



CENTRE FOR CAREER DEVELOPMENT
INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI

ELECTRONICS & ELECTRICAL ENGINEERING

Batch of 2027 | Academic Program

B.TECH · M.TECH · MS(R)+PHD · PHD ·

About IIT Guwahati

Established in 1994, Indian Institute of Technology Guwahati is the sixth member of the IIT fraternity and one of India's premier institutions for higher education, research, and innovation.

Within a short span, the Institute has emerged as a global centre of excellence in science, technology, management, and design.

The picturesque campus spans 285 hectares on the northern bank of the Brahmaputra River, approximately 20 km from the heart of Guwahati city.

Surrounded by scenic hills and open spaces, it offers a perfect environment for learning, research, and holistic development.

IIT Guwahati offers a wide array of academic programmes including B.Tech., B.Des., BSc (Hons), M.Tech., M.Des., M.Sc., MBA, M.A., MS(R) and Ph.D.

across 11 departments, 9 interdisciplinary centres, and 5 schools, covering major disciplines in engineering, science, humanities, healthcare, and management.

The Institute has built world-class infrastructure and

houses state-of-the-art laboratories and National Centres of Research that support cutting-edge research.

Students are encouraged to take up interdisciplinary coursework, pursue minor degrees, and choose from a rich variety of open and interdepartmental electives.

IIT Guwahati has signed MoUs with top international universities, facilitating semester exchanges and summer internships, thereby broadening students' global exposure.

Our students regularly intern at leading global firms and research institutions, gaining invaluable real-world experience.

Ranked among the top 100 world universities under 50 years by Times Higher Education (THE), IIT Guwahati continues to excel globally.

The Institute was ranked 42nd globally in 'Research Citations per Faculty' and 344th overall in QS World University Rankings.



Director's Message

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Indian Institute of Technology Guwahati was established in 1994 by an Act of Parliament. The academic programme started with 65 students in three undergraduate programmes in 1995. The institute is growing steadily and the total number of students in eleven departments, nine academic centres and five schools in numerous undergraduate and postgraduate programmes is now around 8600. The institute has excellent infrastructure for the all round development of its students. The institute has full-fledged Technology Incubation Centre and Research Park to promote entrepreneurship activities.

IIT Guwahati continues to maintain its superior position in various International and National Rankings. IIT Guwahati secured the 8th position among the top engineering institutions in India in the NIRF 2025 Rankings, released by the Ministry of Education.

Additionally, IIT Guwahati has been ranked as the 11th best university in the country. IIT Guwahati has been ranked 2nd in the 'Swachhata Ranking' conducted by the Govt. of India. IIT Guwahati has been ranked as the topranked university in 2019 for IT developers by HackerRank in the Asia-Pacific region. IIT Guwahati gained 42 position globally in the 'Research Citations per Faculty' category and overall 344 rank in the QS World University Rankings 2025 released recently. Also, IIT Guwahati ranks 6th globally in Sustainable Development Goal 7 (Affordable and clean energy) of the Times Higher Education Impact Rankings 2023.

With Best Wishes,

Prof. Devendra Jalihal

Director, IIT Guwahati

The institute has a very good central library, which provides library and information services to support teaching, learning, and research activities by creating state-of-the-art facilities. It is housed on a four-storey building having a floor area of about 7500 sq. meter. Inhouse services of the library are fully computerised and wi-fi facility is provided within the library building for connecting to the internet and accessing the Institute's electronic resources. The sports facilities of the institute are of international standard. The students graduating from this institute are motivated, bright, and very eager to perform after they graduate.

IIT Guwahati has extensive facilities for cultural and creative activities too. For example, the Technical Board promotes technology, creativity and innovation. IIT Guwahati helps in shaping up bright minds with proper perspectives. IIT Guwahati hosts two supercomputing facilities PARAM-Kamrupa (838 TF) and PARAM-ISHAN (250TF) to carry out research activities in various scientific domains including forecasting of weather and climate, bioinformatics, computational chemistry, molecular dynamics, artificial intelligence (AI) and machine learning and especially data science.

Because of the excellent performance of the students of IIT Guwahati in all the fields of study and research, guided by the dynamic faculty members and with the full support of the non-teaching employees, IIT Guwahati could feature in the coveted list of young universities (under 50 years of age) of the world selected by the Times Higher Education (THE) magazine. IIT Guwahati is the only Indian entry to this elite list. I cordially invite all prospective employers to visit IIT Guwahati and to participate in the on-campus placement and internship processes.

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About the Department

The department was established in 1995, alongside the inception of the institute, as the Department of Electronics and Communication Engineering (ECE).

From its commencement, the department has focused on delivering high-quality education, training, and research at the undergraduate, postgraduate, and doctoral levels, with a strong emphasis on the design aspects of electronic systems. In 2008, the department introduced a BTech program in Electronics and Electrical Engineering, designed to equip students with a solid foundation in electrical engineering, complemented by a robust background in electronics. In 2011, the department was renamed the Department of Electronics and Electrical Engineering (EEE).

The major areas of faculty expertise of the department include Biomedical Signal Processing, Communication Systems, Computer Networks, Control Systems, Digital Signal Processing, Image Processing & Computer Vision, Pattern Recognition, Instrumentation, Multimedia Security, Power Electronics, Power Systems, Radar Signal Processing, RF and Microwaves, Microstrip Antennas, Optoelectronic and Optical Communication, Speech Signal Processing, VLSI Systems and MEMS.

The department provides students with opportunities for hands-on learning through laboratory work, projects, internships, and research activities. The strong academic environment in our institute encourages students to explore emerging technologies and develop innovative solutions to real-world engineering challenges.

The Electronics and Electrical Engineering (EEE) department nurtures a diverse and talented pool of students, equipped to excel in the corporate world. Our students combine theoretical knowledge with practical skills and a passion for innovation. A comprehensive curriculum covering power systems, control systems, electronics, and communication provides them with a strong foundation in electrical engineering principles.

With a strong focus on research, innovation, interdisciplinary learning, and industry exposure, the department prepares students for diverse careers across core engineering, electronics, communication, power systems, semiconductor technology, automation, and emerging technology domains.



Head of Department's Message



We are pleased to introduce you to the Department of Electronics and Electrical Engineering (EEE) at the esteemed Indian Institute of Technology Guwahati (IITG). It is with great pride that we present our exceptional pool of talent and invite you to explore the vast potential of our students. At IITG, we are dedicated to cultivating the next generation of leaders and innovators in electrical and electronics engineering. The EEE department is renowned for its academic excellence, pioneering research, and emphasis on practical application. Our students benefit from a robust theoretical foundation coupled with hands-on experience in cutting-edge laboratories.

A large number of faculty members in our department are young and have completed PhDs or gained postdoctoral experience in the forefront technologies at highly reputed universities in the world. They are leading experts in their fields, providing inspiration and mentorship that drive students to push the boundaries of knowledge and devise innovative solutions to real-world challenges. Our curriculum is meticulously designed to offer a comprehensive education, preparing students to excel in their careers and be capable of contributing substantially to your organization.

The EEE department at IITG offers a diverse range of specializations. Our students are equipped with advanced tools, software, and equipment, enabling them to undertake groundbreaking research and tackle complex problems.

Through academic projects, internships, and industrial collaborations, they consistently demonstrate their ability to apply theoretical knowledge to practical scenarios.

We emphasize the importance of collaboration and teamwork, encouraging students to engage in interdisciplinary projects, participate in national and international competitions, and involve themselves in co-curricular and extracurricular activities. These experiences enhance their communication, leadership, and problem-solving skills, making them valuable assets to any team or organization.

In addition, the strong industry connections of the EEE department ensure that our graduates are well-prepared to make an immediate impact in the corporate world. Our Training and Placement Cell collaborates closely with leading companies to provide internships, industrial visits, and placement opportunities that align with organizational needs.

We invite you to explore the profiles of our talented students, each possessing a unique blend of technical expertise and leadership qualities. We are confident that you will find exceptional candidates capable of contributing to the growth and success of your organization. Our alumni have pursued excellence and achieved remarkable success across the fields, many holding prominent positions in academia and industry, and some of them have founded successful enterprises. We look forward to the opportunity to collaborate with you and showcase the exceptional talent of IIT Guwahati.



With Best Wishes,

Prof. Harshal B. Nemade

Head of Department · EEE

Programmes Offered

Bachelor of Technology (B.Tech)

ADMISSION VIA JEE ADVANCED

The institute offers two BTech programs: Electronics and Communication Engineering (ECE) and Electronics and Electrical Engineering (EEE). The ECE program focuses on building a strong foundation in theoretical, practical, and design aspects, covering electronic circuits, devices, signal processing, and communication. The EEE program, launched in 2008, aims to develop engineers with a deep understanding of electrical engineering, complemented by a strong background in electronics.

Master of Technology (M.Tech)

ADMISSION VIA GATE

In 2010, the department has started two new MTech programmes with specializations in Communication Engineering and Power & Control. In 2015, the department had started one new MTech programme with specialization in RF & Photonics. The department now offers MTech in following specializations: 1) Signal Processing and Machine Learning, 2) VLSI & Nanoelectronics, 3) Power Engineering, 4) Systems, Control & Automation, 5) Communications Engineering, 6) Microelectronics, Photonics & RF Engineering.

Dual MS (Engineering) + PhD

ADMISSION VIA WRITTEN TEST & INTERVIEW

The department offers a Dual MS (Engg.) + PhD programme for engineering graduates seeking an integrated pathway to advanced research. The programme combines rigorous graduate-level coursework with research training, enabling students to develop strong analytical, problem-solving, and research skills. Students progressively transition from coursework and guided projects to independent doctoral research. On successful completion, students are awarded both MS (Engg.) and PhD degrees.

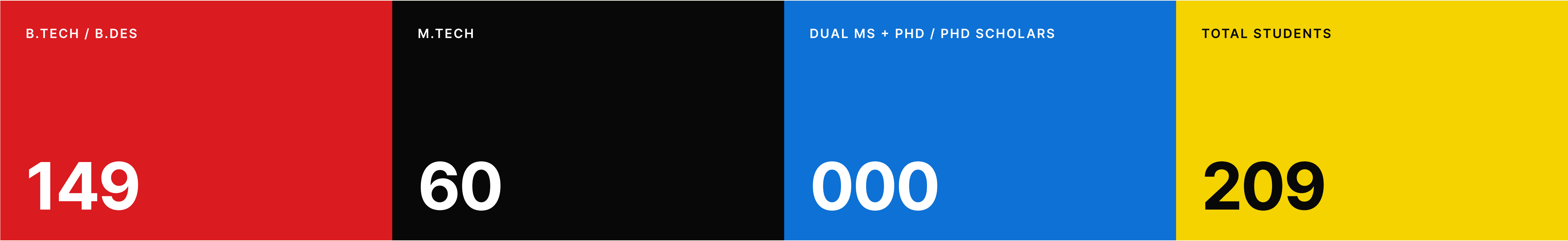
Doctor of Philosophy (PhD)

ADMISSION VIA WRITTEN TEST & INTERVIEW

The PhD programme focuses on original research and technological innovation in Electronics and Electrical Engineering. Scholars work closely with faculty mentors to identify challenging problems, develop novel approaches, and advance knowledge in their chosen area. The programme emphasizes independent thinking, rigorous research, experimentation, and scholarly communication. Students are encouraged to disseminate their findings through high-quality publications and contribute meaningful solutions to academic and real-world challenges.

Student Strength

PROGRAMME	GRADUATING YEAR	STUDENTS
Bachelor of Technology	Batch of 2027	149
Master of Technology	Batch of 2027	60
Dual MS (Engineering) + PhD	Batch of 2027	000
Doctor of Philosophy	Batch of 2027	000
Total		



Curriculum Highlights

Core courses

Semiconductor devices, Circuit Theory

Analog circuits, Digital Circuits

Embedded Systems, Advanced Control Systems

Power Electronics, Electrical Power Systems

Signals and Systems, Digital Signal Processing

Digital Communication, 5G Wireless Networks

Electrical Machines and Drive Systems

Digital IC Design, Analog IC Design, RTL to GDS II

VLSI CAD, Electromagnetic Theory

VLSI Architecture, System Hardware Design

Optimal Control, Nonlinear Systems and Control

Power Electronics Applications in Power Systems

Signal Processing Algorithms and Architectures

Electives

Applied Signal and Image Processing

Pattern Recognition & Machine Learning

Probability & Stochastic Processes

Data Structures and Algorithms

Graph Operators & Learning

Computer Vision

Optimization Techniques

Information Theory

Linear Algebra, Advanced Computer Architecture

Video Analytics, Electronics System Packaging

Laboratory courses

Digital Signal Processing Lab

Machine Learning Laboratory

Digital IC Design Lab

System Hardware Design Lab

Analog IC Design Lab

Nano Fabrications Lab

Electrical Machines Lab

Control & Robotics Lab

Advanced Electrical Engineering Lab

High Frequency Lab

Photonics and Microelectronics Lab

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Microelectronics , Photonics & Radio Frequency

The Microelectronics, Photonics and RF Engineering group brings together research in semiconductor devices, integrated circuits, photonics, electromagnetics, microwave and millimeter-wave technologies. The group focuses on developing advanced devices, circuits and systems for emerging applications in communications, sensing, computing and energy technologies.

Research spans the complete spectrum from device physics and semiconductor technologies to integrated circuits, photonic devices, optical systems, antennas and RF/microwave systems. The group explores the design, modelling, fabrication and characterization of advanced electronic and optoelectronic devices, high-frequency circuits and electromagnetic structures for emerging applications. Research also covers nanoelectronics, silicon photonics, nanophotonics, plasmonics, metamaterials, millimeter-wave and terahertz technologies, enabling innovative solutions for high-speed communication, intelligent sensing, imaging, energy-efficient computing and wireless systems. The integration of electronic, photonic and electromagnetic technologies further supports the development of miniaturized, high-performance and reconfigurable devices and systems for next-generation communication, sensing and information-processing applications.

Thrust areas

Microelectronics, Semiconductor Devices & Integrated Circuits

Research focuses on semiconductor device physics, nanoelectronics and microelectronic circuit design for high-performance and energy-efficient electronic systems.

Key areas include wide-bandgap semiconductors, power semiconductor devices, solid-state devices, nano-scale transistors, semiconductor modelling, sensors and analog integrated circuits. Research also addresses device scaling, emerging device architectures and advanced materials for next-generation electronics.

Work in integrated circuits includes analog and mixed-signal circuit design, RF electronics, frequency synthesizers, PLLs, low-power circuits and high-frequency electronic systems, connecting device-level innovation with system-level applications.

Optoelectronics & Integrated Photonics

Research explores the generation, manipulation, transmission and detection of light at micro-, nano- and integrated scales for communication, sensing, imaging and information processing.

Research areas include silicon photonics, integrated nanophotonic devices, optical modulators, optical multiplexers, fiber amplifiers, photonic sensors, photonic integrated circuits and optical communication. Emerging areas include nanophotonics, plasmonics, tunable metadevices, programmable photonics and quantum photonics.

The group also works on optical signal processing, optical metrology, digital holography, phase imaging, interferometry, laser speckle imaging and fringe projection profilometry, enabling advanced optical measurement and instrumentation

The research activities combine theoretical modelling, computational design, device fabrication, circuit development and experimental characterization. Work includes semiconductor and nanoelectronic devices, integrated photonic circuits, optical instrumentation, RF circuits, antennas, wireless communication, electromagnetic systems and emerging photonic-RF technologies.

Particular emphasis is placed on technologies supporting 5G and beyond wireless communication, optical networks, intelligent sensing, energy harvesting, advanced semiconductor devices and integrated photonics, along with interdisciplinary applications in healthcare, imaging, industrial monitoring and information processing.

RF, Microwave, Antennas & Electromagnetics

Research encompasses the design and analysis of antennas, microwave components, RF circuits and electromagnetic systems for modern wireless and sensing applications.

Key areas include microstrip and MIMO antennas, SSPP/SIW-based antennas and microwave devices, RF circuit design, electromagnetic modelling, metamaterials, millimeter-wave technology and terahertz devices. Research also explores advanced antenna architectures and electromagnetic structures for high-frequency communication and sensing.

Applications include 5G and beyond wireless communication, UWB communication, MIMO systems, OAM communication, RF metamaterials, microwave imaging, energy harvesting and emerging millimeter-wave/THz systems.

Power Engineering

Power Engineering integrates fundamental and advanced concepts in electrical power systems, power electronics, renewable energy, and modern grid technologies. Research in this area focuses on the planning, operation, control, protection, and optimization of reliable and sustainable power networks, along with the integration of distributed energy resources, energy storage, and power-electronic interfaces.

The Power Engineering curriculum covers Power System Analysis, Power System Dynamics and Stability, Power Electronics, Electrical Machines, Renewable Energy Systems, High Voltage Engineering, Power System Protection, Smart Grids, and FACTS devices. Research activities combine analytical modelling, simulation, optimization, artificial intelligence, and experimental approaches to address emerging challenges in modern power networks.

The nature of Power Engineering enables the development of reliable, flexible, and intelligent electricity infrastructure. Research integrates conventional generation with renewable and distributed resources while addressing challenges related to grid stability, power quality, protection, cybersecurity, energy management, and large-scale renewable integration. Advanced computational techniques, real-time simulation, data-driven methods, and machine learning are increasingly being explored for resilient and efficient power-system operation.

Thrust areas

Power Electronics and Renewable Energy Integration

Research in Power Electronics and Renewable Energy focuses on advanced converter technologies and their application in modern energy systems. Research includes DC–DC and DC–AC converters, multilevel converters, grid-connected inverters, power-factor correction, FACTS controllers, energy storage interfaces, and power-electronic converters for solar and wind energy systems.

Particular emphasis is placed on improving converter efficiency, power quality, dynamic response, and reliability under varying operating conditions. Research also addresses grid integration of renewable energy, battery energy storage systems, electric-vehicle charging, distributed energy resources, and advanced control techniques for stable and flexible operation.

Smart Grid and Power System Operation

Research in Smart Grid and Power System Operation focuses on developing intelligent, flexible, and resilient electrical networks capable of accommodating renewable and distributed energy resources. Research areas include power system state estimation, load-flow analysis, dynamic security assessment, voltage stability, frequency stability, optimal power flow, demand response, distributed generation, and microgrids.

Key research challenges include maintaining reliable system operation under high renewable penetration, uncertainty in generation and demand, and changing network configurations. Research also investigates synchrophasor-based monitoring, wide-area measurement systems, intelligent protection, machine-learning-based power-system applications, and data-driven approaches for real-time grid monitoring and decision-making.

High Voltage, Protection and Power System Reliability

Research in High Voltage, Protection and Power System Reliability focuses on insulation coordination, high-voltage phenomena, lightning and switching surges, condition monitoring, and reliable protection of electrical power equipment. Research includes numerical and experimental investigation of insulation systems, fault analysis, protective relaying, adaptive protection, and equipment health assessment.

Research challenges include detecting and isolating faults rapidly, improving protection coordination in active distribution networks, and maintaining system reliability under increasingly complex operating conditions. Advanced approaches involving artificial intelligence, signal processing, real-time monitoring, and predictive maintenance are explored for transformer, transmission-line, and distribution-system applications.

Communication Engineering

Communication Engineering integrates strong foundations in digital and wireless system designs with advanced technologies such as 5G/6G, MIMO, OFDM, RIS, and intelligent communication systems. The program develops expertise in Hardware design, information theory, wireless networks, and next-generation communication, preparing students for cutting-edge industry and research roles.

The Communication Engineering curriculum covers Digital Communication, Information Theory, Error Control Coding, Wireless Communication, Signal Processing, MIMO, OFDM, Mobile Communication, and Communication Networks, with advanced areas such as 5G/6G, RIS, OTFS, ISAC, V2X, and intelligent wireless systems. The program emphasizes research-oriented learning through mathematical modeling, simulations, and practical implementation using tools such as, VHDLs ,MATLAB and Python, preparing students for advanced communication, R&D, and technology roles.

The nature of Communication Engineering enables the development of reliable, intelligent, and high-capacity communication systems for next-generation connectivity. Research integrates digital communications, signal processing, information theory, wireless networks, and optimization with applications in 5G/6G, MIMO, OFDM, RIS, OTFS, ISAC, V2X, satellite communication, and intelligent wireless systems. Students gain exposure to modern communication methodologies including advanced modulation and coding, channel estimation, multi-antenna systems, adaptive communication, resource allocation, and machine-learning-based wireless techniques, alongside classical statistical, mathematical, and optimization-based approaches.

Thrust areas

Beyond 5G and 6G Communication

Research in Beyond 5G (B5G) and 6G communication focuses on developing intelligent, ultra-fast, reliable, and energy-efficient wireless networks capable of supporting emerging applications such as autonomous systems, extended reality, smart cities, industrial IoT, and massive machine-type communication. The research explores advanced technologies including massive MIMO, millimeter-wave and terahertz communication, RIS, AI-enabled networks, cell-free massive MIMO, integrated sensing and communication (ISAC), and intelligent resource allocation.

Key research challenges include achieving extremely high data rates, ultra-low latency, massive connectivity, improved spectral and energy efficiency, seamless coverage, and reliable communication under high mobility. Research also investigates AI-driven network optimization, advanced waveform design, channel estimation, beamforming, interference management, and joint communication-sensing systems to enable the intelligent and adaptive wireless networks envisioned for 6G.

Industry-Grade Wireless Protocols

Research in industry-grade wireless protocols focuses on designing, analyzing, and optimizing robust communication protocols capable of meeting the stringent requirements of modern industrial and commercial wireless systems. The work addresses high reliability, low latency, scalability, security, mobility, interoperability, and efficient spectrum utilization, with applications across 5G/6G networks, industrial IoT, connected vehicles, smart factories, and mission-critical communication. Research involves the development of MAC, PHY, and network-layer protocols, including channel access mechanisms, scheduling, resource allocation, link adaptation, retransmission strategies, interference management, synchronization, and mobility management. Advanced techniques such as massive MIMO, OFDM, beamforming, device-to-device communication, network slicing, edge computing, and AI-assisted resource optimization can be incorporated to improve network performance under dynamic and heterogeneous conditions. develop wireless protocols that are reliable, scalable, energy-efficient, and suitable for real-world deployment in next-generation communication networks.

OFDM and Multicarrier Communication

Research in OFDM and multicarrier communication focuses on designing high-capacity and spectrally efficient transmission techniques for modern wireless systems. OFDM divides a high-rate data stream across multiple orthogonal subcarriers, making it highly effective for frequency-selective and multipath fading channels and forming a foundation for technologies such as broadband wireless, Wi-Fi, and cellular communication.

Research areas include OFDM waveform design, synchronization, channel estimation, equalization, PAPR reduction, carrier-frequency offset compensation, Doppler mitigation, adaptive modulation and coding, and resource allocation. Advanced multicarrier waveforms such as Filter Bank Multicarrier (FBMC), Universal Filtered Multicarrier (UFMC), Generalized Frequency Division Multiplexing (GFDM), and OTFS are investigated to address limitations of conventional OFDM.

Particular emphasis is placed on high-mobility and time-varying communication environments, where Doppler shifts and rapid channel variations can degrade system performance.

VLSI and Nanoelectronics

The VLSI and Nanoelectronics brings together circuit and system design, computer architecture, semiconductor device engineering, and nanoscale materials to address challenging problems in modern electronics. Research spans circuit simulation and VLSI CAD, digital IC and electronics-system design, hardware security, embedded systems and IoT, high-performance computing, semiconductor devices, MEMS, and flexible, wearable and sensor electronics — aligning closely with the India Semiconductor Mission and industry needs for skilled manpower in integrated circuits and nanoelectronics devices.

The departments's design-oriented research runs the full stack from transistor to system. Work spans circuit simulation for analog, RF and digital circuits, VLSI CAD, electronics-system design, computer architecture, and high-performance computing, extending into hardware security and hardware realization of machine-learning algorithms.

VLSI architectures for signal processing, machine learning and communication algorithms, along with digital IC design and adaptive and biomedical signal processing, drive energy-efficient, high-throughput silicon and FPGA implementations for communications, healthcare and IoT.

Thrust areas

VLSI Design, CAD and Computing Systems

Circuit simulation for analog, RF and digital circuits and VLSI CAD is paired with parallel and high-performance approaches to large-scale VLSI power-grid simulation and efficient circuit simulators for novel devices.

Computer-architecture research covers cache design in tiled chip multiprocessors and RISC-V-based low-power core micro-architectures. VLSI architectures for signal-processing, machine-learning and communication algorithms include distributed-arithmetic-based FIR and adaptive filters, energy-efficient FFT processors, and pipelined accelerators for LSTM networks — emphasizing low-area, low-power, high-throughput digital IC design.

High-performance computing, large-scale optimization, and the hardware realization of machine-learning algorithms round out this thrust, including in-memory computing and RRAM-based neural-network accelerators.

Hardware Security, Embedded Systems and Emerging Computing

Hardware security is a major focus, with work on post-quantum cryptography, secure hardware accelerators for SoC including FPGA co-designs of lattice-based homomorphic encryption and chaos-based cryptographic primitives.

Embedded systems and IoT include VLSI circuit design for IoT applications, near-threshold-voltage standard-cell libraries for energy-efficient IoT processors, and secure biomedical IoT architectures, alongside low-power digital baseband transceivers for body-area-network standards.

Emerging computing paradigms — quantum-electronics circuit design, spiking neural networks, neuromorphic computing, and blockchain hardware — extend the group's reach into next-generation, application-driven electronics.

Complementing this circuits-and-systems effort, the department has deep strength in devices, MEMS and nanoelectronics. Research covers semiconductor devices, MEMS, analog/RF and mixed-signal ICs, energy harvesting, biosensors, and two-dimensional-material and post-silicon transistors.

Work also focuses on solid-state devices, flexible and wearable electronics, electronic-sensor design and development, density functional theory, electronic materials, and sensor-interface circuits — enabling co-design of sensing front-ends, novel transistors, and the systems that read them out.

Semiconductor Devices, MEMS and Sensor Electronics

Research on semiconductor devices, MEMS and VLSI circuits/system design covers junctionless and negative-capacitance transistors, carbon-nanotube and two-dimensional-material field-effect transistors for post-silicon and terahertz electronics, MEMS microhotplates, and energy-harvesting and power-management ICs.

Solid-state devices, flexible and wearable electronics, and electronic sensor design and development anchor a second strand — with specialisation in chemiresistive and gas sensors, breath-biomarker detection, sustainable and biodegradable sensors, additive manufacturing for electronics, and sensor-interface circuits, guided by density functional theory and electronic-materials studies.

Biosensing and healthcare devices cross-cut both strands — including FET and surface-acoustic-wave biosensors for cancer biomarkers and viral antigens, osmotic and micro-cantilever-printed sensors, and analog front-ends for physiological monitoring.

Signal Processing and Machine Learning

SPML combines strong foundations in signal processing with modern machine learning and AI to solve complex real-world problems. The group develops expertise across deep learning, computer vision, intelligent sensing, biomedical AI and data-driven systems, preparing students for cutting-edge technology and research roles.

SPML brings together signal processing, statistical learning and artificial intelligence to address challenging problems involving complex and high-dimensional data. Research spans statistical signal processing, machine learning, computer vision, image and video processing, speech and audio processing, optimization, and data-driven AI.

The program builds strong foundations in linear algebra, probability, optimization, signal processing and machine learning, complemented by practical laboratory and project-based learning.

The interdisciplinary nature of SPML enables the development of intelligent systems for perception, prediction and decision-making. Research translates advanced signal-processing and AI methods into applications including healthcare, biomedical imaging, intelligent sensing, embedded AI, remote sensing and next-generation communication systems.

Students gain exposure to modern AI methodologies including deep learning, CNNs, RNNs/LSTMs, autoencoders and reinforcement learning, alongside classical statistical and optimization-based approaches.

Thrust areas

Signal Processing & Intelligent Sensing

Research focuses on developing robust methods for analysing complex temporal, spatial and multidimensional signals. Areas include digital and statistical signal processing, filtering, estimation, detection, spectral analysis, time-frequency methods and feature extraction for extracting reliable information from noisy and heterogeneous data.

The group combines mathematical modelling, probability, stochastic processes and optimization with data-driven approaches to address challenging signal-processing problems. This enables intelligent systems capable of learning patterns, making inferences and adapting to changing signal characteristics.

These techniques find applications in sensor intelligence, embedded systems, biomedical signals, speech and audio processing, and real-time analytics. Research also explores efficient implementations of signal-processing and machine-learning algorithms for resource-constrained and real-world sensing environments.

Machine Learning, Deep Learning & CV

Research covers a broad spectrum of supervised and unsupervised learning, classification, regression, clustering, dimensionality reduction, probabilistic models and ensemble learning. Strong foundations in linear algebra, probability and optimization enable students to develop models that are both mathematically grounded and computationally effective.

The group explores modern deep-learning architectures including CNNs, RNNs, LSTMs and autoencoders, along with representation learning and advanced pattern-recognition techniques. Applications span image understanding, video analytics, semantic segmentation, recognition and intelligent visual perception.

Machine learning and vision techniques are integrated with signal-processing methods to develop systems capable of perception, prediction and decision-making. Research addresses challenging applications in autonomous systems, multimedia analytics, remote sensing and intelligent environments, with an emphasis on scalable computational frameworks.

AI for Healthcare & Emerging Applications

SPML research applies signal processing and machine learning to biomedical data, including cardiovascular signals, medical images, retinal imaging and other physiological measurements. The objective is to develop robust computational methods for analysis, reconstruction, segmentation and intelligent interpretation of medical data.

Deep learning and data-driven approaches are being explored for healthcare intelligence, medical imaging and computer-aided analysis. Research combines domain knowledge with modern AI techniques to address complex problems involving noisy, high-dimensional and multimodal biomedical data.

Research extends beyond healthcare into speech and audio processing, speech recognition, brain-computer interfaces, remote sensing and intelligent communication systems. This interdisciplinary ecosystem enables the development of AI solutions across diverse sensing modalities and emerging technology domains.

System Control and Automation

SCA integrates control theory, dynamical systems, optimization and automation to develop intelligent, reliable and autonomous engineering systems. The specialization builds expertise across linear and nonlinear control, robust and optimal control, MPC, distributed and networked control, robotics, multi-agent systems and reinforcement learning, with applications in autonomous vehicles, power electronics, renewable energy, electric vehicles and hybrid energy storage systems.

The Systems, Control and Automation (SCA) specialization integrates dynamical systems, control theory, optimization, automation and intelligent systems to address complex engineering problems involving modeling, estimation, decision-making and autonomous control. Research spans linear and nonlinear systems, robust and optimal control, model predictive control (MPC), distributed and networked control, system identification, robotics and multi-agent systems. The program builds strong foundations in linear systems theory, nonlinear control, mathematical modeling, linear algebra, optimization, estimation and identification, and robust control, complemented by computational and project-based learning. Students gain practical exposure to MATLAB/ Simulink, autonomous robotics and embedded control, with applications involving TurtleBot3, FPV drones and autonomous vehicles. Research translates advanced control and automation methodologies into applications including robotics and autonomous systems, UAVs and underwater vehicles, multi-agent systems, power electronic converters, renewable energy, electric vehicles and hybrid energy storage systems (HESS). Emerging approaches such as reinforcement learning, MPC, robust control and leader–follower control are explored for intelligent, resilient and autonomous engineering systems.

Thrust areas

Advance Systems,Control and Optimization

Research focuses on the modeling, analysis and control of complex dynamical systems using modern systems and control methodologies.

Key areas include linear and nonlinear control, robust and optimal control, model predictive control (MPC), estimation and system identification, and optimization.

Research addresses challenges involving uncertainty, disturbances, constraints, nonlinear dynamics and varying operating conditions, with emphasis on stability, performance and reliability. These methodologies enable the design of high-performance controllers for complex engineering and cyber-physical systems.

Robotics ,Autonomy & Multi-Agent Systems

Research focuses on the development of intelligent, autonomous and cooperative robotic systems capable of perception, navigation, trajectory tracking and decision-making in dynamic environments.

Advanced approaches including nonlinear control, MPC, reinforcement learning, distributed control and leader–follower strategies are explored for aerial, ground and underwater vehicles. Research encompasses UAVs, FPV drones, TurtleBot3 and autonomous underwater systems, as well as coordination and cooperation among multiple robotic agents.

The work combines theoretical control design with simulation, experimentation and real-world robotic implementation.

Intelligent Energy & Power Systems

SCA Research addresses the control, optimization and energy management of modern power and electrical systems, with emphasis on power electronic converters, renewable energy integration, electric vehicles and hybrid energy storage systems (HESS).

Advanced methodologies including robust control, MPC, optimization and coordinated energy management are employed to achieve stable, efficient and reliable operation under uncertain loads, disturbances and changing operating conditions.

Research includes battery–supercapacitor energy management, battery management, converter control and renewable-integrated systems, supporting the development of next-generation electric mobility and sustainable energy technologies.

Laboratories & Facilities



VLSI LAB

ESTABLISHED 2004

Set up in 2004 under the government-sponsored SMDP-II programme, the VLSI Laboratory brings education, research, and design under one roof. The group focuses on digital and analog circuit design, with CAD tools funded by the Ministry of Communications and IT. Notable work includes a novel inductor structure and completed VCO/LNA designs — the group is also enrolled with EuroPractice for chip fabrication.

The lab is well-equipped with FPGA kits from Xilinx and Altera, along with industry-standard design software such as Cadence, Synopsys, Mentor Graphics, Magma, and CoWare — giving students hands-on experience with the same tools used in the chip design industry.



Electro Medical and Speech Technology Lab

ESTABLISHED 2004

The Electro Medical and Speech Technology (EMST) Laboratory was set up in the department of Electronics and Electrical Engineering (EEE), Indian Institute of Technology (IIT) Guwahati during 2004. The laboratory focuses on the research and development activities related to biomedical signal and image processing, speech signal processing, coding and technology areas.

Some of the current topics of interest include speech enhancement, speaker recognition, children speech recognition, speech synthesis, stressed speech processing, fundus image processing, ECG signal processing, biometrics and handwriting data processing.



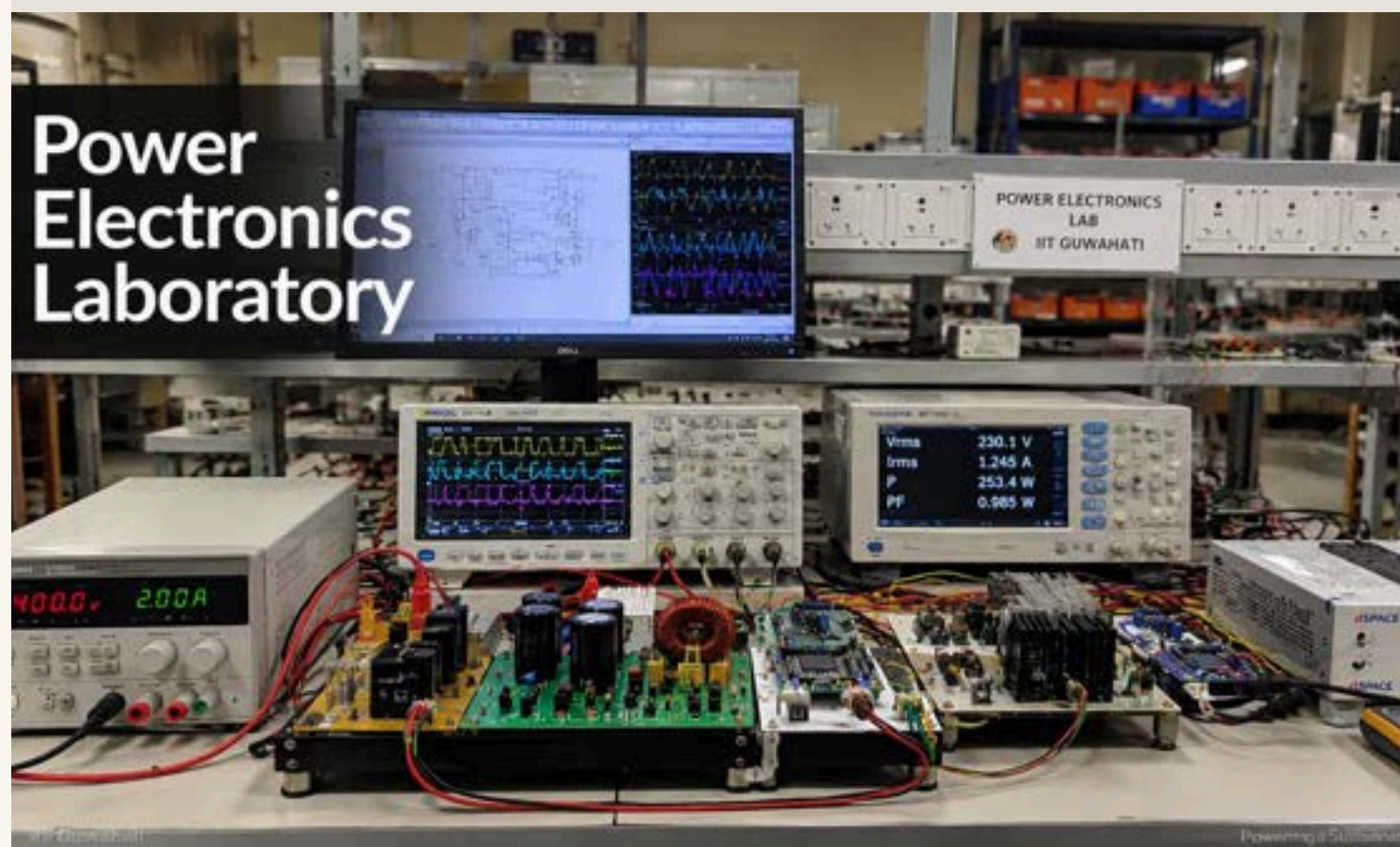
5G Wireless Lab

ESTABLISHED 2004

The 5G Wireless Laboratory at IIT Guwahati provides an advanced environment for research and experimentation in next-generation wireless communication systems. The lab supports research in 5G/6G networks, massive MIMO, OFDM, wireless channel modelling, beamforming, resource allocation, network optimization, and emerging intelligent communication technologies.

The research environment extends toward emerging areas such as OTFS, intelligent reflecting surfaces (RIS), cell-free massive MIMO, vehicular communications, AI/ML for wireless systems, ultra-dense networks, UAV communications, and edge-enabled networks.

Laboratories & Facilities

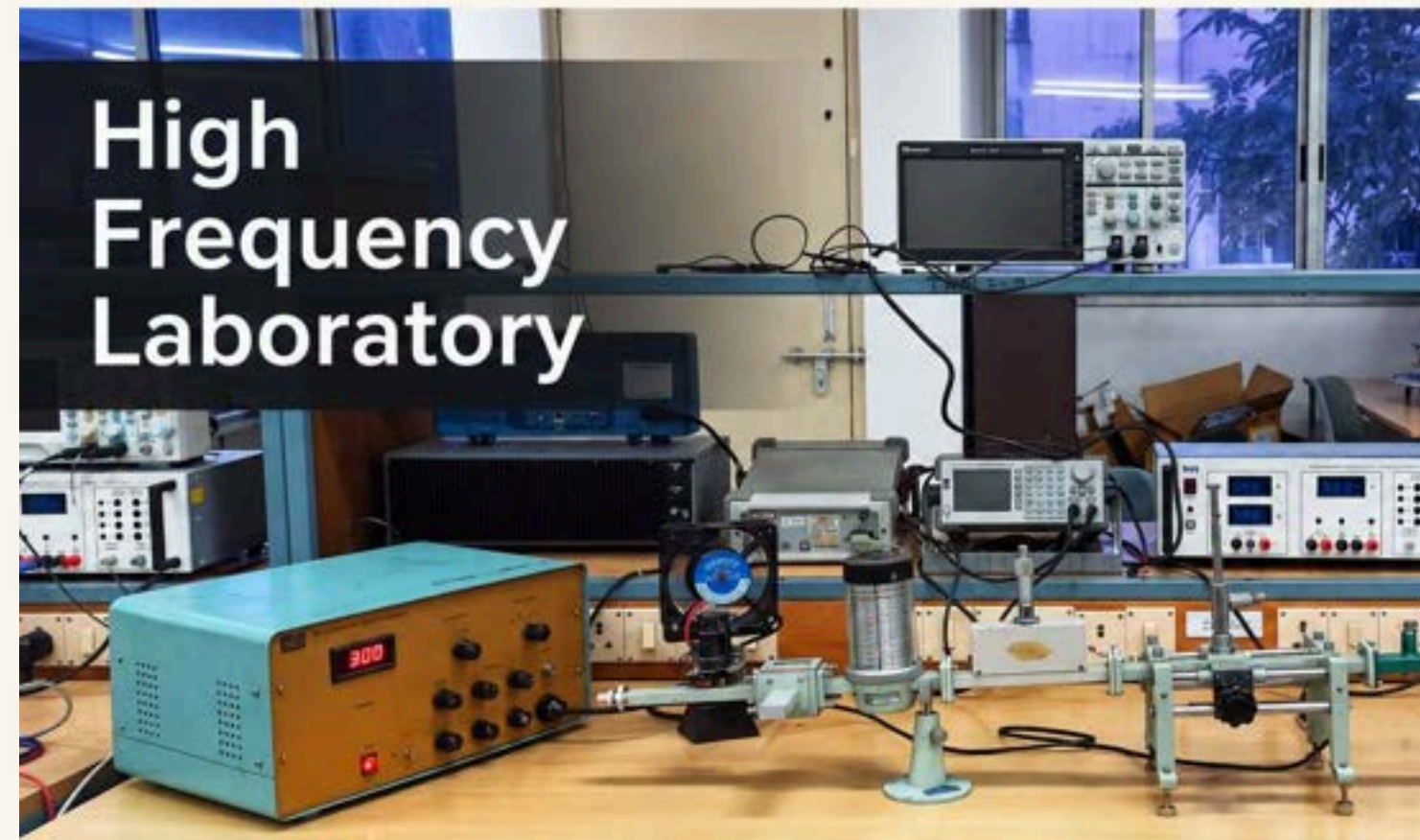


Power Electronics Lab

ESTABLISHED 2004

The Power Electronics Laboratory supports advanced teaching and research in the design, modelling, control, and testing of modern power electronic converters. The lab covers DC-DC, AC-DC, and DC-AC converters, power-factor correction, renewable-energy interfaces, and converter control.

Equipped with power converters, semiconductor devices, oscilloscopes, power analysers, digital controllers, and programmable power supplies, along with tools such as MATLAB/Simulink and PLECS, the laboratory provides students with hands-on experience in converter design, closed-loop control, and experimental validation.

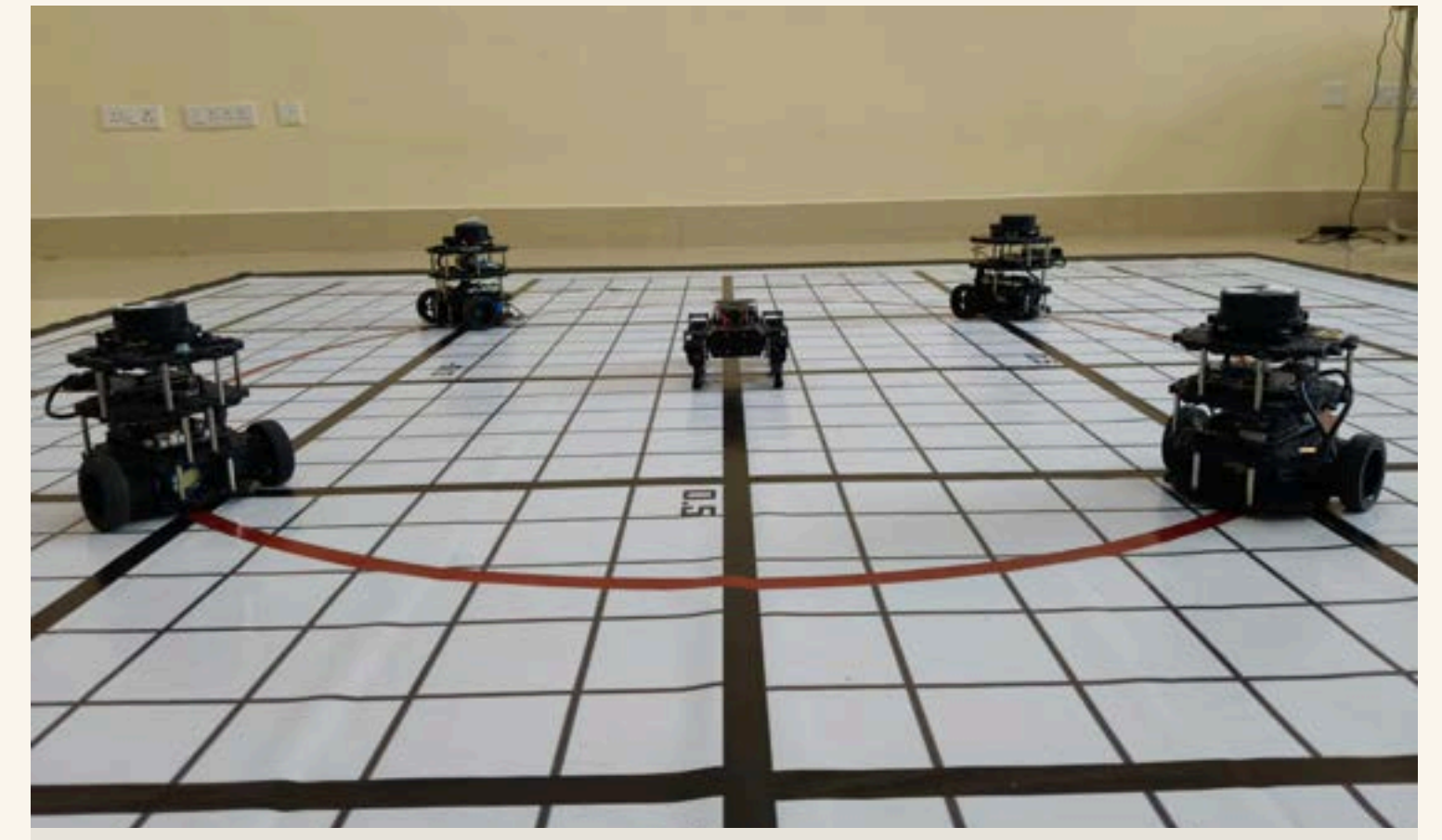


High Frequency Laboratory

ESTABLISHED 2004

The High Frequency Laboratory at the Department of Electronics and Electrical Engineering, IIT Guwahati, supports research and teaching in antennas, microwave engineering and computational electromagnetics. The laboratory provides facilities for experimental investigation and characterization of high-frequency electronic and electromagnetic systems.

Research and experimental activities cover microwave measurements, antenna characterization, RF systems, electromagnetic analysis and wireless communication technologies. The laboratory supports coursework and research in Microwave Engineering, Communication Systems and Design, while providing an experimental platform for validating RF and microwave designs. The laboratory is equipped with microwave sources and test benches, synthesized RF signal generators, RF power meters, 6-GHz spectrum analyzers, arbitrary waveform generators, digital oscilloscopes and electronic test equipment.



Control and Robotics Lab

ESTABLISHED 2026

The Robotics Laboratory provides a hands-on platform for robot modeling, motion planning, trajectory tracking and autonomous control using physical robotic systems.

Research includes nonlinear control, model predictive control (MPC), reinforcement learning, localization and navigation, along with leader-follower, formation and distributed control. The laboratory bridges MATLAB/Simulink-based controller design with real-time implementation and experimental validation on mobile robots and UAV platforms.

Achievements



Analog Design Hackathon

2024 · MINISTRY OF ELECTRONICS AND INFORMATION TECH

Secured the 2nd Runner-Up among 693 teams and 3119 participants from across the country.



The Lam Research Challenge

2025 · BY T - WORKS

It is a system engineering hardware competition held where the team achieved 1st runner ups among 600+ teams.

Faculty distinctions

Prof. M. K. Bhuyan: Selected for the prestigious IETE – Prof. Anita Gopal Dandekar Award 2026 for significant and original contributions to Generative Artificial Intelligence, with potential applications across business, education, healthcare, and AI systems.

Dr. Anirban Dasgupta: Awarded the Young Faculty Excellence in Teaching Award 2026 for excellence in teaching at IIT Guwahati.

Dr. Ramesh Kumar Sonkar: Recipient of the IEEE Kolkata Section Award – Outstanding Volunteer 2025, along with multiple IEEE travel grants for international professional engagements.

Prof R. S. Kshetrimayum and B. B. Pathak were granted a patent for “A Conformal Ultra-Thin Broadband Bandpass Filter System for Beyond 5G Radio Stripe Networks.”

Dr. Sonali Chouhan: Appointed External Expert, Board of Studies, ECE Department, NERIST (2026–29) and leads major externally funded projects in maritime safety and railway technology.

Dr. Manoj B. R.: Leading an ongoing €20,000 research project funded by Nokia Solutions and Networks Oy, Finland, focused on reliable machine-learning techniques for Joint Sensing and Communication.

Student distinctions

1st Runner Up at V-Guard Big Idea Tech Design Competition. It was a hardware product design competition.

1st & 3rd Runner ups in T-Works Embedded Championship 2023, offering amazing prizes and interns to the teams.

Four times in a row winners of Best Hardware Project - Judges Choice in Techevince since 2021. Techevince is the technical projects showcase that is organised by Techboard IIT Guwahati.

Sidhartha Kumar Sahu - Received the Young Scientist Award at the URSI Asia-Pacific Radio Science Conference, Sydney, Australia

Souraja Kundu - Awarded the prestigious QUAD Fellowship by the QUAD governments/Institute of International Education, supporting PhD studies at Carnegie Mellon University (CMU), United States.

Student Activities & Clubs

IIT Guwahati encourages students to look beyond their academic curriculum, building skills, exploring new domains and gaining practical experience through a vibrant ecosystem of student clubs and activities.

At IIT Guwahati, learning goes well beyond the classroom. While academics provide a strong foundation, our 30+ active clubs give students the opportunity to explore new interests, build skills and gain hands on experience beyond their core discipline.

Students from diverse academic backgrounds come together through a wide range of technical, professional and innovation focused clubs, including:

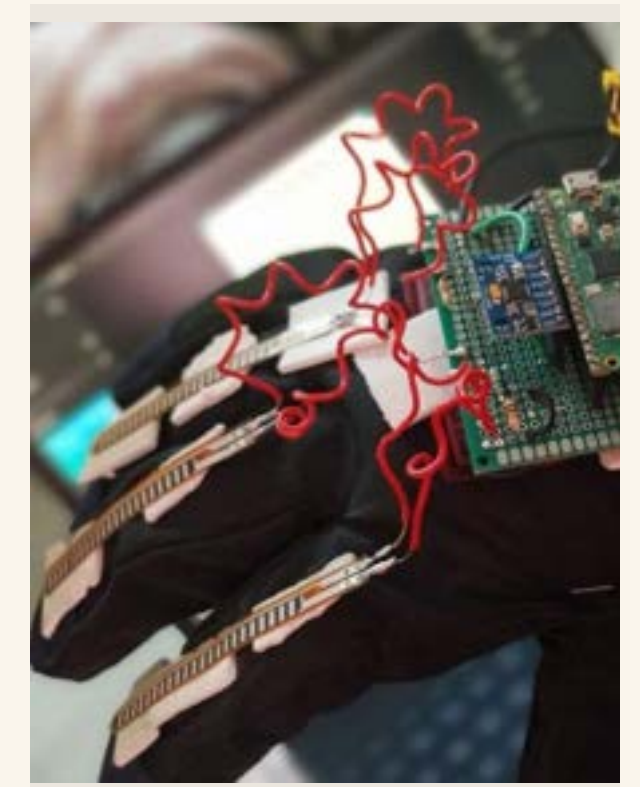
Technology & Engineering

1. IITG.ai
2. Coding Club
3. Robotics Club
4. Electronics Club
5. Aeromodelling Club
6. IITG Racing (Automobile Club)
7. Game Dev
8. Equinox (Astronomy Club)
9. 4i Labs (Innovation Club)

Professional & Business

1. Finance & Economics Club
2. Consulting & Analytics Club
3. Entrepreneurship Cell
4. Whitespace (Design Club)

Together, these experiences allow students to explore domains beyond their curriculum, work with people from different backgrounds and turn their curiosity into practical skills. A student's branch is a foundation, not a boundary, enabling them to take on challenges across disciplines and bring a broader perspective to the workplace.



Past Recruiters

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