Ph.D. Admissions Brochure

Department of Electrical Engineering

Indian Institute of Technology Hyderabad

August 2023 Session

भारतीय प्रौद्योगिकी संस्थान हैदराबाद
Indian Institute of Technology Hyderabad

Electrical Engineering Department @ IIT Hyderabad

- Faculty: 32 + 1 (Emeritus) + 2 (Distinguished) + 3 (Adjunct)
- Programs:B.Tech., M.Tech. and Ph.D.
- Specializations:
  - Communication and Signal Processing (CSP)
  - Microelectronics and VLSI (Micro)
    - - Nanodevices and Technology
    - - Integrated Circuits and Systems
  - Power Electronics and Power Systems (PEPS)
  - Systems and Control (SysCon)
- Students: 516 (BTech - 212, MTech - 136, PhD -168)
- Research Labs: 14
- Teaching Labs: 15
- Journal + Conference publications > 1000
- Patents/Products/prototypes > 50
- Research funding in excess of Rs. 216 Crore since inception

Faculty profile (clickable names)

Amit Acharyya (Micro)
Professor
Research interests: Signal Processing Algorithms, VLSI Architectures, Low Power Design Techniques

Ravikumar Bhimasingu (PEPS)
Associate Professor
Research interests: Power system analysis and modeling, AI techniques applications for power systems security improvement, Renewable Energy Integration.

Sushmee Badhulika (Micro)
Professor
Research interests: Nanomaterials, flexible devices, sensors, supercapacitors

Sumohana Channappayya (CSP)
Professor
Research interests: Image and video quality assessment, perceptually optimal algorithms, multimedia communication

Gajendranath Chowdary (Micro)
Associate Professor
Research interests:
Analog and Mixed Signal Circuit Design

U. B. Desai (CSP)
Professor Emeritus
Research interests: Wireless communications, cognitive radio

Ketan Detroja (Systems and Control)
Associate Professor
Research interests:
Multivariable control systems,
Distributed state estimation,
AI/ML for control applications,
Hardware-Software design for control

Abhinav Kumar (CSP)
Associate Professor
Research interests: Green cellular networks, user network selection, device to device communications, and radio resource management in heterogeneous wireless access networks.

Faculty profile (clickable names)

Naresh Emani (Micro)
Associate Professor
Research interests: Nanophotonics, Mid-Infrared Devices, Integrated Optical Sensors, Semiconductor Devices.

Ashudeb Dutta (Micro)
Professor
Research interests: Analog Circuit Design, RFIC, Semiconductor Devices.

Soumya Jana (CSP)
Professor
Research interests: Multimedia signal processing and compression, Network communication, Information theory

Kiran Kuchi (CSP)
Professor
Research interests: Communication theory, Signal processing for communications, Network MIMO, Interference mitigation

Sri Rama Murty Kodukula (CSP)
Associate Professor
Research interests: Signal Processing, Speech Analysis, Pattern Recognition

Siva Kumar K. (PEPS)
Professor
Research interests: Multilevel inverters, open-end winding induction motor drives, Switched Mode Power Conversion, micro grids, Power quality and control.

Mohammad Zafar Ali Khan (CSP)
Professor
Research interests: Space-Time Coding for MIMO Channels, Cognitive Radio and MIMO Radar

Shishir Kumar (Micro)
Assistant Professor
Research interests: Bionanosensors, Nanofluidics, Large scale microfluidics, Nanocarbons, 2D materials, Composites.

Faculty profile (clickable names)

Kaushik Nayak (Micro)
Associate Professor
Research interests: Electron Device Physics
Nanoelectronic Devices
Novel Transistors.

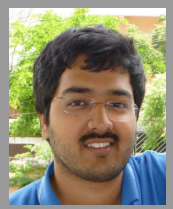
Lakshmi Prasad Natarajan (CSP)
Assistant Professor
Research interests:
Coding and Modulation for Communications

P. Rajalakshmi (CSP)
Professor
Research interests:
Wireless Sensor Networks,
Cognitive Radio; Embedded Systems;
Optical Networking

G. V. V. Sharma (CSP)
Associate Professor
Research interests: Communication
Theory, Signal Processing

Vaskar Sarkar (PEPS)
Associate Professor
Research interests: Power system
restructuring, voltage stability, transmission
expansion planning, microgrids,
distribution system analysis

Shiv Govind Singh (Micro)
Professor
& Head of the Department
Research interests: 3D ICs (Metal-Metal
interconnect Technology, Wafer scale
Heterogeneous integration) Bio/Gas Sensors,
MEMS, Lab on Chip and organic Solar cell



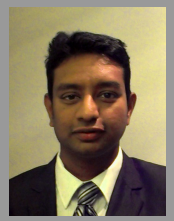
Aditya Siripuram (CSP)
Assistant Professor
Research interests: Signal processing,
Sparse representations, Sampling techniques

V. Seshadri Sravan Kumar (PEPS)
Assistant Professor
Research interests: Grid Connected
Renewable Energy Systems, Micro Grids,
Wide Area Monitoring & Control.

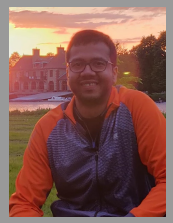
Faculty profile (clickable names)

Siva Rama Krishna Vanjari (Micro)
Professor
Research interests: Biosensors,
Lab on Chip applications,
VLSI Technology

Rupesh Wandhare (PEPS)
Assistant Professor
Research interests: Power Electronics,
Electric Drives,
Renewable Energy Sources,
Distributed Energy Generation,
Standalone and Hybrid Energy Generation,
Microgrid,



Pradeep Yemula (PEPS)
Associate Professor
Research interests: Smart Grids,
Power System Control Centers,
Information Technology Architectures
Smart Grid Standards,
Smart Cities



Abhishek Kumar (Micro)
Assistant Professor
Research interests:
Analog and radio-frequency IC design,
Full-duplex wireless communication

Shashank Vatedka (CSP)
Assistant Professor
Research interests:
Information theory and coding,
Physical layer security

Oves Badami (Micro)
Assistant Professor
Research interests:
Semiconductor Device Physics,
Computational Nanoelectronics
and TCAD Development

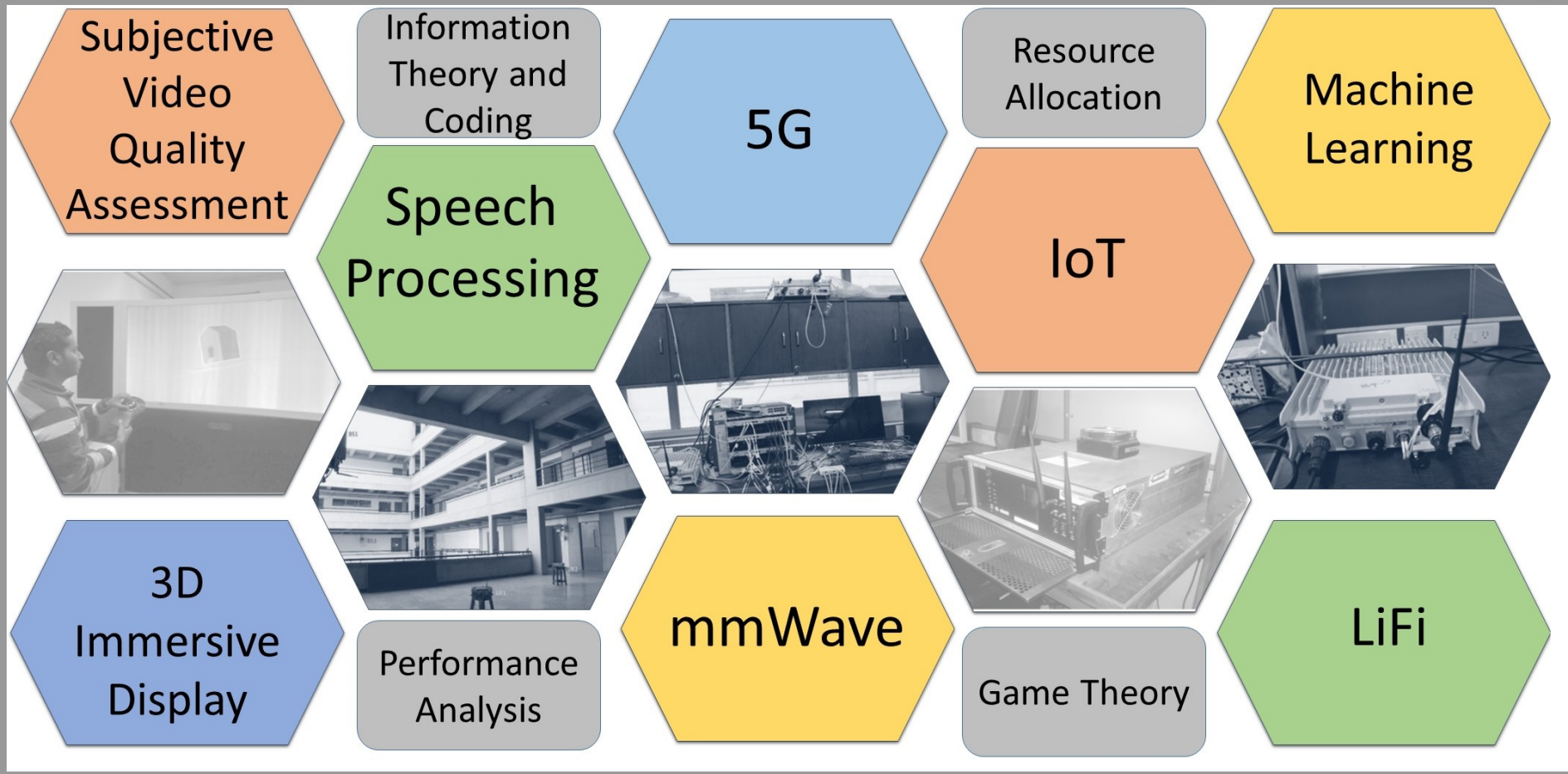
Sundaram Vanka (CSP)
Associate Professor
Research interests:
Mathematical modeling,
Simulation and prototyping of wireless systems
and networks, especially low power applications

Faculty profile (clickable names)

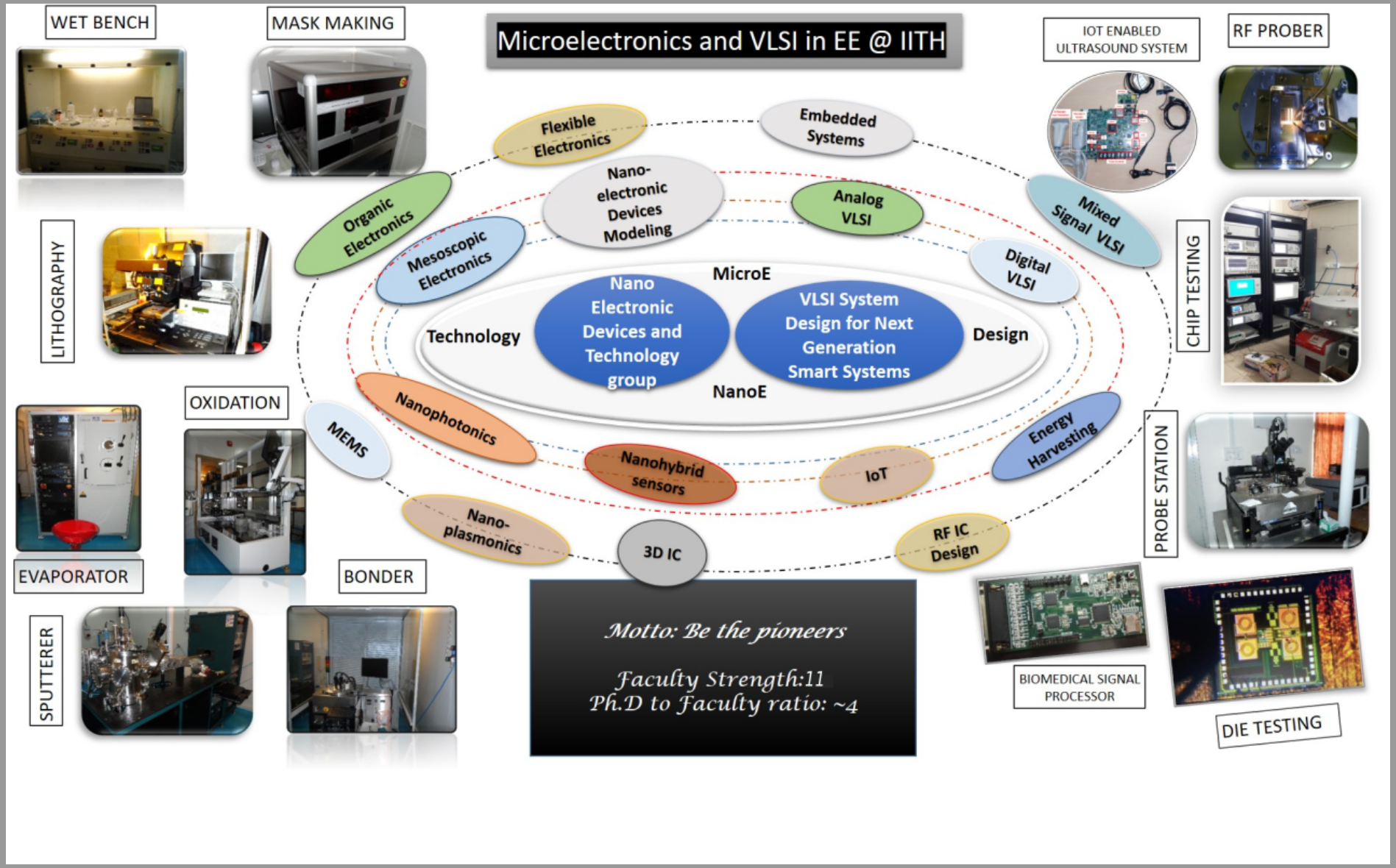
Shubhadeep Bhattacharjee (Micro)
Assistant Professor
Research interests:
Low-power nanoelectronic devices: steep-slope (sub-60 mV/dec) transistors, neuromorphic devices, twisted 2D heterostructures, nanofabrication and characterization

Jose Titus (PEPS)
Assistant Professor
Research interests:
Medium Voltage Drives, Electric Machine Design, Sensorless Control Techniques

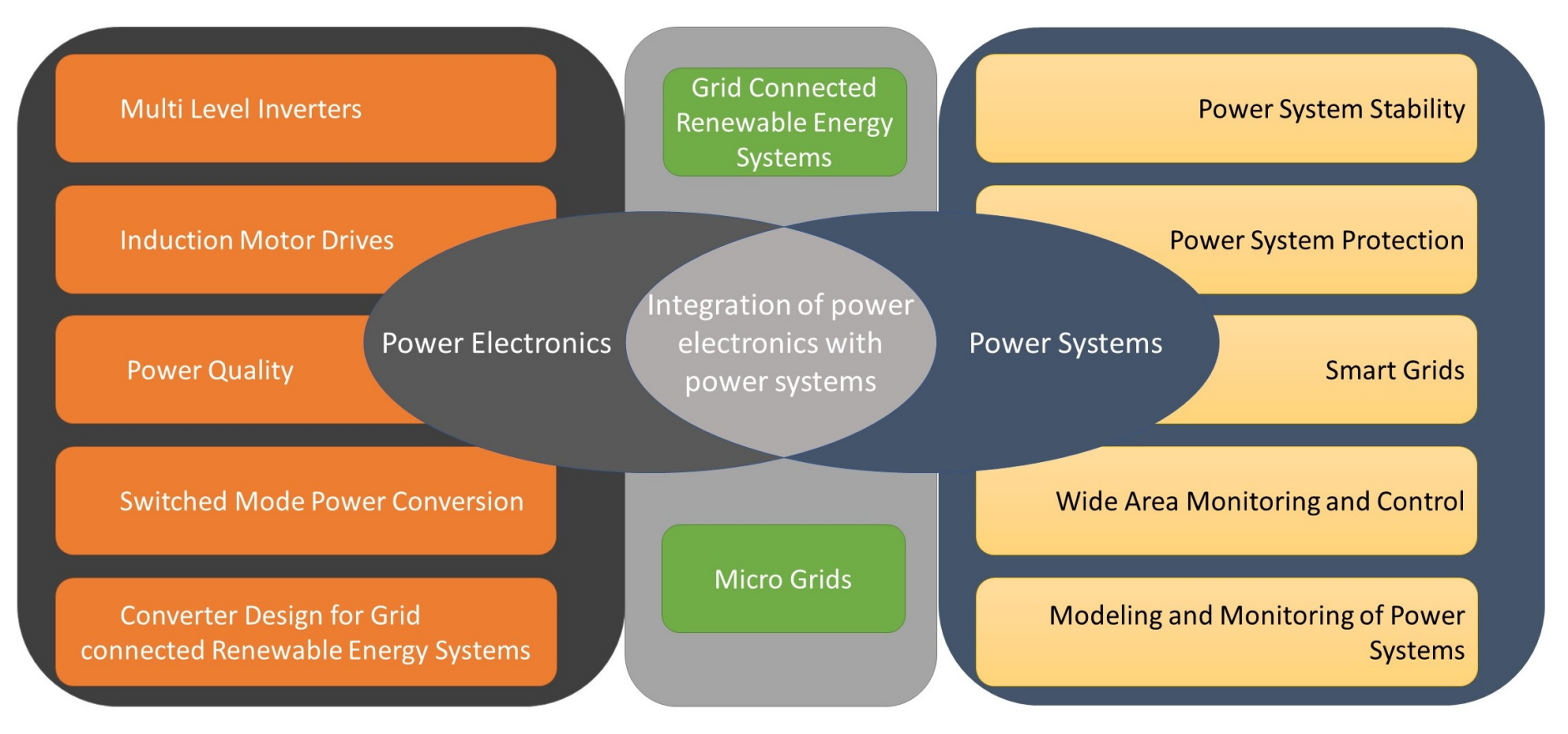
Communications and Signal Processing (Research Areas)



Microelectronics and VLSI (Research Areas)



Power Electronics and Power Systems (Research Areas)

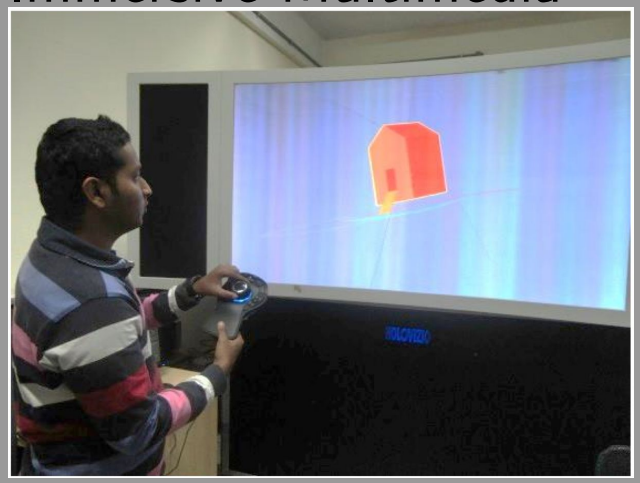


Systems and Control (Research Areas)

- Pattern Matching and Data Mining
- Big Data Analytics
- Condition Monitoring
- Advanced/Statistical Control
- Multi-Agent System
- Systems Biology

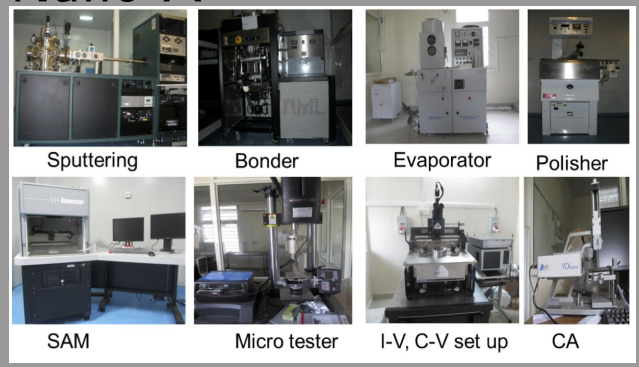
Research facilities @ EE, IITH

- Immersive Multimedia



- Smartgrids

- Nano-X



- Next-gen communication

Eligibility (Communications and Signal Processing)

Who can apply?

- Candidates with B.E./B.Tech. with following specialization:
  - Electrical/Electronics and Communication Engineering
  - Any other related branch of Engineering/Technology

OR

- Candidates with M.E./M.Tech. with following specialization:
  - Electrical/Electronics and Communication Engineering
  - Any other related branch of Engineering/Technology

OR

- Candidates with a valid GATE score in the following: EC GATE paper

Eligibility (Microelectronics and VLSI)

Research track: Nanodevices and Technology

Who can apply?

- Candidates with B.E./B.Tech. in Telecommunication Engineering (EC)/Electrical Engineering (EE) / Engineering Physics (EP) / Instrumentation Engineering (IN) / Engineering Sciences (ES) / Nanotechnology / Nanobiotechnology / Material Science and engineering

OR

- M.Sc. or equivalent in Electronics / Electronic Sciences (EL) / Physics (PH)/ Nanotechnology/Material Science

OR

- Candidates with M.E./M.Tech. in Microelectronics / VLSI Design / Nanoelectronics / Nanotechnology/ Nanobiotechnology / Material Science and engineering

Candidates without M.E./M.Tech. must also fulfill ONE of the following additional requirements:

- Valid GATE score in EC, EE, IN, PH, MT or XE.
- Valid JEST score in Physics.
- Junior research fellowship (JRF) of CSIR/UGC or DST INSPIRE fellowship.

Eligibility (Microelectronics and VLSI)

Research track: Integrated Circuits and Systems
Who can apply?

- Candidates with B.E./B.Tech. in Telecommunication Engineering (EC) / Electrical Engineering (EE) / Engineering Physics (EP) / Instrumentation Engineering (IN) / Engineering Sciences (ES) / Nanotechnology

OR

- M.Sc. or equivalent in Electronics / Electronic Sciences (EL) / Physics (PH)

OR

- Candidates with M.E./M.Tech. in Microelectronics / VLSI Design / Nanoelectronics / Nanotechnology

Candidates without M.E./M.Tech. must also fulfill ONE of the following additional requirements:

- Valid GATE score in EC, EE, IN, PH.
- Junior research fellowship (JRF) of CSIR/UGC or DST INSPIRE fellowship.

Eligibility (Power Electronics and Power Systems)

Who can apply?

- Candidates with B.E./B.Tech. with following specialization:
  - Electrical/Electrical and Electronics/Power engineering or equivalent
  - Any other related branch of Electrical Engineering/Technology

OR

- Candidates with M.E./M.Tech. with following specialization:
  - Power Electronics/Power Systems/Electrical Engineering
  - Any other related branch of Electrical Engineering/Technology

OR

- Candidates with a valid GATE score in the following: EE GATE paper

Eligibility (Systems and Control)

Who can apply?

- Candidates with B.E./B.Tech. with following specialization:
  - Instrumentation and Control/Control Engineering
  - Any other related branch of Engineering/Technology

OR

- Candidates with M.E./M.Tech. with following specialization:
  - Systems/ Control & Computing/ Automation Engineering
  - Any other related branch of Engineering/Technology

OR

- Candidates with a valid GATE score in the following: IN/EE/EC GATE paper

Dual Degree (M. Tech. + Ph.D.) for direct B.Tech./B.E. to Ph.D. candidates

- After successful completion and examination of Ph.D. thesis, both the degrees (M. Tech. & Ph.D.) are awarded to the candidate.
- The following categories are available for Dual Degree (M. Tech. + Ph.D.) program;
  - Direct admission to dual degree program right after B.Tech. from an IIT: CGPA$\geq$8.0 for admission without GATE;
  - Direct admission to dual degree program right after B.Tech./B.E. at a non-IIT institution: GATE Score based shortlist followed by written test and interview for students with CGPA $\geq$ 8.0.

PhD in External/Sponsored Category

- Candidates employed in well-resourced scientific institutions, R & D establishments, and industry laboratories, engaged in research based activities can opt for applying in the external (or sponsored) category.
- The candidate should be working in an organization closely related to the proposed Ph.D. research topic.
- The minimum educational qualification is same as mentioned in the previous specialization specific Eligibility in this brochure.
- In case the candidate is shortlisted for further selection process, the candidate should furnish a No Objection Certificate (NOC) issued by his/her organization for verification.
- The candidates given admission under this program are NOT eligible for any financial assistantship from the institute.

How to Apply

Interested candidates can apply online through IIT Hyderabad's website:
http://www.iith.ac.in

Selection Process

- Candidates called for selection should choose one of the four specializations for consideration.
- Selection is based on a two-stage screening process:
  - Written/online test (see syllabus in following slides).
  - Candidates selected after the written/online test will have to appear for a technical interview.
- Final selection is based on performance in the interview.
- It is advisable that shortlisted candidates bring call letter, original educational degree certificates, GATE score cards (if applicable), and hard copy of recommendation letters from two referees in sealed envelopes for the selection process.
- Decision of selection committee will be final.

Syllabus (Communications and Signal Processing)

In addition to GATE EC syllabus, emphasis will be on:

- Signals and Systems
- Discrete time signal processing
- Linear Algebra
- Probability and random processes
- Analog and digital communications

Syllabus (Microelectronics and VLSI)

Research track: Nanodevices and Technology

- **Fundamentals of semiconductor devices**: Band-diagrams, Carrier transport, Diode operation, MOSCAP CV, MOSFET operating regimes
- **Basic Quantum Mechanics**: Wave-particle duality, uncertainty, Wave-functions, Schrodinger equation and particle in a box problem.
- **VLSI Technology**: Photolithography, Deposition (Physical and chemical), Wet and dry etching.
- **Basic Electromagnetics**: Coulomb's law, Laplace and Poisson's equations, Maxwell's equations in differential and integral form.
- **Computational skills**: familiarity with a programming environment(C/Matlab/python), writing pseudocode.
- **Miscellaneous topics**: Basic operating principles of electronic and electrical devices in everyday life, basics of signal processing(Fourier transform, windowing, low and high pass filtering).

Syllabus (Microelectronics and VLSI)

Research track: Integrated Circuits and Systems

- **Electrical networks**: Network theorems, Steady state sinusoidal analysis, Time domain analysis of simple linear circuits, 2-port networks.
- **Analog electronics**: Diodes, BJTs and MOSFETs, BJT and MOSFET amplifiers: biasing, small signal analysis and frequency response, feedback, op-amp circuits, Active filters, Sinusoidal oscillators.
- **Digital electronics**: Number systems, Combinational circuits: Boolean algebra, Karnaugh map, logic gates and their static CMOS implementations, arithmetic circuits, code converters, multiplexers, decoders, Sequential circuits: latches and flip-flops, counters, shift-registers and finite state machines
- **Signals and systems**: Fourier series and Fourier transform, LTI systems: causality, stability, impulse response, convolution, poles and zeroes, frequency response.

Syllabus (Power Electronics and Power Systems)

In addition to GATE EE syllabus, emphasis will be on:

- Electrical networks
- Electrical machines
- Power systems
- Power electronics
- Control systems
- Linear algebra
- Signals and systems

Syllabus (Systems and Control)

In addition to GATE IN syllabus, emphasis will be on:

- Electrical Networks
- Linear Algebra
- Control systems
- System design
- Advanced Control
- State Space Techniques
- Optimization

Selection Process Note

The department reserves the right to set any cut off criteria for shortlisting the candidates. The shortlisted candidates will be called for further selection process. The department has the right not to select any if appropriate candidates are not found.

Thank You...!

All the Best....!!