

Preferences for Areas of Research (Nov. 2019)

Please indicate your first and second preferences from the following areas (Mark 1,2,3,... in the boxes, in decreasing order of preference)

A. Communication and Networks:

Within the ECE Dept., current research in this area encompasses a broad range of topics covering the theory and practice of communication systems and networks. Example of research topics include (but are not limited to): 5G and beyond, next-generation communications and networking; multi-user/massive MIMO OTFS; ultra low-latency; massive machine-type communications, energy harvesting based techniques; mmWave communications, signal processing for communications, visible light communications. Machine learning for wireless communications; optical networks; information theory, coding theory (including codes for big data storage and network coding); codes for low-latency communication, codes for big data storage, distributed computing, communication networks modeling, analysis, optimization and control; communications and network protocols; machine learning and distributed decision-making.

We use mathematical tools based on probability and statistics, random processes, linear algebra, real and complex analysis, detection and estimation, optimization, statistical physics etc.

Faculty willing to guide: Anurag Kumar, A. Chockalingam, B. Sundar Rajan, P. Vijay Kumar, Utpal Mukherji, Neelesh B. Mehta, Parimal Parag

B. Signal Processing:

Current research in Signal Processing encompasses a broad range of topics covering signal, image and video processing. The research approach in this domain includes the design of algorithms for various applications and their theoretical and/or experimental analysis on real world benchmarking datasets.

Some example research topics, classified as techniques and applications, include:

- Techniques: compressive and sparse sensing; sparse signal processing; distributed signal processing; graph signal processing; distributed computing, deep learning; computer vision; and convex and non-convex optimization; machine learning
- Applications: sensor networks, 5G and next-generation communication systems; cognitive radio; magnetic resonance imaging (MRI) systems; ultrasound imaging; automotive radar; navigation systems; indoor localization and tracking; internet of things (IoT); massive machine-type communications; computer vision and virtual reality systems; image and video quality assessment and enhancement of visual content; and video streaming systems.

We use mathematical tools based on matrix theory, stochastic processes, optimization theory, and statistics. The candidates should have basic computer programming skills.

Faculty willing to guide: A. Chockalingam, B. Sundar Rajan, Neelesh B. Mehta, Parimal Parag

C. Microelectronics:

Research topics currently on offer:

- Nanotransistors with Si, III-V, 2D materials (Graphene, TMD), spintronics, novel memory, CMOS sensors, ultra-low power devices.
- Semiconductor optoelectronic devices, 2D valleytronics, photodetectors and IR detectors, solar cell
- Analog, mixed-signal and RF integrated circuits

Faculty willing to guide: Gaurab Banerjee

D. RF & Microwaves :

Research topics currently on offer:

- Computational electromagnetics, Solutions to Maxwell's equations: finite difference time domain method, finite element method; EMI/EMC for high frequency circuits
- Antenna array analysis and design, radar sensors for civilian applications
- Analog, mixed-signal and RF integrated circuits
- 5G mmwave beamsteering circuits

Faculty willing to guide: K. J. Vinoy, Gaurab Banerjee

E. Photonics:

Research topics currently on offer:

- Optical communication and networks
- Photonic integrated circuits
- Optoelectronics
- Nanophotonics
- Bio photonics & Microscopy
- Micro-opto-electro-mechanical system (MOEMS)
- Quantum Information Technology

Faculty willing to guide: T. Srinivas, Varun Raghunathan

If you have specific research interests in any of the areas listed above, please mention them here:

Signature of the candidate: