, Signal generators, ADC and DAC – characteristics, circuit-architectures.</p>			
Department of Chemistry			
1	PCH01	Nanocomposites	M.Sc / BS-MS or equivalent degree in Chemistry / M.Sc in Polymer Science / Biopolymers or equivalent areas / M.Tech in Materials Science / Nano Technology/ Polymer Technology or equivalent areas
<p><u>Syllabus for screening test for PCH01</u></p> <p>Candidates have to choose any one of the below given areas based upon their qualification.</p> <p>Materials Science and Technology: Classification and Structure of Materials, Thermodynamics, Kinetics and Phase Transformations. Properties and Applications of Materials, Characterization and Measurements of Properties, Processing of Materials, Degradation of Materials</p> <p>Polymer Science and Technology: Chemistry of high polymers, Polymer characterization, Synthesis, manufacturing and properties. Polymer blends and composites, Polymer rheology, Polymer processing, Polymer testing</p> <p>Nanoscience and Technology: Classification and Structure of Materials, Theory of nanomaterials, Synthesis and processing of nanomaterials, Functional nanomaterials, Nano characterization of materials, Applications of nanomaterials</p>			
Department of Physics			
1	PPH01	Atomic and Molecular Physics, Molecular Physics of Interplanetary Ionosphere	M. Sc. or equivalent degree in Physics / M. Sc. or equivalent degree in Electronics / Integrated M. Sc. in Physics / BS-MS in Physics / BS-MS in Applied Physics or equivalent areas

Table 2 : External Funded Projects

Department of Earth and Space Sciences			
1	PES01	Transfer learning approaches for hyperspectral image processing / Big Geospatial Data Analytics	M.E./ M.Tech/M.S. or equivalent degree in Computer Science & Engineering / Information Technology / Signal Processing / Image Processing / Computing / Machine Learning / Data Science / Geoinformatics / Geomatics / Remote Sensing /or equivalent areas with (i) B.E. / B.Tech in Computer Science & Engineering / Information Technology / Electrical & Electronics Engineering / Electronics & Communication Engineering / Civil Engineering / Geoinformatics / or equivalent areas or (ii) M.Sc or equivalent degree in Mathematics / Physics
<p><u>Syllabus for screening test for PES01</u></p> <p>Introduction to remote sensing: different resolutions, names of recent Indian remote sensing satellites, different ranges of electromagnetic spectrum used in remote sensing, spectral signature of different land surface materials.</p> <p>Introduction to digital image processing: digital image definition, sampling and quantization, image enhancement techniques – low pass filtering (image smoothing: mean, median, Gaussian filters etc), high pass filtering (edge detection: Laplacian, Sobel, Roberts filters etc.), 2D Fourier Transform, image classification algorithms (maximum likelihood classifier, Minimum distance/Euclidian classifier), clustering (k-means, ISODATA, C-Means).</p> <p>Reference books:</p> <ol style="list-style-type: none"> Digital image processing, Gonzalez, Woods Remote sensing digital image analysis, An Introduction, Richards ISRO/NRSC website for list of Indian Remote Sensing Satellites 			
Department of Physics			
1	PPH02	Adaptive Optics	M.Sc / MS or equivalent degree in Physics /Applied Physics / Photonics or equivalent areas or M.E./M.Tech or equivalent degree in Applied Optics / Optoelectronics / Optical Engineering or equivalent areas
<p><u>Syllabus for screening test for PPH02</u></p> <ol style="list-style-type: none"> Geometrical optics (Matrix Method of Ray optics, monochromatic and chromatic aberrations) Interference (Wavefront division and Amplitude division) Diffraction(Fresnel and Fraunhofer diffraction, Gratings) Polarisation(linear, elliptical and circular polarisation) Optical coherence(Spatial and Temporal) 			

Table 3 : 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
1E	Avionics	EAV01	Spacecraft Mission Design	(i) ME / MTech / MS / Dual Degree or equivalent degree in Control Systems, Aerospace / Aeronautical / Guidance and Navigation or equivalent areas with B.E/ BTech in Avionics, Electronics and Communication, Electrical and Electronics, Aerospace / Aeronautical Engineering / Computer Science or equivalent areas or (ii) M.Sc or equivalent degree in Physics with B.Sc in Physics.
		EAV02	Control Systems	M.E / M.Tech / MS in Control System / Instrumentation and control / Process control or equivalent areas with B.E/ B.Tech/ BS in Electrical and Electronics Engineering / Electronics and Communication / Electronics and Instrumentation / Avionics / Instrumentation /Control and Instrumentation.
		EAV03	MEMS and Microelectronics	ME / M-Tech / MS or equivalent degree in Microelectronics, Solid State Technology, VLSI and Microsystems or equivalent areas
2E	Chemistry	ECH01	Energy Storage Materials for Batteries and Super Capacitors	BS-MS /MSc or equivalent degree in Chemistry / Physics / Material Science or equivalent areas
		ECH02	Functional Materials Hardware for Life Science Experiments	BS-MS / MSc or equivalent degree in Chemistry / MSc Materials Science / MSc Biochemistry or equivalent degree / Masters in Chemical Engineering/ Masters in Biotechnology or equivalent areas

3E	Earth and Space Sciences	EES01	High Energy Astrophysics	M.Sc/M.S or equivalent degree in Physics / Astronomy & Astrophysics / Space Physics / Integrated MS in Physics / BS-MS in Physical Sciences or equivalent areas
4E	Mathematics	EMA01	Deep Learning/Graphical Models/Topological Data Analysis	(i)M.E./ M.Tech./M.S. or equivalent degree in Computer Science / Electronics / Electrical / Machine Learning or equivalent areas. (or) (ii) M.Sc. or equivalent degree in Computer Science / Machine Learning / Mathematics / Statistics or equivalent areas.
		EMA02	Differential Geometry and Applications	M.Sc or equivalent degree in Mathematics or equivalent areas.
5E	Physics	EPH01	Experimental Condensed Matter Physics, Intelligent Sensor Development for Space Physics	BS-MS, MSc or equivalent degree in Physics/ Applied Physics, B.Tech in Engineering Physics with M.Sc./M.Tech in related areas of condensed matter physics.
		EPH02	Statistical Mechanics	BS-MS / M. Sc or equivalent degree in Physics Integrated MSc in Physics or equivalent areas
		EPH03	Optics	BS-MS/ M.Sc / MS or equivalent degree in Physics / Applied Physics / Photonics or equivalent areas or M.Tech or equivalent degree in Applied Optics / Optoelectronics / Optical Engineering or equivalent areas.

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 selected for the PhD positions listed in Table 2 will be paid as per the DST/funding agency norms. At present this is Rs.31000/- plus 16% HRA per month. The payment of fellowship will be coterminous with the duration of the project.
- 4) 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.
- 5) 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.
- 6) 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.
- 7) 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)

Description of Fees	Amount (Rs.)
Tuition Fees(*)/ Semester	Rs.2500(*)
Other Fees/Semester	Rs.4950
Total Fee(A)	Rs.7450
Hostel Fee/ Semester	Rs.10250
Admission Fee (Non-Refundable) One-time	Rs.1500
Caution Deposit (Refundable)(One-time)	Rs.5000
Mess Bill/(Nominal) in advance	Rs.18000 (#)
Total Fee(B)	Rs.34750 (**)
Grand Total 1st Semester (A+B)	Rs.42200
2nd Semester onwards (A+B-one time)	Rs.35700

Note:

- **A candidate who confirms the seat has to remit the fees of Rs. 7450/-.**
- (*) SC/ST/PD students are exempted from payment of Tuition Fees.

- **(**) Will be collected at the time of physical reporting at the Institution.**
- **(#) 3000 p.m. X 6 months as advance**
- Additional fees: Supplementary Examination fees - Rs.100/- per paper and Thesis Submission - Rs.1000/- and Convocation fees - Rs.2000/- & Alumni Registration fees - Rs.500/-, which will be collected with the final semester fee.

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 and indicate the period of fellowship validity.
- 5) A short-list of applicants for Online screening test or interview will be displayed in IIST website by **02.07.2021(Tentative)**.
- 6) **Online screening test will be on 11.07.2021 (Tentative).**
- 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 Aptitude and class 12 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.
- 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. The date of interview spans over a period of several days. In case the date and time of the interview clashes with the applicant's End semester examination in his/her qualifying examination, the Institute will consider shifting the date and time of interview within the overall window available.**
- 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: <https://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 completing the process of registration.

- 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/EWS/Persons with Disabilities (PD) applicants shall upload the relevant certificate in the website before the prescribed date. **OBC-NCL/EWS certificates issued after 01/04/2021 only will be accepted.**

IMPORTANT DATES		
Sl. No.	Event	Date
1.	Opening of IIST website for online submission of applications	May 27, 2021 - 1600 hrs (Thursday)
2.	Closing of IIST website for online submission of applications	June 24, 2021 – 2359 hrs (Thursday)
3.	Display of shortlisted candidates for Test	July 2, 2021 – 1700 hrs (Friday) (Tentative)*
4.	Date of online screening test	July 11, 2021 (Sunday) (Tentative)*
5.	Publishing of screening test results	July 19, 2021-1700hrs (Monday) (Tentative)*
6.	Interview Dates	July 22 & 23, 2021 (Tentative)*
7.	Display of Provisionally selected candidates	July 28, 2021-1700hrs (Tentative)*
8.	Last Date of remittance of semester fee	July 30, 2021 (Friday) (Tentative)*
9.	Reporting date at the Institution	July 31, 2021(Saturday) (Tentative)*
10.	Classes begin for Ph.D Programme	August 2, 2021 (Monday) (Tentative)*

*** These dates are tentative and could change depending on the situation of the pandemic Covid-19 in the country.**