Indian Institute of Space Science and Technology

(An autonomous institute under Department of Space, Govt. of India)
Declared as Deemed to be University under Section 3 of the UGC Act, 1956.
Valiamala P.O., Thiruvananthapuram – 695 547, INDIA.
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INFORMATION BROCHURE

(Released on 17th July 2020)

Admission to
PG Programmes
July 2020

Online application portal:
https://admission.iist.ac.in

Email ID : admissions@iist.ac.in
Contact us: 0471-2568477/618/418

1. ABOUT THE INSTITUTE

Indian Institute of Space Science and Technology (IIST) established in 2007, and situated at Thiruvananthapuram, Kerala, is a Deemed to be University under Section 3 of the UGC Act, 1956. IIST, functions as an autonomous institution under the Department of Space (DoS), Government of India. IIST was conceived with a vision to nurture exceptional manpower for the Indian Space Research Organization (ISRO), one of world's leading scientific organizations engaged in space research and space applications. The institute is the first of its kind in the country to offer high quality education at the undergraduate, graduate, doctoral and post-doctoral levels on areas with special focus towards space sciences, space technology and space applications. Equipped with excellent infrastructure and about 100 highly qualified faculty members, IIST has, within a decade of its inception, risen to great heights**.** It was ranked among the top 30 Engineering institutes of the country according to 2019 NIRF rankings of MHRD with a high score of more than 75% in Teaching, Learning and Resources; a score much better than many premier institutes in the country. The institute currently offers three undergraduate and fifteen postgraduate programmes that are listed below.

Postgraduate Programmes

· M.Tech. in Thermal and Propulsion
· M.Tech. in Aerodynamics and Flight Mechanics
· M.Tech. in Structures and Design
· M.Tech. in RF and Microwave Engineering
· M.Tech. in Digital Signal Processing
· M.Tech. in Control System
· M.Tech. in VLSI and Microsystems
· M.Tech. in Power Electronics
· M.Tech. in Materials Science and Technology
· M.Tech. in Earth System Science
· M.Tech. in Geoinformatics
· Master of Science in Astronomy and Astrophysics
· M.Tech. Machine Learning and Computing
· M.Tech. in Optical Engineering
· M.Tech. in Solid State Technology

Undergraduate Programmes

- B. Tech in Aerospace Engineering
- B. Tech in Electronics and Communication Engineering (Avionics)
- Dual Degree (B.Tech in Engineering Physics + Master of Science/ M.Tech in one of the following):
    - Master of Science in Astronomy and Astrophysics
    - Master of Science in Solid State Physics
    - M. Tech in Earth System Science
    - M. Tech in Optical Engineering

In addition, IIST has a vibrant research environment with close to 200 PhD scholars engaged in frontline research areas. The academic programmes have been formulated to strengthen the fundamentals, provide hands-on experience through practical work, enhance the understanding and expand the boundaries of knowledge in various areas of interest. IIST focuses on inculcating the culture of innovation in students.

The curriculum labs are meticulously designed and the best experimental set-ups and equipments are provided. IIST has three Centres of Excellence in the areas of (i) Advanced Propulsion and Laser Diagnostics, (ii) Virtual Reality and (iii) Nano science and Technology, where students get to involve themselves in various advanced and sophisticated experiments. The many state-of-the-art research laboratories offer a unique learning environment for the students to delve into cutting-edge research. With IIST stepping into the next decade, the decadal plans promise ample opportunities to the young, bright students to get actively involved in space related projects like ExoWorlds – An ISRO Exoplanet Mission, Space Robotics, Space Sensors, etc.

IIST AT A GLANCE - 2020		
Strength of Departments		
Department	**Faculty members**	**Scientific/Technical Staff**
Aerospace Engineering	25	19
Avionics	23	8
Chemistry	8	4
Earth and Space Sciences	14	3
Humanities	5	0
Mathematics	11	3
Physics	13	8

Postgraduate Enrollment (2010 – 2019)	
Department	**Total no. of students enrolled**
Aerospace Engineering	158
Avionics	206
Chemistry	59
Earth and Space Sciences	105
Mathematics	57
Physics	66
Total	651

Undergraduate Enrollment (2007 – 2019)	
Course	**Total no. of students enrolled**
B.Tech. in Aerospace Engineering	743
B.Tech. in Electronics & Communication Engineering (Avionics)	786
B.Tech.* in Engineering Physics (Dual Degree)	347
Total	1876

*Including earlier B.Tech. (Physical Science)

PhD Enrolment (2010 – 2019) – 312 Nos

Degrees Awarded (2011-2019)			
Postgraduate	**Undergraduate**	**Dual Degree**	**PhD**
424	1154	30	69

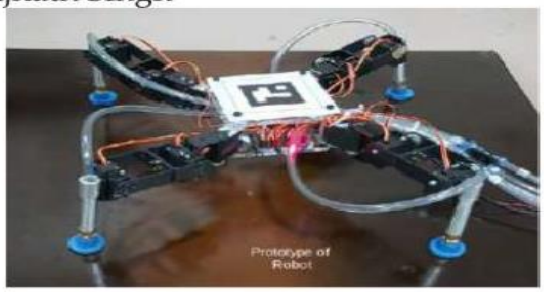
Snippets from IIST News Letter

Dare to Dream Contest by DRDO

The IIST Team consisting of Shri Saurabh Chatterjee (PhD Scholar) and Abhijith Prakash (B Tech Student) won the first prize in the DRDO organized "Dare to Dream Contest" based on the topic 'Multi Leg Mobility'. The team has designed a four legged walking robot with vacuum suction pads which is able to climb on to surfaces of aircrafts and launch vehicles and inspect them for defects. The prototype was built and demonstrated as climbing an inclined plane. DRDO organised the 'Dare to Dream Contest' to bring together enterpreneurs, academicians and individual innovators and encourage them to 'dare to dream'. The contest attracted over 3,000 entries in 12 topics of which 20 were awarded prizes. The prize distribution was done by Hon. Defense Minister of India, Shri. Rajnath Singh during the DRDO's directors conference in New Delhi on15th Oct, 2019.

Shri. Saurabh Chatterjee receives award from Hon. Defence Minister Shri. Rajnath Singh

Abhijith Prakash



Awards and Recognition

Future Research Talent Award Winners (2020), **organised** by **Australian** National University, Canberra, **Australia**

Ms. Ushasi Bhowmick, (B,Tech EP 6th Semester), *Ms.Kolencheri Jithendran Nikitha* (DD, Master of Science in Astronomy and Astrophysics, 8th Semester), *Mr. Pratik Sharma* (B.Tech ECE, 6th Semester), *Mr. Gaurav Kumar* (M.Tech, ESS, 2nd Semester), *Ms. Reema Mathew* (DD, M.Tech, ESS, 8th Semester), *Ms. Chinmai Sai Jureddy* (DD, Master of Science in SSP, 8th Semester) have been selected by Australian National University (ANU) for their Future Research Talent (FRT) Awards for the year 2020. It may be noted here that, ANU has selected the largest contingent of Indian students from IIST this year. Last year, ANU has selected 5 IIST students for the ANU-FRT Awards from among 51 students selected all over India spanning 19 Institutions. ANU-FRT provides air travel and living expenses for each student amounting to 6000 Australian Dollars. Selected students will get to spend close to3 months of summer internship at ANU during May-July 2020.

Ushasi Bhowmick | Kolencheri Jithendran Nikitha | Pratik Sharma | Gaurav Kumar | Chinmai Sai Jureddy | Reema Mathew

IIST promises a vibrant campus life for the young and energetic students amidst the serene greenery close to the foothills of the Sahyadri ranges.

Campus life at IIST

There are well equipped hostels, student canteens, cafeteria, bank and ATM, play grounds, gyms, etc. Very good medical and counselling facilities are also available on campus. Clubs like the Astronomy Club, Robotics Club, and Mathematics Club are very active in the campus. Conscientia, IIST's Astronomy & Technical Fest, is organized every year by the students to trigger innovative ideas. For their holistic growth, IIST encourages students in extra-curricular pursuits like sports and cultural activities. IIST's Annual Cultural Fest, Dhanak is now one of the most popular student festivals in south India, where a large number of students converge to showcase their talent. Festivals and events are celebrated with enthusiasm by the student community with active participation from the entire IIST fraternity.

2. POSTGRADUATE PROGRAMMES: AN OVERVIEW

Department of Aerospace Engineering (AE)

1. M.Tech in Aerodynamics and Flight Mechanics

The M.Tech programme is designed to impart knowledge in the areas of low speed and high speed aerodynamics, space and atmospheric flight mechanics, and control & design of aerospace vehicles such as aircraft, space crafts and launch vehicles. The curriculum is tailored to be accessible to students with a basic Mechanical engineering background. The elective courses allow the student to build up on the foundations in their fields of choice, ranging from advanced aerodynamics, computational methods and control theory. Laboratory facilities available for this programme include an aerodynamics lab equipped with low speed wind tunnels, shock tube with advanced instrumentation such as hot wire anemometer, high speed Schlieren high speed data acquisition systems etc. The flight dynamics lab operates several, instrumented, and fixed and rotary wing MAV's, which are routinely used for instructional and research flights. Access to several commercial and open source CFD software packages is also available, through the centralised HPC facility. During the M. Tech thesis work, the student has the opportunity to use these facilities to work on a fundamental or applied research problem, providing exposure to the state of the art in the fields of Aerodynamics and flight mechanics. On completion of the M Tech programme, the student is expected to be capable of working with suitable aerodynamic/orbital mechanics models and analyse/design the stability and performance characteristics of aerospace vehicles. The Flight Mechanics lab has a variety of in-house fabricated UAVs for research and experimental purposes.

The research activity involves the guidance and control of all type of UAVs using classical and unconventional methods. A platform for new design methodology for the UAVs is available for the students to bring out their imagination. Fair numbers of top students are currently pursuing their doctoral degrees in prominent universities like IIT Madras, IIT Bombay and IISc Bangalore.

Figure: Flight Mechanics lab

2. M.Tech in Structures and Design

This programme mainly focuses on concepts of design and analysis of advanced structures. The programme covers fundamentals of static and dynamic analysis and design of various structures. The curriculum covers topics such as Elasticity, Structural Dynamics, Finite element methods, Composite mechanics and a wide variety of electives in the areas of Acoustics, Stochastic Mechanics, Structural Health Monitoring and Wave Propagation, Fracture Mechanics, Robotics, and Advanced Computational Techniques.

Students get an opportunity to carry out their lab experiments at various state of the art facilities in house and in research centres of ISRO. The lab facilities available in house include Modal testing, Experimental composite micromechanics using microRaman spectrometer, Structural health monitoring facility using laser doppler velocimetry, Advanced robotics and wheeled Rovers for NDT. Students have access to Computational mechanics software such as ABAQUS, ANSYS, NASTRAN, FEAST, ADAMS and various modelling software. An interdisciplinary approach with flexibility in choosing courses enables students to tackle real life engineering challenges. Students are exposed to the structural design challenges faced by the Aerospace and allied industries

and related research. Dissertation enables students to tackle research and industrial problems with a fundamental outlook.

Figure: micro Raman Spectrometer

Out of the graduated students of M.Tech in Structures and Design, about 53% have been placed in different reputed firms such as UTC Aerospace, Indian Space Research organisation, Indian Railways, Entuple Technologies, TCS (Engineering and Industrial Services), to name a few.

About 22% of the graduates from Structures and Design are undergoing higher studies in reputed Universities within the country and abroad including IISC Bangalore, India, Indian Institute of Technology, Kanpur, India, Indian Institute of Technology, Hyderabad, India, Pennsylvania state University, USA, University of Groningen, Netherlands, Politecnico di Torino, Italy.

3. M.Tech in Thermal and Propulsion

The Master's degree programme in Thermal and Propulsion offered by the Department of Aerospace Engineering at Indian Institute of Space Science and Technology provides an opportunity for the B.Tech. or equivalent degree holders in Aerospace/ Aeronautical/Mechanical/Chemical Engineering to specialize in the field of thermal-fluid sciences and propulsion engineering. This postgraduate program consists of advanced compulsory courses, electives, a laboratory practice course, a credit seminar, and a year-long project in the final phase. The curriculum and syllabus are framed to develop a fundamental understanding of the basic subjects offered as core courses in the field of specialization for further extension of the learning in the niche areas being offered as electives. The final year individual project provides ample

opportunity for the student to develop insight and exposure in frontier research and developments in the field of fluid mechanics, compressible flows, heat transfer, combustion, propulsion technology, computational fluid dynamics, and two-phase flows. The Department of Aerospace Engineering at Indian Institute of Space Science and Technology has enough faculty resources and infrastructure for academics, laboratory practices, and research. This includes thermal and propulsion laboratory for academic training equipped with advanced heat transfer equipment, combustion diagnostics, test rigs for turbojet and ramjet, various types of compressors, etc. Department has a Centre of Excellence in advanced propulsion and laser diagnostics and research facilities in combustion and flame diagnostics, heat transfer, two-phase flows, high-speed flows etc. Institute also has a computational facility with necessary software packages for modeling and simulation in the field of thermal-fluid sciences and propulsion engineering. In addition to this, the department also promotes computational research using open-source resources and indigenously developed computer codes.

Accurate prediction of flow field variables and forces are in demand from Aerospace and other industries. A typical CFD simulation results obtained by solving the governing equations in fluid dynamics and heat transfer using advanced numerical techniques is shown below (Figure 1(a)). One of the major advantages of CFD is that it can handle complex geometries and non linearities in the governing equations. Compared with analytic approaches, CFD requires relatively few restrictive assumptions and gives a complete description of the flow field for all variables. It can provide complete information of the field variables at low cost and relatively high speed. Using flow visualization techniques full-scale or small scale models of the objects are experimentally tested and phenomena of interest are carefully studied in controlled conditions. A typical flow field captured by 2D Particle Image Velocimetry (2D-PIV) is shown in Figure 1(b)

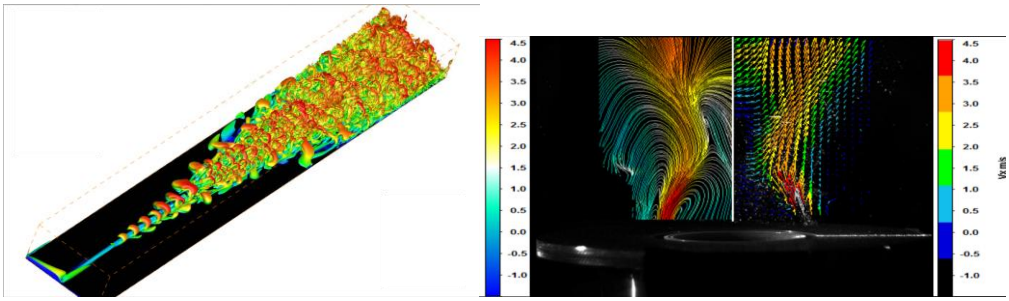


Figure. (a) Direct numerical simulation of laminar- turbulent flow transition; (b) Streamlines (left) and 2D mean axial velocity (right) distribution under isothermal conditions in a swirl stabilized burner measured using 2D Particle Image Velocimetry (2D-PIV)

Out of the graduated students of M.Tech in Structures and Design, about 57% have been placed in different reputed firms such as CSIR National laboratories, Indian Space Research organisation, AirIndia Engineering Services LTD, Skyroot Aerospace Pvt. Ltd. to name a few.

About 23% of the graduates from Structures and Design are undergoing higher studies in reputed Universities within the country and abroad including IISC Bangalore, India, Indian Institute of Technology, Bombay India, Indian Institute of Technology, Madras India

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Department of Avionics (AV)

1. M.Tech in Control Systems

M.Tech in control Systems is a unique two-year interdisciplinary master's program designed to provide due weightages for both R&D as well as Industrial sectors. This well-structured and focused M.Tech program gives a comprehensive exposure to students in a wide area of control systems theory and practice. Senior scientists of ISRO who had been involved in the development of control systems for ISRO launch vehicles and satellites are also serving as adjunct/ guest faculties in the control group. This provides a better realistic perspective for the courses and projects being offered.

Courses in this program range from fundamental topics like classical control design techniques to advanced topics like nonlinear control theory, optimal control design etc. These courses are backed with design projects in embedded systems and control. Further, students are exposed to application of control theory in the field of launch vehicles, spacecraft and robotics as part of their elective courses. As part of their final year project, students get an opportunity to work with cutting edge technologies in the field of robotics, spacecraft attitude control, biomedical engineering, UAVs etc.

The M. Tech students have ample opportunities to do internships and projects related to the advanced research projects undertaken by the faculties of control group. The list of few such projects is given below:

1) Control system development for the half humanoid Vyommitra to be launched by ISRO to function on-board the Gaganyaan, a crewed orbital spacecraft.

2) Configuration design and Control system development for a human mimetic general purpose humanoid, an advanced R&D project initiated by ISRO as a part of Vision-2030.

2. M.Tech in Digital Signal Processing

The M.Tech in Digital Signal Processing (DSP) programme is a two-year course offered to students who are passionate about the field of signal processing and allied fields such as communication systems, image processing, machine learning for signal processing, and computer vision. Students in this course are instructed by experienced faculty in fundamental subjects such as probability and random processes, estimation and detection, linear algebra, advanced signal analysis, pattern recognition, and machine learning. These fundamental subjects enable students to proceed seamlessly to advanced courses in signal processing, communication systems, deep learning, computer vision and Internet of Things which are offered in the programme. The M.Tech in DSP programme also offers the students hands-on experience in various subjects through laboratories in digital signal processing, communication systems, machine learning, artificial intelligence, computer networks and systems, and computer vision. Our labs are well equipped with software defined radios, MIMO evaluation kits, spectrum analyzers, RF signal generators, digital signal processing boards, sensor network motes, and network development kits, to name a few.

A few representative pictures of the labs are given below.

Digital Signal Processing Laboratory

Communication Systems Laboratory

Systems and Networks Lab	Virtual Reality Laboratory

The rigorous study enables the M.Tech in DSP students to participate competitively in current research activities, development projects, and pursue higher studies. The work done by our M.Tech students has been reported in 6 journal publications and 14 conference publications. The students work on various research projects in association with several centers of ISRO such as URSC, IISU, NRSC, and VSSC. They also get opportunities to work in collaborative projects with other institutes such as IIT. Students from M.Tech in DSP have received the prestigious INAE best project award, and two best paper awards for their work.

The two-year programme also offers ample opportunities for developing industry-specific skills through an innovative design project, summer internship, and final year project. Till date 25% of our students have been ISRO employees who have joined the DSP programme for further training or have been placed in ISRO after their graduation. Of the rest of the students, 58% have been placed or have had internship opportunities in PSUs, industries, and research organizations such as:

- NPOL (DRDO)
- IES (Railways)
- Analog Devices
- Mathworks
- Team Indus
- Mercedes Benz
- Tata Consultancy Services (Research and Development)
- Subex
- Flytxt Mobile Ltd.
- KPIT

After graduation, 24% of students (non ISRO employees) have or are pursuing higher studies in universities and institutes such as

- Indian Institute of Science, Bangalore
- Indian Institute of Technology, Bhubaneswar
- Indian Institute of Technology, Madras
- Indian Institute of Technology, Kharagpur
- Georgia Institute of Technology, Atlanta

3. **M.Tech in RF and Microwave Engineering**

M.Tech. in RF and Microwave Engineering under the department of Avionics is a unique two-year course designed with a specific focus of the state of the art industry requirements, Government R & D Laboratories and higher education. The course curriculum under the programme is designed in a well-balanced manner to equip the students with fundamental courses along with advanced ones in the niche area of Advanced Electromagnetics, Antenna technology, Microwave and MM-wave circuits and THz Technology. There is ample opportunities for the students to pursue advanced research through integrated components of the curriculum like, course based mini-projects, Engineering Design, Seminar Presentation on the latest trends as well as extensive projects work running for two full semesters. Thanks to the availability of the well-equipped antenna fabrication facilities and high frequency measuring instruments in the laboratory, students get ample exposure on various practical experiments, hands-on experience and associated system aspects through various research projects of Department of Science and Technology, (Government of India), ISRO centres along with IIST projects.

Figure-1: Glimpses of the selective major equipment and devices/antennas/system realized by the M.Tech. in RF and Microwave students at IIST

Due to strong association and collaboration with various centres and laboratories of Indian Space Research Organization (ISRO) , students get opportunities to work in various live projects catering to the space antennas, mm-wave and THz antennas, Internet of Things testbeds, and circuits etc. in various ISRO centres and industries. Figure-1 shows the glimpses of some of the research equipments/facilities along with a few selected prototypes developed by the M.Tech. RF and Microwave Engineering students under the supervision of the faculty members of the group. More than 65% of the alumni of M.Tech. in RF and Microwave have been placed and currently working in different reputed organizations like (selective):

- Ansys , Bangalore, India
- Mercedes-Benz, Bangalore, India
- COMSOL Multiphysics, Bangalore, India
- Astra Microwaves , Hyderabad, India
- Asarva Chips and Technologies Pvt. Ltd., Bangalore, India
- TeamIndus, Bangalore, India
- Honeywell, India and Canada
- NEST Technology, Trivandrum, India
- BPL Medical Technologies, Bangalore, India

- Space Application Centre, ISRO, Ahmedabad, India
- UR Rao Satellite Centre,ISRO, Bangalore, India
- Satish Dhawan Space Centre (SDSC), ISRO, Sriharikota, Andhra Pradesh
- Raman Research Institute, Bangalore, India
- NIT Surathkal, India
- Shivaji University,Kolhapur, Maharashtra

Till date 27% of the graduates from the RF and Microwave Engineering Students have opted for higher education in premier Institute across India and abroad. A selective list is as follows:

- ❏ Indian Institute of Space science and Technology, Trivandrum, India
- ❏ University of Waterloo,Ontario,Canada
- ❏ Curtin University, Perth, Austrailia
- ❏ IISC Bangalore, India
- ❏ Indian Institute of Technology, Chennai, India
- ❏ Indian Institute of Technology, Hyderabad, India

Graduates of M.Tech. in RF and Microwave Engineering students have

- received several best paper awards in prestigious International conferences
- received International Travel support awards from DST, Government of India
- published various high quality articles in reputed journals like IEEE Transaction on Antennas and Propagation, Microwave and Optical Technology Letters. IEEE Access, IET Microwave Antennas and Propagation etc.

4. **M.Tech in Power Electronics**

M. Tech in Power Electronics (PE) offers courses that cover the latest trends in Power Converters, Electric Drives, Grid Connected Systems, Internet of Things, and Control Systems with hands-on laboratory experience.

The PG Power Electronics Lab is equipped with several converter modules including rectifiers, inverters, multi-phase and multi-level converters, high-end digital signal oscilloscopes, LCR meters, thermal-cameras, power quality analyzers, programmable power supplies, and electronic loads, which are available for research and extensive experimentation to PG students. Control

platforms such as Digital Signal Controllers, Programmable System on Chip, and FPGAs are available. Electric machines including induction machines (3-phase, 5-phase, 6-phase), synchronous machines (3-phase, 6-phase), DC machines are available. In addition to these, special electrical machines such as BLDC motors, multi-phase motors are also available.

PG students are encouraged to design and build converter prototypes and controller platforms, design electrical machines, explore research problems in emerging areas such as solid-state transformers, electric-vehicle technology, multi-level converters, and multi-phase drives. B. Tech and M. Tech students who work in power electronics labs regularly publish in high quality journals and international conferences. In the past two years, there have been more than 2 journals and ten international conference publications where the lead work was done by an M. Tech student. Furthermore, the projects are nominated for the prestigious Indian National Academy of Engineering Innovative Students Project Award - as of now, two projects have qualified for the final presentation. A few achievements of students gave been listed below.

Awards:

1. GS Athira (M.Tech 2018) Shortlisted for final presentation for INAE Innovative Student Project Award.
2. Ranjith S (M.Tech 2019) Shortlisted for final presentation for INAE Innovative Student Project Award.
3. Pragya Yadav (M. Tech 2020) Quarter finalist in India Innovation Design Challenge Competition 2020 (IICDC 2020).

Journals:

[1] Ranjith S, Vidya V and R. Sudharshan Kaarthik, "An Integrated EV Battery Charger with Retrofit Capability," in IEEE Transactions on Transportation Electrification (Accepted - Feb 2020) doi: 10.1109/TTE.2020.2980147

[2] S. K. Dash and R. Sudharshan Kaarthik, "Independent Speed Control of Two Parallel Connected Split-Phase IM With a Common DC Link and Inverter," in IEEE Transactions on Power Electronics, vol. 34, no. 10, pp. 9957-9965, Oct. 2019.

M.Tech in PE started from 2016 and has graduated two batches of students so far in 2018 and 2019 respectively. The placement/higher education scenario for these two years at a glance is

Of the 4 students graduated in 2018:

- 3 students got placement offers from four companies namely Delta Electronics, Schnieder Electric India, Centum Electronics and also ROHM Semiconductors in the final year of their PG program. One student went on to pursue PhD at IIT Kharagpur

Of the 5 students graduated in 2019:

- 4 students got placement offers from Delta Electronics in the final year of their PG program. One student got an offer as an adhoc faculty at the National institute of Technology Nagpur, after completion of the course.

Two of our research labs:

PE research lab

PEDS Lab

5. M.Tech in VLSI and Microsystems

M.Tech in VLSI and Microsystems is a 2-year Full-Time post-graduate program offering specialization in Very Large Scale Integration (VLSI) design and Microelectronics systems.

The course covers the basics and advanced topics of Semiconductor devices and technology, analog, digital and mixed-mode VLSI design, RF Integrated Circuit Design, microelectronic devices and materials, Micro Electro Mechanical Systems (MEMS) and its applications and Optoelectronics system design. Mastering the above courses, entails the students to acquire significant theoretical, practical experience and knowledge with the techniques and state of the art development tools of Integrated circuits and Micro electro Mechanical System to cater the need of integrated microsystem and VLSI industries.

The VLSI Design Lab and Microelectronics Lab are well equipped with the latest IC design tools and MEMS design tools which could mould the student to take up design of IC/MEMS for fabrication. The students will get hands-on experience on fabrication in the fabrication Lab, developing sensors and characterization in the sensor lab which is one of the unique features of this course.

The uniqueness of this course is depending on the student interest, they will get the opportunity to work specifically on VLSI designs on developing analog/digital/mixed-signal design or integrated microsystem which includes sensors, actuators and its sophisticated electronic system for control and communication which will enable them to get expertise in the respective area. o Faculty members associated with this M-Tech program have active collaborative R&D projects with ISRO centres for development of MEMS and VLSI based ASICs. The programme also has close collaboration with SCL Chandigarh (ISRO) for realizing the devices.

VLSI Microsystem Laboratories

The laboratories are being established to support the Post Graduate programme VLSI and Microsystems introduced in the year 2013 and research activities in the areas of VLSI, Micro/Nanoelectronics, MEMS/NEMS devices and technologies. These laboratories would support the R&D activities in these areas at ISRO. The development of the R & D ecosystem in the area of NEMS

and Nanoelectronics at IIST for academia, ISRO and other research organizations is also in progress.

VLSI Design Lab

The VLSI Design Lab is equipped with high end computing facility, FPGA design kits (zynq , Virtex 7) with latest IDE software and state of art IC design simulation tools for Digital/ Analog and Mixed VLSI IC Design from Cadence, Synopsys, Mentor Graphics.

MEMS & Microelectronics Design Lab

The lab is equipped with modelling, design and simulation tools for MEMS devices, Micro/Nanoelectronics devices and systems. (High end workstations, Coventorware and MEMS+ from Coventor, Silvaco ATLAS and ATHENA TCAD,Sentaures TCAD 3D Process and Device TCAD from Synopsis, COMSOL Multiphysics etc.)

VLSI and Microelectronics Design Lab

MEMS & NanoFAB (Micro/Nanofabrication Laboratory)

MEMS/Micro/nanofabrication facility is planned to be established in a clean room spanning 140 square meters. The facility is planned for 4” silicon wafer substrates with upgradability for 6” wafers. Phase-1 of MEMS & NanoFAB has been established with the following major facilities.

a) Class 1000 Modular wall cleanroom

b) Double Side Mask Aligner (Photolithography)
c) Spin processor and Hot Plates
d) DC/RF/ Pulse DC Sputtering System
e) Parylene CVD
f) Water Plant

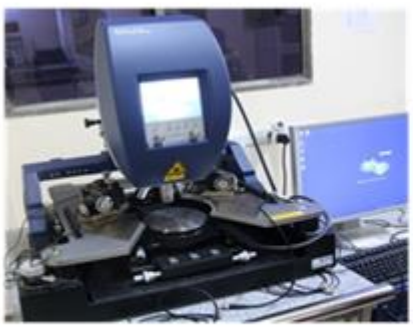
Micro/Nanosystems Characterization lab

Micro/Nanosystems characterization lab has characterization equipment for electrical and mechanical characterization of micro/nano-scale devices and VLSI.

Wafer Probe Station
Cascade EPX 150 Triax

Semiconductor Parametric Analyzer
Agilent B1500

Optical high Resolution
Semiconductor Microscope



MSA-500 Microsystem Analyzer
(Laser Doppler Vibrometer)

Hysitron Nanoindenter

Micro/Nanosystems Characterization lab

Gas Sensor and Biosensor Lab:

The lab is having a facility to characterize the gas sensor for four gases together. Now, the lab is upgrading to handle eleven gases including explosive and toxic volatile compounds. It is also having a facility to develop electrochemical sensors for various applications.

Placement Details

Scholars who have graduated from IIST in M.Tech VLSI and Microsystem are well placed in various Core industries and pursuing PhD in various reputed institutes. Till now around 30% of the students are placed in INTEL, 30% of the students are placed in BEL, Texas Instruments and related VLSI Design industries. 30% of the students got admission for PhD in various reputed institutions such as IIT Delhi, IISc Bangalore, IIT Madras, and IIT Bombay.

Achievements

Patents

M-Tech students in VLSI and Microsystems are provided opportunities to contribute to various R&D projects and some of their works have resulted in patent applications related to sensors/devices too.

The scholar has involved in developing new sensors/devices and it is patented

1. "Reliable room temperature Gas Sensor with negligible baseline drift suitable at different air flow conditions" Palash Kumar Basu L. Karthikeyan, Akshaya. M. V, [Indian Patent 2017: 201741027050.

Papers Published

The scholars along with the faculty members has published papers in various reputed journals and proceedings such as IEEE Sensor, Journal of Micromechanics and Microengineering, Microsystem Technologies (Springer), International Workshop on Physics of Semiconductor Devices, IEEE VLSI Design Conference etc.,

Best thesis/paper Award

The thesis work of the M.Tech (VLSI and Microsystem) graduates are accepted for INAE-M.tech Best Thesis award and best paper award in international Conferences.

Department of Chemistry (CH)

M.Tech in Materials Science and Technology

'Steeped in fundamentals yet space-age' is the guiding principle of the M.Tech. Program in Materials Science and Technology primarily offered by the Department of Chemistry. The core faculty strength of the department spread over diverse areas of Chemistry, Chemical Engineering, and Materials Science along with shared expertise from the Aerospace department suffice to implement this 71 credits program which attracts students from diverse backgrounds including Polymer Science and Technology/ Chemical Engineering/ Rubber Technology/ Metallurgical Engineering/Materials Science/Materials Science and Metallurgical Engineering/ Mechanical Engineering/ Production Engineering/ Production and Industrial Engineering/ Plastic Technology/ Chemistry/Physics/Materials Science/Nanoscience and Technology. A comprehensive curriculum grounded in fundamental sciences, assists students to appreciate the macro-micro-nano-angstrom level manifestations in materials and their role in dictating the material properties and their diverse utility including those for space applications. Substantial components of laboratory sessions revealing the nexus of research and practice, a broad set of electives to explore and expand their research interests, and innumerable project opportunities to tackle real-world problems await the aspirants of the program.

The students enrolled in the program get opportunities to work in the advanced laboratories established in the department including Polymer and Materials Processing Lab, Materials Characterization Lab and Nanoscience Lab housing some of the advanced instrumentation facilities along with exposure to some of the unique facilities in ISRO centres. Most of the students succeed in having publications/patents out of their final year project and emerge highly competent for pursuing higher studies or work in reputed firms demanding high levels of professionalism and practical knowledge. Among our alumni over the past 5 years 25% of the candidates were ISRO sponsored, 44% are currently pursuing PhD in reputed international and national institutes (like IISc Bangalore, IITB, IITM) and 22% are placed in PSUs or other firms.

Glimpses of Materials processing, Materials characterization and wet labs utilized by Masters' students in The Department of Chemistry

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Department of Earth and Space Sciences (ESS)

1. **Master of Science in Astronomy & Astrophysics**

The science of Astronomy & Astrophysics deals with application of laws of Physics towards understanding celestial objects and phenomena. The celestial environment provides a natural laboratory to study phenomena in extreme conditions such as the near vacuum of interstellar space to nuclear densities inside neutron stars. A unique aspect of Astronomy & Astrophysics is that it invokes several areas of Physics such as electromagnetism, quantum mechanics, statistical mechanics, special and general relativity, thermodynamics, particle physics, etc. Consequently, pursuit of a career in Astronomy & Astrophysics requires a strong foundation in basic Physics.

The Master of Science program in Astronomy & Astrophysics prepares students for a career in research in Astronomy & Astrophysics or education at the university level. The first year of the program will include coursework covering a broad range of areas including astronomical techniques, computational astrophysics, planetary sciences, stellar astrophysics, high-energy astrophysics, galaxies and cosmology. Students are also exposed to techniques used to analyze multi-wavelength data, and also collect and analyze data from the

institute's observatory facility. The second year of the program is devoted to a thesis where students will conduct original research. The Astronomy & Astrophysics group has six faculty members interested in a wide spectrum of research areas such as star formation, interstellar and intergalactic medium, physics of accretion around compact objects and relativistic stellar explosions.

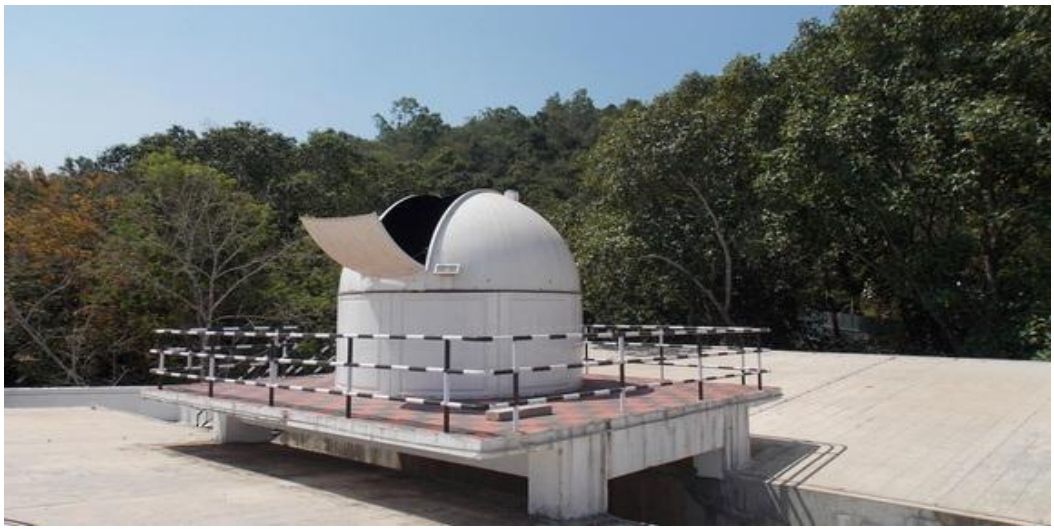


Figure - The observatory at IIST hosts an 8-inch and a 14-inch telescope. Students collect and analyze data from the telescope as part of their observational lab.

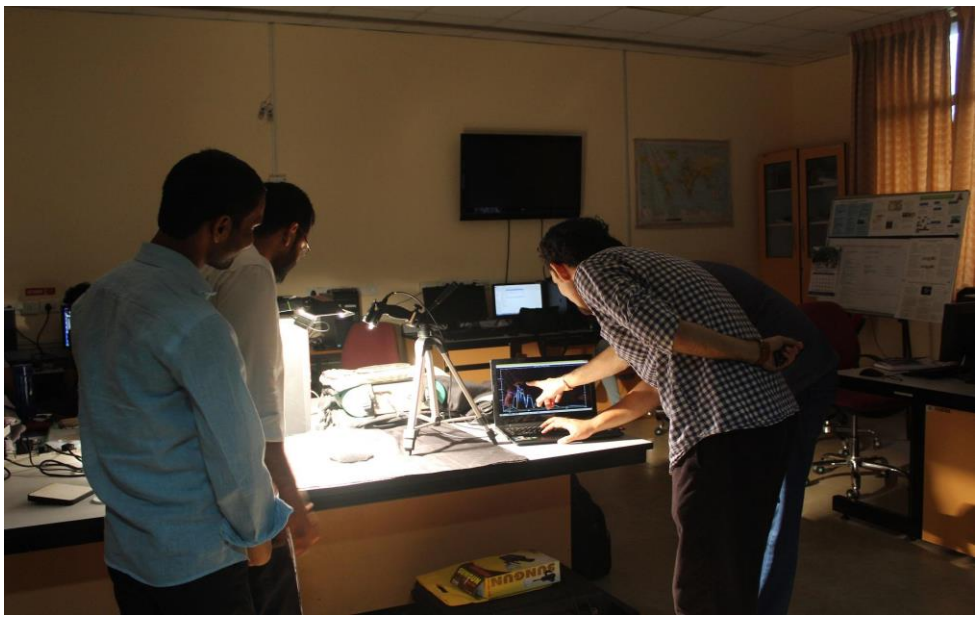
In the past, the program has attracted undergraduate and post-graduate students from diverse backgrounds in engineering and physical sciences. Most of the graduates from the Master of Science program (100% over the last two years) have gone on to pursue a doctoral program in Astronomy & Astrophysics in universities across the world or have taken up research project positions at various institutions. Universities where students have been placed (over the duration of the program) include University of Liege (Belgium), Université Côte d'Azur (France), Universität Potsdam (Germany), University of Groningen (Netherlands), University of Texas, Dallas (USA), University of Strasbourg (France), University of Western Australia (Australia), IIST, Tata Institute of Fundamental Research, IIT Hyderabad and Indian Institute of Astrophysics (Bangalore).

2. M.Tech in Geoinformatics

Since July 2013, Indian Institute of Space Science and Technology has been offering M.Tech in Geoinformatics with the objective of contributing to the development of skilled man power in Geoinformatics with potential for taking up methodological and computational aspects of Geoinformatics. The type of courses and delivery mechanism of this programme is structured in such a way

as to equip the students with necessary skills in theoretical, practical and software implementations of different aspects of Geoinformatics and make themselves suitable for taking up careers in research and corporate entities. The programme spans through various fundamental courses like remote sensing, image processing, geographic information system, spatial data analytics, photogrammetry and microwave remote sensing initially followed by advanced courses as core and elective subjects.

Rationale in curriculum design

1. To keep pace with the changing tools, technology and industrial environments for enhanced job prospects of students,
2. To continue offering the firm background in various areas of remote sensing, GIS and related IT environments and reflect the contemporary developments such as hyperspectral and LiDAR remote sensing, and close range photogrammetry.
3. Blending the geospatial data handling and analysis with machine learning based approaches
4. To ensure student-led problem solving initiatives, the course has credited unconventional credited outreach programme to interact with government and non-government sector and identify local/regional social problems which can be addressed with geoinformatics
5. Improving masters level academic project works with staggered credits oriented towards research, manuscript writing and publication
6. 

Geoinformatics students passed out have mostly joined industries across the country through Campus placement and individually. Geospatial industries where our alumni work include Aarav Unmanned Systems Pvt. Ltd, Tech Mahindra, Geokno pvt Ltd, Satsure, Seacon Pvt Ltd, Bhuh Pramaan Pvt Ltd, Quantela Pvt. Ltd etc. About 40% of the students are pursuing research in IITs, IISC and other international universities including University of Nice Sophia Antipolis France, Trinity College Dublin, University of Michigan - Ann Arbor in the field of image processing, remote sensing and spatial analytics. Few have joined the Government Departments also.

3. M. Tech in Earth System Science

The Earth System Science deals with understanding of the complex physical processes of Earth's atmosphere, oceans, and its geological features. This stream specifically focuses on the dynamics and thermodynamics of atmosphere and the oceans and the interactions between the atmosphere-oceans and land surface that lead to the evolution of Earth's weather and climate. The study of atmospheric and oceanic sciences includes all aspects of the atmosphere and physical oceanography, their mutual interaction, and their interaction with space and the rest of the earth system. Although the most important goal is to understand the atmosphere and ocean for the purpose of predicting the weather, atmospheric and oceanic sciences encompass and deal with the following broad interest as well: motions at large, medium, and small scales; clouds and precipitation; solar and terrestrial radiation; air chemistry and quality; and past, present and future climates. Furthermore, satellites play a very pivotal role in obtaining atmospheric observations as well as sea surface observations together with atmospheric circulation patterns at both global and local scales.

The objective of the Master's program in Earth System Science is to prepare the students to appreciate and master all aspects of the atmosphere, oceans and land processes and their role in determining the weather and climate of Planet Earth. In the first semester, M.Tech students are provided a thorough introduction to the basic concepts and tools in the core courses, which cover the physics and dynamics of the atmosphere and ocean, in addition to a course on Earth Resources and Tectonics. An array of elective courses are offered in the second semester, in the areas of Numerical Weather Prediction, Air-Sea Interactions, Aerosol-Cloud-Climate Interactions, Boundary layer meteorology, Planetary Geosciences, Satellite Meteorology and Oceanography, and Atmospheric and Oceanic Instrumentation and Measurement Techniques. The students will

conduct original research in the second year of the program. The Earth System Science group has five faculty members who have expertise in various aspects of Earth Science such as atmospheric modeling, aerosol and its interactions to climate, Ocean modeling, Climate modeling and analysis, Climate change, Solid Earth, and Planetary Geosciences.

During the last three years, the placement is close to 100%. The passed out students in the MTech Earth System Science programme are pursuing higher studies toward the Doctoral program. Universities where students have been placed include University of Hohenheim (Germany), University of Maryland (USA), LATMOS (Paris, France), University of Washington (USA), Embry–Riddle Aeronautical University (USA), University of Alberta (Canada), Lund University (Sweden), Maastricht University (Netherlands), IISc (Bangalore), IITM (Pune) etc. A few of them got placed in industries and government sectors such as Climate Connect and Airport Authority of India.

Department of Mathematics (MA)

Master of Technology in Machine Learning & Computing

About the course

The Master of Technology (M.Tech.) in Machine Learning & Computing offered by the Department of Mathematics, IIST is a two year programme which started in 2010. It is one of the first Master programmes the institute has started and has now become one of the most sought-after courses. The admission is based on the GATE score and is highly competitive. A few seats are reserved for scientists from ISRO.

It is a four-semester programme tailored in tune with the mathematical and computational aspects of the cutting-edge technologies in the area of Machine Learning. The curriculum comprises of the topics related to Artificial Intelligence, Machine Learning and Computer Programming by giving equal emphasis on their theoretical and practical aspects. Such a treatment helps to produce highly competent Data scientists who could contribute positively to the growing field of Machine Learning.

The core courses include Optimization Techniques, Data Mining, Numerical Linear Algebra, Foundations of Machine Learning, Advanced Machine

Learning and Statistical Models and Analysis. The elective courses in the program give the candidate an exposure to the latest technologies and state-of-the-art techniques in Data Modeling. The list of elective courses include Discrete Mathematics & Graph Theory, Introduction to Internet-of-Things, Introduction to Parallel Programming, Image & Video Processing, Advanced Kernel Methods, Advanced Optimization, Computer Vision, Graphical and Deep Learning Models, Reinforcement Learning, Theory of Algorithms, Topological Data Analysis, and Cloud Computing.

The second year of the programme is dedicated solely for the Project and Seminar. As part of the project thesis, the candidate is expected to work on a challenging problem that leads to novel contributions in the field of Machine Learning.

Lab facilities

The Machine Learning lab provides computer systems of customized configurations to meet the demanding computational requirements of the courses offered.
The lab is equipped with a high-end workstation of 2 x Intel Xeon 3.2GHz CPU, Tesla K80 and GTX 1080 GPUs and 256 GB RAM, two workstations with Intel Xeon 2.4 GHz CPU, Quadro K4200 GPU and 80 GB RAM, a workstation with Intel Xeon 2.4 GHz CPU, GTX 1080-Ti GPU and 80 GB RAM, 10 desktops with Intel i5 3.2 GHz CPU and 4 GB RAM and a brain computer interface with 16 channel EEG recording unit.

Alumni details

The prospects of the course are found to be very promising on the basis of the current status of our Alumni. Majority of the alumni are working with reputed industries and some of them are in the field of academics.
Our students are in great demand in industries and are offered positions that ensure career growth and the best salary package available in the market. The industries in which they are working include Robert Bosch, Michelin, Hitachi, FireEye, Flytxt, Quantela, Happiest Minds, UST Global, Innovation Incubator Labs, Accenture, and TCS.

Our students have also been enrolled for PhD in reputed national as well as international universities such as ETS - Canada, Caen Normandie University - France, and Indian Institute of Technology Madras.

Machine Learning Lab

Department of Physics (PH)

1. M.Tech in Optical Engineering

Optical engineering program is offered to prepare students for application of fundamental optics in modern technology and research environments. Rapid advancements in the field optics, lasers and optoelectronics is making optical engineering an essential tool in majority day today applications. Moreover, the recent advent of quantum information technology is largely driven by a combination of fundamental optics and optical technology. The masters program is offered in a truly interdisciplinary manner and it accommodates students from physics, mechanical engineering, electrical and electronics engineering and equivalent areas equally well. The courses are designed with a right balance of science and engineering with full emphasis on optics. Advanced concepts like Fourier optics, holography, image processing, guided waves etc. are complemented by practical courses like, laser and optoelectronics, optomechanical design, adaptive optics, etc. The course is supported by one of the most advanced optics training laboratories in the country. Emerging areas of quantum technology are also covered in the program since the requisite expertise covering both experimental and

theoretical aspects is available in the department. Experts from ISRO regularly visit the department to impart knowledge in specific areas unique to ISRO. The students get to visit and work in some of the ISRO centers as part of their projects.

Figure. A view of the Applied and Adaptive Optics Lab

As a matter of convention, most students passing out from the program continue to pursue higher education in the field of optics and optical engineering. This is fuelled by the standards met both by the students as well as faculty involved in this program. Many of our M. Tech. in optical engineering students publish papers in reputed international journals such as Physical Review A, Optics Letters, JOSA A, Applied Optics, etc, as part of their final year project, and this has enabled them to gain international visibility. Since the inception of the program in the year 2012, with the first batch passing out in 2014, several of the passing out students have gone to pursue higher studies. In fact, **two of our MTech in Optical engineering students had won the prestigious Marie Curie fellowship** towards pursuing their doctorates in Europe. Seven others have gone abroad to pursue Ph.D. which are fully funded. Three of them have gone on to pursue Ph.D. in the country, both at IIST and IITs. Four of them have got absorbed in to public sector undertakings through open competition. The remaining have been readily placed in the industry due their unique training and experience.

FIG. 2. Prof. Chris Dainty interacting with a student in the Optics Lab, and Prof. Takeda with some of our M. Tech. in Optical engineering students.

Professors of international repute working in the field of optics, visit the department every year to deliver talks and interact with IIST students, and collaborate with our faculty. In particular, our M. Tech. in Optical Engineering students gets the opportunity to interact with them on a very informal basis, to gain exposure.

2. M. Tech. in Solid State Technology

Program Overview:

The program is open to students with a bachelor's degree in engineering or masters in physics. This is a unique programme that draws the research expertise available in the department in imparting sound knowledge on the basics of solid state physics and functioning of solid state devices. The course prepares the student to take the challenge of R&D units and industries dealing with semiconductor technology, quantum technology and material science.

Selection Process: GATE score and personal interview.

Structure of the Program:

This is a four semester program with the first two semesters of course work and two semester long project work. The students are trained to use up-to-date computer technology, computer simulations to address issues in engineering and natural sciences. Independent student projects on a topic of their own choosing are offered to the students as their final year projects in frontline application oriented areas within and outside the campus. Students are encouraged and assisted in taking up their research projects in various ISRO centers also. These projects help students to orient themselves in the issue and often provide challenging results publishable in scientific journals or applicable to the development of new engineering technologies.

Course characteristics:

This course is intended to build a basic understanding of solid state physics, on which much of modern device technology is built. It is oriented towards advanced topics of condensed matter physics, offers knowledge of the physical essence of condensed matter and theoretical description and interpretation of unique phenomena those originate at the atomic level. We focus on the basic properties electrons and associated other elementary excitations in solids - those are responsible for different properties of any condensed matter system and

have technological relevance. Course includes a review of quantum mechanics and solid state physics, solution of Schrodinger equation for band structure, interatomic bonding leading to crystal structure, reciprocal lattice, structure-property correlation, Crystal structures and defects, X-ray diffraction, lattice dynamics, Quantum mechanics and statistical mechanics, thermal properties, electrons in metals, semiconductors and

A magnet levitating above a superconductor cooled by liquid nitrogen at IIST, Physics Dept. A Nd magnet is floating above YBCO, a high Tc Superconductor

It also covers other fundamental physical phenomena including Fermi surfaces and metals, superconductivity, paramagnetism, ferromagnetism and antiferromagnetism, dielectrics and ferroelectrics, and surface and interface physics aiming at understanding the essences of the condensed matter science. We also provide hands on experience on low temperature physics, virtual instrumentation with LabView, 3D CAD drawings, vacuum techniques, noise environment etc, knowledge of which are essential to develop new technologies. These courses help the students from engineering backgrounds to reach a good level of physics understanding while helping the physics background students to consolidate their previous training. With the inhouse expertise and sophisticated laboratory infrastructure, the students are exposed to a strong research environment for a substantial portion of the course.

The program helps students from varied backgrounds to plan and undertake careers in solid state technology applications. A substantial portion of the students go for national and international doctoral programs. The rest are placed at various government and private industries where their training finds substantial value.

3. SEAT MATRIX FOR POSTGRADUATE PROGRAMMES IN THE ACADEMIC YEAR 2020-2021

Department of Aerospace Engineering						
Sl.No	Branch	UR	OBC	SC	ST	EWS
1	Aerodynamics and Flight Mechanics	5	2	1	1	1
2	Structures and Design	4	3*	1	1	1
3	Thermal and Propulsion	4	2	1	0	1
Department of Avionics						
Sl.No	Branch	UR	OBC	SC	ST	EWS
1	Control Systems	4	2	1	1	1
2	Digital Signal Processing	4	2	2*	1	1
3	RF and Microwave Engineering	4	2	1	1	1
4	Power Electronics	4	3	2	0	1
5	VLSI and Microsystems	5	3	2	0	0
Department of Chemistry						
Sl.No	Branch	UR	OBC	SC	ST	EWS
1	Materials Science and Technology	4*	2	1	1	0
Department of Earth and Space Sciences						
Sl.No	Branch	UR	OBC	SC	ST	EWS
1	Astronomy and Astrophysics	5	2	1	1	1
2	Earth System Science	4*	2	1	1	1
3	Geoinformatics	4	2	1	0	1
Department of Mathematics						
Sl.No	Branch	UR	OBC	SC	ST	EWS
1	Machine Learning and Computing	5*	2	1	0	1
Department of Physics						
Sl.No	Branch	UR	OBC	SC	ST	EWS
1	Optical Engineering	4	3*	1	1	1
2	Solid State Technology	4	2	2	0	1
	Total	64	34	19	9	13
	Total Seats	139 Seats				

**** Indicates that one PD candidate is included in the relevant category***

4. RESERVATION OF SEATS

As per the reservation policy of Government of India applicable to Central Educational Institutions (CEI), candidates belonging to the following categories are admitted to reserved seats based on relaxed criteria. The categories and the corresponding percentage of reservation are:

· Scheduled Castes (SC): 15%
· Scheduled Tribes (ST): 7.5%
· Other Backward Classes (OBC) belonging to Non-Creamy Layer (NCL): 27%
· Persons with Disabilities (PD): 5% (Horizontal Reservation)
· Economically Weaker Section (EWS): As below.
*In each PG programme, four seats are reserved for ISRO/Dos employees.

A total of 13 EWS seats (10% of the remaining strength after the sponsored seats are filled up) is reserved for EWS category. The above listed categories are the **ONLY** reservation categories for admission to the postgraduate programmes at IIST.

Important Notes:
(i) *EWS Candidates:*
Eligible candidates applying under EWS category are required to produce a EWS certificate issued by a competent authority in the prescribed format given in APPENDIX–I. **Certificates in any other format will not be accepted.** The certificate (in original) must be produced at the time of verification at the specified Reporting Centres, failing which the candidature will not be considered for admission under the EWS category.

(ii) *SC/ST Candidates:*
Candidates belonging to SC/ST categories are required to produce the original Scheduled caste/tribe certificate issued by a competent authority in the prescribed format given in APPENDIX–II. **Certificates in any other format will not be accepted.** The documents (in original), must be produced at the time of verification at the specified Reporting Centres, failing which the candidature will be cancelled. Seats remaining vacant under ST category shall be allotted to SC candidates. Seats remaining vacant under the SC/ST categories shall not be filled by candidates belonging to any other category.

(iii) *OBC-NCL Candidates:*

Under the OBC-NCL category, only castes mentioned in the Central list of OBCs, published by the Department of Personnel and Training, Government of India, will be considered. In addition, the candidate should also satisfy the condition of non-creamy layer as defined by the Government of India. Seats remaining vacant under this category shall be allotted to General candidates.

The OBC-NCL candidates seeking the benefits of reservation are required to produce the **original certificate issued on or after 1st April, 2020** by a competent authority in the prescribed format given in APPENDIX–III. **Certificates in any other format will not be accepted.** The certificate (in original) must be produced at the time of verification at the specified Reporting Centres, failing which the candidature will not be considered for admission under the OBC-NCL category. Candidates belonging to the OBC-NCL category are also required to submit a declaration/undertaking in the format given in APPENDIX–IV.

(iv) *PD Candidates:*

5% seats are reserved (horizontal reservation) for PD candidates. The benefit of reservation would be given only to those who have **at least 40% physical impairment**. Candidates seeking benefit under this category are required to produce **original certificates, issued by a district medical board/ competent authority,** at the time of verification at the specified Reporting Centres, failing which the candidature will not be considered for admission under the PD category.

(v) *ISRO/DoS employees:*

In each PG programme, four seats are reserved for ISRO/Dos employees.
The Institute is offering

1.Two years Full time PG programme: ISRO/DoSemployees shall avail 24 months study leave to pursue and complete PG programmes with stay at IIST.

2.PG Programmes leading to Ph.D Programmes: Those Candidates with CGPA 8.00 and Above, at the end of first year may register for Ph.D programmes and completethe required course work for Ph.D programme during the second year project period. ISRO/DoS sponsored employees shall avail 24 months leave.

3.PG Programmes converted to Part Time after course work completion: ISRO/DoS sponsored employees shall avail 10 months / (2 Semester) study

leave and complete all the first year courses. Project work can be continued in their respective ISRO centres in a part-time mode and project report should be submitted after 2 year works/3 year after enrolment.

5. SEMESTER FEE STRUCTURE FOR PG PROGRAMMES

The fee Structure per semester is as follows:

Sl No	Item	Fees (Rs.)	Remarks
PG Programmes Fees payable per semester*			
1	Statutory Semester Fees	5,000/-	SC/ST Students are exempted
2	Student Amenities Fees	1,350/-	
3	Hostel Charges	4,500/-	Also applicable to those DOS/ISRO sponsored students who are staying in IIST Hostel
4	Establishment charges	8,000/-	
5	Medical cover	800/-	
Sub - Total		19,650/-	
One time payment at the time of admission			
6	Caution deposit	3,000/-	
Grand –Total		22,650/-*	

*Subject to Revision.

Important Notes:

(i) The First Semester Fee has to be paid through online transfer at the time of acceptance of allotted seat during the admission process. Fees for the remaining semesters have to be paid at the beginning of each semester before the notified date.

(ii) At the time of joining the institute, students are required to remit a caution deposit of INR 3000 which is refundable (without interest) at the time of leaving the institute.

(iii) Any revision to Medical, Hostel and Dining charges will be informed well in advance.

6. AICTE/INSTITUTE PG SCHOLARSHIP

- M.Tech Students with valid GATE score will be receive scholarship through AICTE.
- For Master of Science students, the scholarship will be paid by IIST/respective CSIR/UGC fellowship.

7. ELIGIBILITY FOR ADMISSION

Nationality : Applicant should be an Indian citizen.

Age Limit

32 years as on 08.06.2020. Age relaxation is applicable to SC / ST / Persons with disability (PD) category as per Government of India Orders. **No age relaxation for OBC/EWS and women candidates**.

Minimum Qualifications

- B.E./B.Tech./Master of Science or equivalent degree with a minimum of 60% marks or CGPA 6.50 out of 10 for General/EWS& OBC category and minimum of 55% marks or CGPA 6.00 out of 10 for SC/ST&PD category . A valid score in GATE/JEST/UGC NET/CSIR-NET in relevant area as the case may be, as specified above is essential.

- When CGPA & Equivalent percentages are both in the mark list/certificate, CGPA alone would be considered for eligibility.

Programme Code	Department	Name of the Branch	Educational Qualification
MAE01	Aerospace Engineering	Thermal and Propulsion	(i) B.Tech. or equivalent degree in Aerospace Engineering, Aeronautical Engineering, Mechanical Engineering, Chemical Engineering (ii) A valid GATE Score in Aerospace Engineering or Mechanical Engineering or Chemical Engineering or XE papers
MAE02		Aerodynamics and Flight Mechanics	
MAE03		Structures and Design	(i) B.Tech.or equivalent degree in Aerospace Engineering, Aeronautical Engineering, Mechanical Engineering, Civil Engineering or Production Engineering (ii) A valid GATE Score in Aerospace Engineering or Mechanical Engineering or Civil Engineering or XE papers
MAV01	Avionics	RF and Microwave Engineering	(i) B.E./B.Tech.or equivalent degree in Avionics/Electronics and Communication/ Electronics Engineering/ Electrical Engineering/ Electronics and Telecommunication (ii) A valid GATE Score in Electronics and Communication Engineering.
MAV02	Avionics	Digital Signal Processing	(i) B.E./B.Tech. or equivalent degree in Avionics/Electronics and Communication/ Telecommunication/Electrical and Electronics Engineering/Electrical Engineering/ Electronics and

			Telecommunication (ii) A valid GATE Score in Electronics and Communication Engineering**.**
MAV03		VLSI and Microsystems	(i) B.E./B.Tech.or equivalent degree in Avionics/Electronics and Communication/ Electrical Engineering/ Electronics and Telecommunication (ii) A valid GATE score in Electronics and Communication Engineering.
MAV04		Control Systems	(i) B.E./B.Tech.or equivalent degree in Avionics/Electrical and Electronics / Electronics and Communication/ Electronics and Instrumentation / Instrumentation and Control Engineering/Electronics and Electrical Engineering/Electronics and Telecommunication. (ii) A valid GATE score in Electronics and Communication Engineering/ Instrumentation Engineering/Electrical Engineering.
MAV05		Power Electronics	(i) B.E./B.Tech.or equivalent degree in Avionics/ Electrical Engineering/Electrical and Electronics Engineering / Electronics and Communication Engineering / Electronics and Instrumentation Engineering / Instrumentation and

			Control Engineering/Electronics and Electrical Engineering /Electronics and Telecommunication and related areas. (ii) A valid GATE score in Electrical Engineering or Electronics and Communication Engineering.
MMA01	Mathematics	Machine Learning and Computing	(i) M.Sc. in Mathematics/ Statistics/ Computer Science/ Mathematics and Computing OR (ii) B.E./B.Tech. or equivalent degree in Avionics/ Computer Science and Engineering/ Electronics and Communication Engineering/ Electrical Engineering/ Electrical and Electronics Engineering/Information Technology/ Electronics and Telecommunication Engineering (iii) A valid GATE Score in Mathematics/ Statistics/ Computer Science and Information Technology / Electronics and Communication Engineering/ Electrical Engineering.
MCH01	Chemistry	Materials Science and Technology	(i) B.E./B.Tech.or equivalent degree in Polymer Science and Technology/ Chemical Engineering/ Rubber Technology/ Metallurgical Engineering/Materials Science/Materials Science and Metallurgical Engineering/ Mechanical Engineering/ Production Engineering/ Production and

			Industrial Engineering/ Plastic Technology OR M.Sc/M.S in Chemistry (all branches)/Physics/Material Science/ Nanoscience and Technology (ii) A valid GATE score in Engineering Sciences/Chemical Engineering/ Metallurgical Engineering/ Mechanical Engineering/ Production and Industrial Engineering/ Chemistry/Physics.
MPH01	Physics	Optical Engineering	(i) B.E./B.Tech.or equivalent degree in Electronics/ Electrical Engineering/ Electronics and Communication Engineering/ Mechanical Engineering/ Engineering Physics OR M.Sc. in Physics/ Applied Physics/ M.S. (Integrated) Physics. (ii) A valid GATE score in Electronics and Communication/ Electrical/ Mechanical Engineering/Physics.
MPH02		Solid State Technology	(i) B.E./B.Tech.or equivalent degree in Electronics/ Electrical Engineering/ Electronics and Communication Engineering/ Engineering Physics. OR M.Sc. in Physics/ Applied Physics/ M.S. (Integrated) Physics. (ii) A valid GATE score in

			Electronics and Communication Engineering/ Electrical Engineering/ Physics.
MES01	Earth and Space Sciences	Earth System Science	(i) B.E./B.Tech. or equivalent degree in Aerospace Engg, Aeronautical Engineering, Mechanical Engineering, Chemical Engg, Civil Engg, Avionics, Electronics and Communication Engineering, Electrical Engineering, Electronics and Electrical Engineering, Electronics and Instrumentation Engineering, Instrumentation and Control Engineering, Physical Sciences, Agricultural Engineering, Engineering Science , Instrumentation Engineering, Engineering Physics. OR M.Sc. in Physics/Mathematics. (ii) A valid GATE score in Aerospace Engineering/ Civil Engineering/ Chemical Engineering/ Electronics and Communication Engineering/ Electrical Engineering/ Mechanical Engineering/ Engineering Sciences/ Agriculture Engineering/ Instrumentation Engineering/ Physics/ Mathematics. Note: *Students with M. Sc. degree must have studied Physics, Mathematics at the B. Sc. level. Students having B. Tech or BE in other branches of engineering will be considered only if they have appropriate*

			experience in related areas of Atmospheric and Oceanic Sciences/ Meteorology/ Geology/ Remote Sensing etc
MES02	Earth and Space Sciences	Geoinformatics	(i) B.E./B.Tech. or equivalent degree in Computer Science Engineering/ Information Technology/ Electrical and Electronics Engineering/Electronics and Communication Engineering/ Civil/Avionics/Physical Sciences/ Engineering Sciences/ Geoinformatics/ Agricultural Engineering OR M.Sc in Mathematics /Physics (ii) A valid GATE score in Computer Science and Information Technology/Electrical Engineering/ Electronics and Communication Engineering/Civil Engineering/Engineering Sciences/Agricultural Engineering /Mathematics/Physics/ Geology and Geophysics / Atmospheric Ocean Sciences
MES03		Master of Science in Astronomy and Astrophysics	(i) B.E./B.Tech.or equivalent degree in Aerospace Engineering, Aeronautical Engineering, Mechanical Engineering, Chemical Engineering, Civil Engineering, Avionics, Electronics and Communication Engineering, Electrical Engineering, Electronics and Electrical

			Engineering, Electrical and Electronics Engineering, Electronics and Instrumentation Engineering, Instrumentation and Control Engineering, Physical Sciences, Engineering Science, Instrumentation Engineering, Engineering Physics Electronics Engineering. OR Master of Science / M.Sc. in Physics, Space Physics, Space Science, Space Science and Technology (ii) A valid score in any one of the following: a. GATE in any one of these subjects - Physics/Electronics and Communication Engineering/ Electrical Engineering/ Engineering Sciences. b. Joint Entrance Screening Test (JEST) in Physics. c. JRF(NET)CSIR / JRF(NET)UGC /JRF(CSIR) / NET LECTURESHIP in Physical Sciences

General Conditions:

1. Only Indian citizens are eligible to apply.
2. Applications received online only will be considered for processing under any circumstances.
3. The applicants will not be allowed to make any changes in the profile registration once submitted. Hence utmost care should be taken by the candidate while filling the profile.
4. The applicants who wish to apply for more than one programme shall exercise their order of preference of Post Graduate Programmes, at the time of applying itself.

5. Applicants can choose a maximum of six preferences within or across all the departments. The preference once exercised shall be final.
6. SC/ST/OBC (Non-Creamy Layer)/EWS/Persons with Disabilities (PD) candidates shall upload the relevant certificates as per the format available in admission portal before the last date of online application. **OBC-NCL certificates issued after 01/04/2020 only will be accepted**.
7. **Applications of SC/ST/OBC/EWS/PD candidates will be processed only after the receipt of the relevant proof online. In other words, non-submission of proof online will lead to rejection of application.**
8. Reservation of seats for SC/ST/OBC/EWS/PD is applicable as per Govt. of India Orders.
9. In case of ST seats falling vacant, it will be filled by SC category candidates.
10.

Application fee			
Sl No	Category	For 1 - 3 programmes Amount (INR)	For 4 - 6 programmes Amount (INR)
1.	Male candidates in General/EWS/OBC-NCL	600	1200
2.	Female candidates in General/EWS/OBC-NCL	300	600
3.	All SC/ST/PD candidates	300	600

11. **The application fee shall be paid through online only. The last date of registration and payment of application fee is 08.06.2020.**
12. **The application fee is non-refundable**.
13. **For the M.Tech. Programmes offered by Departments of Aerospace Engineering, Mathematics and M.Tech.in Digital Signal Processing, RF and Microwave Engineering and VLSI and Microsystems offered by Department of Avionics, candidates will be rank listed based only on the valid GATE score. An admission list would be prepared based on the rank list & available number of vacancies & preference given by the candidate.**
14. The shortlist will be prepared based on GATE score for the other M. Tech./Master of Science programmes offered by Departments of Chemistry, Earth and Space Sciences, Physics and Avionics. The applicants who are shortlisted for M.Tech./Master of Science programmes for above mentioned programmes are required to appear for an Interview. List of shortlisted candidates for interview for Departments of Chemistry, Earth and Space

Sciences, Physics and Avionics, will be displayed in the IIST website on 17th June 2020*. Shortlisted candidates may download their interview call letter from the website.

15. **Interview will be conducted through video conferencing. Details will be announced later.**
16. A provisional admission list will be prepared based on the GATE score, interview test score, number of vacancies & preferences given by the candidate.
17. After the provisional admission list is published, the candidate has to remit their first semester fee through online **(SBI Collect)** within the stipulated date.
18. In case the candidate in the provisional admission list fails to remit the fee within the stipulated date, the seat will be allotted to the next candidate in the rank/wait list.
19. **All candidates who are in the rank list should confirm their willingness to be considered for further allotments in the web portal by choosing "Revalidate and proceed" option on specified dates as given in Table A.**
20. **The candidates who do not confirm their willingness using the** revalidate **option on the specified dates will not be considered for any future vacancies** or **for any change in the branch of higher preference. (However, their existing allotment would be retained if they pay the fees.)**
21. The order of preference given by the candidate cannot be changed once the application is submitted. However, the candidate can withdraw from the allotted programmes in which they appear in the Allotment list/waiting list.
22. If the candidate with a confirmed seat, after paying fees, wishes to withdraw before the commencement of the class, he/she may send a request to academics@iist.ac.in. The fee will be refunded as per UGC Guidelines and for details refer to Table B (withdrawal of confirmed seats after remitting the fees.)
23. Students who are completing their qualifying degree programme in 2019-20 will have to provide the consolidated mark list/mark lists of all semesters along with Provisional/Degree Certificate on or before October 31, 2020. Till the date of submission of degree Certificate, the admission will be treated as provisional and such students who have not submitted the degree certificate/verification certificate/Graduation certificate will not be eligible for scholarship. Also those students who have not submitted the Degree certificate/Transfer certificate/Provisional certificate before 1700 hrs on

October 31, 2020 shall be disqualified and such students shall not be eligible to continue their studies at IIST further. On submission of the certificate on or before October 31, 2020, the scholarship will be paid with effect from the date of commencement of classes or from the date of admission to the programme whichever is earlier.

24. Students who have completed their qualifying degree prior to and for 2019-20 will have to produce all the certificates and TC in original at the time of admission.

25. M.Tech students with valid GATE score will be receiving scholarship through AICTE.

26. Students selected for Master of Science programme, the scholarship will be paid by IIST or respective CSIR/UGC fellowship.

27. Candidates who are employed in Government/Semi Government/PSUs/ Autonomous Bodies need to produce a "No Objection Certificate (NOC)" at the time of interview.

28. The M.Tech./Master of Science students will be required to assist the Departments in academic activities as and when required.

29. Students who are selected for the admissions have to join the course on the specified dates as given in Table 1. Dates for starting of classes for these students are also given in Table 1.

30. Due to the current situation, the classes for PG students may be conducted only through online mode. The necessary arrangements for taking part in the online classes should be made by the students.

31. In case, classes are conducted for the whole semester online, the hostel fee remitted by the students may be adjusted against the next semester fee subject to Governing Council approval.

32. New entrant candidates who have not completed all the requirements of the qualifying degree shall be permitted to join the PG programmes for the academic year 2020-21 in IIST from 01 September 2020 as provisional students.

33. Students who are completing their course in the academic year 2019-2020 and who are not able to produce the provisional / degree certificate at the time of admission shall furnish the same and consolidated mark list/mark lists of all semesters on or before 31 December, 2020. However, till the date of submission of Degree Certificate, the admission will be treated as provisional and such students who have not submitted the Degree Certificate will not be eligible for scholarship. On submission of the certificate on or before 31 December, 2020, the scholarship will be paid with effect from the

date of admission to the programme or date of commencement of classes, whichever is later. If the student fails to submit the certificates on or before 31 December, 2020, his/her claim for the M.Tech/Master of Science admission will become null and void.

IIST PG Admission Statistics

M.Tech /Master of Science Admission 2018-2019

Sl No	Programme	GATE SCORE CUT – OFF		
		GENERAL	OBC-NCL	SC/ST/PD
1	Machine Learning and Computing	550	495	275
2	Optical Engineering	450	405	225
3	Solid State Technology	450	405	225
4	Materials Science and Technology	450	405	225
5	Aerodynamics and Flight Mechanics	530	477	265
6	Thermal and Propulsion	530	477	265
7	Structures and Design	530	477	265
8	Control System	490	441	245
9	Digital Signal Processing	450	405	225
10	RF and Microwave Engineering	450	405	225
11	VLSI and Microsystems	450	405	225
12	Power Electronics	450	405	225
13	Geoinformatics	450	405	225
14	Earth System Sciences	450	405	225
15	Astronomy and Astrophysics	450	405	225

M.Tech /Master of Science Admission 2018-2019

Sl No	Programme	GATE SCORE CUT – OFF WITHOUT INTERVIEW		
		GENERAL	OBC-NCL	SC/ST/PD
1	Aerodynamics and Flight Mechanics	530	477	265
2	Thermal and Propulsion	530	477	265
3	Structures and Design	530	477	265
4	Control System	490	441	245
5	Digital Signal Processing	450	405	225

6	RF and Microwave Engineering	450	405	225
7	VLSI and Microsystems	450	405	225
8	Power Electronics	450	405	225

M.Tech /Master of Science Admission 2019-2020

Sl No	Programme	GATE SCORE CUT – OFF		
		GENERAL	OBC-NCL/ EWS	SC/ST/PD
1	Aerodynamics and Flight Mechanics	530	477	265
2	Structures and Design	530	477	265
3	Thermal and Propulsion	530	477	265
4	Control System	490	441	245
5	Digital Signal Processing	450	405	225
6	RF and Microwave Engineering	450	405	225
7	Power Electronics	450	405	225
8	VLSI and Microsystems	450	405	225
9	Materials Science and Technology	425	382	212
10	Astronomy and Astrophysics (GATE)	450	405	225
	Astronomy and Astrophysics (JEST)	JEST Rank up to 300		
11	Earth System Science	470	423	235
12	Geoinformatics	450	405	225
13	Machine Learning and Computing	550	495	275
14	Optical Engineering	425	382	212
15	Solid State Technology	425	382	212

M.Tech /Master of Science Admission 2019-2020

Sl No	Programme	GATE SCORE CUT – OFF WITHOUT INTERVIEW		
		GENERAL	OBC-NCL/EWS	SC/ST/PD
1	Aerodynamics and Flight Mechanics	530	477	265
2	Structures and Design	530	477	265
3	Thermal and Propulsion	530	477	265
4	Control System	490	441	245
5	Digital Signal Processing	450	405	225
6	RF and Microwave Engineering	450	405	225

7	Power Electronics	450	405	225
8	VLSI and Microsystems	450	405	225
9	Geoinformatics	450	405	225
10	Machine Learning and Computing	550	495	275

8. ONLINE ADMISSION PROCEDURE

1. Online application can be made through http://admission.iist.ac.in. Read instructions thoroughly before filling up of the application. To complete the application process, please check all the boxes corresponding to the declarations. A login ID and password will be sent through online for the successfully completed applicants.
2. For course registration and setting the preference for various program, re-login using the login ID. Select courses and submit, a fee registration number will be generated. With the profile registration number and the fee registration number you can make application fee payment through bill desk.
3. Short list / Rank list will be published on 17.06.2020 (For All PG programmes). The shortlisted candidates from Departments of Aerospace Engineering, Mathematics and M.Tech.in Digital Signal Processing, RF and Microwave Engineering and VLSI and Microsystems offered by Department of Avionics would be offered admission based on their GATE score only. Using the login ID and password, the candidate can confirm their seats through online web portal. First semester fee has to be remitted through "SBI Collect" to confirm the seat.
4. **A fresh allotment list will be prepared and updated in IIST website every Monday, Wednesday and Friday at 1700 hrs, if vacancies exist. The candidate in the allotment list has to remit the stipulated fees on or before the subsequent Wednesday, Friday and Monday 0900hrs to confirm their candidature to the program and branch allotted. Any change in the aforementioned schedule would be notified in the website.**
5. **If the candidate's highest preference is allotted and if he/she fails to remit the fees in the stipulated time, then his/her candidature will be cancelled.**
6. **If candidate is allotted one of his/her lower preferences and he/she does not remit the fees, then the candidate will be eligible for being considered for his/her higher preference provided he/she chooses "Revalidate and Proceed" option as per Table 2.**

7. **Candidates can login to their web portal and withdraw from the allotted programmes in which they appear in the allotment list/wait list. The order of preferences cannot be altered.**
8. **All candidates would be considered for allotments in the subsequent vacancy filling rounds only if the candidate chooses "REVALIDATE and PROCEED "option in the web portal on specified dates given in Table A.**

Table A : REVALIDATION DATES

All PG Programmes	31.07.2020 to 03.08.2020
	14.08.2020 to 17.08.2020
	28.08.2020 to 31.08.2020
	04.09.2020 to 06.09.2020

Note: The candidates who have paid the fees, who wish to withdraw from the program should do so as per the details given in the Table below.

Table B: Cancellation Charges

PG Programmes	Cancellation charges
PG programmes in Departments of Aerospace Engineering, Mathematics and M.Tech.in Digital Signal Processing, RF and Microwave Engineering and VLSI and Microsystems offered by Department of Avionics	Will be announced later
Other PG programmes	

9. IMPORTANT DATES

Table : IMPORTANT DATES

Sl No	Event	Date
1	Display of shortlisted rank list for PG programmes which is based on only GATE score	July 17, 2020 (Friday) (Tentative)*
2	Display of short listed rank list PG programmes which is based on GATE score and interview	July 22, 2020 (Tentative)*
3	Reporting date at the Institution	August 28, 2020 (Tentative)*
4	Classes begins for all PG Programmes	September 01, 2020 (Tentative)*
5	PG Admission closes	September 14, 2020 (Tentative)*

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

10. JOINING IIST

Candidates, who have accepted the seat allotment and completed the certification verification procedure, are required to report at IIST on dates specified in Table 10. During the joining process, Medical verification, issue of photo-identity cards, opening of bank account, facilitate purchase of local SIM cards, allotment of hostel rooms, etc. will be organized.

Candidates **ARE REQUIRED** to submit the following documents at the time of joining IIST:

a)SSLC/SSC or equivalent

b)Pre-degree / Plus-2 or equivalent

c)B.E. / B.Tech / Master of Science, or equivalent degree certificate and consolidated mark sheet containing break-up of marks of all semesters. If consolidated mark list is not received, mark sheet of all semesters have to be produced.

d)GATE/UGC/CSIR NET JRF/NET Lectureship Score card.

e)OBC-Non Creamy Layer certificate issued by the competent authority issued on or after 01/04/2020, if applicable.

f)EWS Certificate issued by the competent authority issued on or after 01/04/2020, if applicable

g)SC / ST certificate issued by the competent authority, if applicable

h)Transfer / Migration Certificate and Conduct Certificate in original from the Institution last studied.

i)Medical Fitness certificate from a Class ‘A’ Medical Practitioner

j)Vaccination certificate duly signed (along with seal) by a registered Medical Practitioner in the proforma attached herewith.

k)No Objection Certificate' from the authorities concerned to your accepting the admission, if you are already under obligation to serve a Central Government Department/Organization/State Government/Public Authority.

Candidates have to make their own arrangements for stay in Thiruvananthapuram or Nedumangad (a nearby town). Hostel accommodation will be available only for students, from the evening of the date of joining, after completion of the admission formalities at IIST. Instructions to reach IIST can be found at https://www.iist.ac.in/aboutus/how-to-reach. Further instructions will be uploaded on the Admission Website.

11. CONTACT DETAILS

Contact Address	Chairman, PG Admissions Indian Institute of Space Science and Technology Valiamala (P.O.), Thiruvananthapuram – 695547 Kerala, INDIA
E-Mail	admissions@iist.ac.in **Queries will be answered via E-mail ONLY**
Help Desk Contact numbers	**Landline Numbers:** 0471-2568477, 478, 618, 418 (Monday to Friday from 9:30 a.m to 5:00 p.m) **Fax:** 0471-2568556 **Help Desk will assist ONLY in Online Admission Procedure. Other queries will be accepted and answered over E-mail ONLY.**

12. DISPUTE REDRESSAL

Any complaints, grievances, etc. related to Admission to IIST must be referred to the Chairman, Postgraduate Admissions–2020, IIST. Director, IIST will be the appellate authority with respect to such complaints. The courts having their jurisdiction at Thiruvananthapuram alone can adjudicate on all matters related to IIST Admission.