As the placement season for the year 2018-19 draws near, we would like to invite the leaders in the industry of Wireless Technology and Communication to recruit the students of our center for their Organization. The Radio Frequency Design & Technology (RFDT) program at IIT Delhi is distinguished from other similar programs by virtue of its orientation towards a more practical research based approach in RF, acoustic systems and MEMS device fabrication including their design and application. Such an approach is aided by the availability of necessary infrastructure in the form of design and simulation software, fabrication tools and technology and state of the art instruments for measurements.

Furthermore, the departmental coursework is structured to meet industry standards and equip our students with the requisite skills and knowledge to tackle and resolve challenges effectively. Most of the M.Tech projects are part of industry sponsored research projects thus giving the students a broad outlook and practical approach towards problems. The foundation laid by the rigorous coursework often results in our students coming up with innovative ideas during their project work some of which have resulted in publications and valuable contribution to the industry.

It is our belief that the students of this batch like their alumni before them, are committed towards excellence and are equipped with necessary skills and motivation to become invaluable assets of your organization and the industry.

Prof. Ananjan Basu
Head CARE
IIT Delhi
ABOUT THE CENTRE:

The Centre for Applied Research in Electronics (CARE) was established in 1971 with the main objective of providing focus to coordinated research and training in specialized areas in Electronics. Since its inception, the Centre has concentrated its R&D programs in three specific areas of Applied Electronics namely:

- Microwave
- Signal Processing
- Microelectronics

The Centre is one of the few in India to be involved in intensive practical research in above fields conducted in advanced laboratories equipped with state of the art facilities and high end industry standard software. The endeavors of the Centre facilitated by state of the art system design and test facilities have resulted in deliverable products for the sponsoring agencies and over 50 technology transfers since 1982. The Centre consists of distinguished faculty members in these areas, renowned for their contribution through papers published in reputed journals, book publications and guest lecturers in various universities and conferences worldwide. They have also been recipients of national and international awards.

ABOUT THE M.TECH PROGRAM:

The M.Tech program in RFDT enrolls the brightest minds from across the country thus ensuring the competitiveness of the program. Students are shortlisted on the basis of scores obtained in GATE conducted by IITs and IISc and are interviewed subsequently by the center's faculty. The completion of the above process lead to a miscellany of handpicked talent that is groomed at the institute in the due course of the program. The coursework is unique imparting hands-on training on topics like digital signal processors and applications, speech processing, wireless and underwater communications, antenna design, active and passive circuit design at microwave and millimeter wave frequencies, fabrication of solid state devices, MEMS based sensors and actuators, RF MEMS etc. The projects undertaken by the students are an exercise in developing their technical skills and efficient problem solving abilities while encouraging novel ideas. The coordinated efforts of the different research groups has resulted in making this Masters program in RFDT highly industry oriented and a much sought after course.

To know more about the Centre, please visit: [http://care.iitd.ac.in](http://care.iitd.ac.in)
Research Groups @CARE

Microwave

110 GHz VNA with Probe station

Signal Processing

DSP Hardware PCB Designed at CARE

Microelectronics

Mask Aligner
<table>
<thead>
<tr>
<th>Focuses On</th>
<th>Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMIC &amp; RFIC Design</td>
<td>VNAs up to 110 GHz.</td>
</tr>
<tr>
<td>RF MEMS</td>
<td>Spectrum Analyzers up to 40 GHz.</td>
</tr>
<tr>
<td>EBG Structures</td>
<td>Microwave Signal Source up to 20 GHz.</td>
</tr>
<tr>
<td>Microwave antennas</td>
<td>Mask making facility with co-ordinatograph</td>
</tr>
<tr>
<td>Microwave imaging</td>
<td>MIC fabrication facility</td>
</tr>
<tr>
<td>RF power amplifiers &amp; transmitter design</td>
<td>200 mm Probing system for submicron probing</td>
</tr>
<tr>
<td>Labs</td>
<td>On-chip Antenna Measurement Facility</td>
</tr>
<tr>
<td>CAD Lab</td>
<td>Quasi-Optical table with 67 GHZ VNA for Dielectric Constant Measurement</td>
</tr>
<tr>
<td>Microwave Measurement Lab</td>
<td>Advanced RF, MEMS and EM simulation Tools viz. Ansoft HFSS, Agilent ADS, CST Studio</td>
</tr>
<tr>
<td>Mask Making / IC Lab</td>
<td>Anechoic chamber with automatic platform controller for antenna testing and characterization</td>
</tr>
<tr>
<td>Radio Amplifiers and Power Trans receivers Lab</td>
<td></td>
</tr>
</tbody>
</table>
**Focuses On**

• Acoustic signal processing: Speech, audio and underwater signals
• DSP systems: Hardware and software
• Detection, Localization & Target Classification Algorithms
• Sonar systems
• Acoustic vector sensors for underwater and air applications
• Machine learning
• Multi sensor data fusion
• Nonlinear optimization
• Deep Learning
• Virtual Reality
• Sensor Array Signal Processing

**Facilities**

• TI’s DSP kits and OMAP Processor kits and FPGA with multi core processors
• Full acoustic anechoic chamber for speech and audio applications
• Underwater tank for underwater acoustic signal processing
• Studio quality recording facility for Speech and audio signals
• NI’s High speed Multi channel simultaneous data acquisition system
• DSP lab equipped with software tools such as Matlab, Comsol, Code Composer Studio, LabView
• 3D printing facility for rapid prototype development

**Labs**

• DSP Lab
• DSP Applications Lab
• Speech and Audio Processing Lab
# Microelectronics

## Focuses On
- Nano Structured Materials
- Silicon Micromachining & MEMS Sensors
- Organic Semiconductors
- SOI Devices
- SAW Devices
- Photonic Devices
- Quantum Dot Devices
- Photo Acoustic/Photo Thermal NDS Techniques
- Memory Devices

## Facilities
- RF/DC Sputtering System
- Thermal Evaporation System
- Reactive Ion Etching
- Diffusion and Oxidation Furnaces
- Photolithography Chamber
- Mask making and Mask Aligner Facility
- Surface Profiler for thickness measurement equipment
- Thermal, Acoustics, Optical and Magnetic systems for Non-Destructive Characterization
- Clean Bench / Chemical Bench Facility
- Sheet Resistance Measurement system
- Alpha Step Measurement system
- Stress Measurement system
- Lab equipped with TCAD for device simulations

## Labs
- Microelectronics Lab
- NDS Lab
- Photonics Lab
- SAW Devices Lab
Courses

Core Courses
- CAD of RF and Microwave Circuits
- RF and Microwave Measurements
- Architectures and Algorithms for DSP
- MIMO Wireless Communications
- CMOS RFIC Design
- Wireless Communication Laboratory
- Basics of Statistical Signal Analysis
- Basics of RF and Microwave
- Fundamentals of Semiconductor Devices
- Sensor Array Signal Processing
- Selected Topics in Radars and Sonars
- Human and Machine Speech Communication
- Sonar Systems Engineering
- Underwater Electronic Systems
- RF and Microwave Active Circuits
- Radiating Systems for RF Communication
- RF and Microwave Solid State Devices
- RF MEMS Design and Technology
- Introduction to Quantum Electronic Devices
- Sensors and Transducers
- Fabrication Techniques for RF and Microwave Devices
- Acoustic Classification using Passive Sonar

Electives
- Signal Theory
- Digital Communication
- Basic Information Theory
- Detection and Estimation Theory
- Advanced Digital Signal Processing
- Wireless Communications
- Mixed Signal Circuit Design
- MOS VLSI Design
- Analog Integrated Circuits
- Introduction to Machine Learning
- Basic Information Theory
# M.Tech Projects (2018-19)

## Microwave
- Antenna for 5G Communication using MIMO Technology
- Automated Radar at 77 GHz
- THz Components

## Signal Processing
- Low Latency Orientation Estimation Algorithm and Measurement setup for Virtual Reality Applications
- Voice Activity Detection using Deep Learning Techniques
- Deep Learning Architecture and Algorithm for Audio Event and Spatial Environment Classification
- High-Resolution Range Doppler Imaging
- Underwater communication systems under different noise conditions using CNN

## Microelectronics
- Strained Induced Photoelectric Effect of Nanowire Fet
- Design and fabrication of MEMS based Non Volatile Memory (NVM)
- Tcad simulation and modelling of coplanar waveguide
- Highly Integrated 28 GHz CMOS front end transceiver design for 5G applications
<table>
<thead>
<tr>
<th><strong>Faculty Profiles</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prof. Arun Kumar</strong> : Digital signal processing, Speech &amp; Audio processing technologies for man machine interaction, underwater acoustics, acoustics for air and media.</td>
</tr>
<tr>
<td><strong>Prof. Anajan Basu</strong> : Microwave &amp; millimeter wave engineering.</td>
</tr>
<tr>
<td><strong>Prof. S K Koul</strong> : Microwave Integrated circuits, Microwave Phase Shifters, Optical and millimetre waves dielectric integrated guides and circuits, CAD.</td>
</tr>
<tr>
<td><strong>Prof. Rajendar Bahl</strong> : Signal &amp; image Processing, Acoustic imaging, Target definition, Sensor System simulator and design, bio Sonar.</td>
</tr>
<tr>
<td><strong>Dr. Prabhu Babu</strong> : Signal processing and communications, Machine learning, Big Data analysis.</td>
</tr>
<tr>
<td><strong>Dr. Pusparaj Singh</strong> : Microelectromechanical systems (MEMS) sensors and micro-systems.</td>
</tr>
<tr>
<td><strong>Dr. Monika Agrawal</strong> : Signal Processing and Communication.</td>
</tr>
<tr>
<td><strong>Dr. Mahesh P Abegaonkar</strong> : Microwave and Millimeter wave Engineering</td>
</tr>
<tr>
<td><strong>Dr. Samresh Das</strong> : Nano Electronics and Optoelectronics</td>
</tr>
<tr>
<td><strong>Dr. Mahesh Chowdhary</strong> : IOT: Architecture and Application, Machine Learning, Deep Learning Architecture, Multi-sensor Fusion, Contextual Awareness, Indoor Positioning.</td>
</tr>
<tr>
<td><strong>Dr. Ulrich L. Rhode</strong> : Microwave circuits, (Amplifiers, Oscillators and Mixers) as well as Frequency Synthesizers.</td>
</tr>
<tr>
<td><strong>Dr. Sakshi Dhanekar</strong> : Nano-sensors, Microfluidics, Porous Silicon fabrication and Applications for chemical and Bio-Detection.</td>
</tr>
</tbody>
</table>
## Collaborations

### International

- Agilent Technologies
- Applied Nanostructures, USA
- Femto CNRS France
- Lockheed Martin USA
- Maxim Semiconductors, USA
- MEMS Cap, USA
- Mitsubishi, Japan
- NXP Semiconductors, Netherlands
- ST Microelectronics, USA
- University of Tokyo
- Delft Institute of Microelectronics
- University of Bath, UK
- Continental Automotive

### National

- Astra Microwave
- BEL
- DRDO (DEAL, LRDE, RCI, NPOL, NSTL, SASE, CABS)
- GAETECH Hyderabad
- Honeywell Bangalore
- Indian Navy
- NPMAS
- Space Application Centre, Ahmedabad
- Tektronix
- Cadence
Past Recruiters

- Applied Materials
- Cypress
- Sasken
- Powerwave Technologies
- Nokia
- TSMC
- Texas Instruments
- NVIDIA
- Bharat Electronics
- Beceem
- Conexant
- Tejas Networks
- Qualcomm
- Agilent
- Fujikura
- MediaTek
- Bosch
- John Deere
- Marvell
- MathWorks
- HCL
- TCS Innovation Labs Placement
- Oski Technology
Recruitment Process

Companies that wish to Participate in the formal Recruitment process through Training & Placement cell of IIT Delhi may contact:

Prof. I.N.Kar
Professor-In-Charge of Training and Placement Cell.
IIT Delhi email id : hodtnp@admin.iitd.ernet.in
Phone: +91-11-26591731/32

Companies that wish to Recruit M.Tech in RFDT Program may contact:

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