M.Tech in Radio Frequency Design & Technology (RFDT)

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About Us

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. The scope of R&D was soon broadened to encompass the areas of Signal Processing, Microwaves, and Microelectronics.

- **Microelectronics**  
- **Microwave**  
- **Signal Processing**

The Centre boasts of unique state of the art facilities like RF components fabrication and testing facilities, underwater test facility, DSP platforms, speech and audio processing facilities, non-destructive characterization of systems apart form high end industry standard softwares. The Centre consists of distinguished faculty members in these areas, renowned for their contribution through papers published in reputed journals, book publications and guest lectures in various universities and conferences worldwide. They have also been recipients of national and international awards. Since 1982, over 30 technology transfers have taken place from the Centre which underscores the importance of the center at the national level.

**About MTech Programme:**

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 ISc and are interviewed subsequently by the center’s faculty. Typical GATE cut-offs for the admission interview have been greater than 98.5 percentile. The completion of the above process leads to a miscellany of handpicked talent that is groomed at the institute in due course of the program. CARE has developed well-equipped state-of-the-art laboratory facilities due to the emphasis on advanced and contemporary experimental research and technology development work. The Centre also participates in the inter-disciplinary M.Tech program VLSI Design Tools & Technology (VDTT). This is joint program of CARE, Computer Science and Engineering department and Electrical Engineering department. Students at CARE, are exposed to the major emerging VLSI and Communication technologies and are adequately skilled in these domains through the diverse and broad spectrum of courses offered.

Courses

**Microelectronics**
- Fabrication Techniques for RF and Microwave Devices
- Introduction to Quantum Electronic Devices
- RF MEMS Design and Technology
- RF and Microwave Solid State Devices
- Technology of RF ad Microwave Solid State Devices

**Signal Processing**
- Basic Information Theory
- Statistical Signal Processing
- Digital Communication
- Sensor Array Signal Processing
- Basics of Statistical Signal Analysis
- Introduction to Machine Learning
- Advanced Digital Signal Processing
- Detection and Estimation Theory
- Human and Machine Speech Communication

**Microwave**
- RF and Microwave Active Circuits
- CAD of RF and Microwave devices
- Radiating Systems for RF Communication
- Sensors and Transducers
- RF and Microwave Measurement System Techniques

**Courses**

- CMOS RFIC Design
- MOS VLSI Design
- Semiconductor Memory Design
- CAD of RF and Microwave Circuits
- RF and Microwave Measurements
- Analog IC Design
- Mixed Signal Circuit Design
- Architectures & Algorithms for DSP System
- Wireless Communications
Microelectronics is one of the most sought after specialization at CARE attracting many candidates nationwide. This group majorly focuses on Silicon Micromachining, MEMS Sensors, SAW Devices, Nano Structured Materials, Quantum Dot Devices, Photonic and Memory Devices.

**Lab Facilities:**
- IC Fabrication and Testing facility for 3-micron technology
- 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
- Stress Measurement
- Alpha Step Measurement system
- Lab equipped with TCAD for device simulations.
- Thermal, Acoustics, Optical and Magnetic systems for Non-Destructive Characterization
- Clean Bench / Chemical Bench Facility
- Sheet Resistance Measurement system

The signal processing specialisation offers a wide variety of courses including speech processing, under-water communication, Deep Learning, Virtual Reality, Multi sensor data fusion and IoT applications. The projects delivered by this group are nationally as well as internationally recognised.

**Lab Facilities:**
- TI’s DSP, OMAP Processor and FPGA kits with multi core processors
- Full acoustic anechoic chamber for speech and audio applications
- 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.
- Underwater tank for underwater acoustic signal processing.
The Microwave specialization is an integral part of CARE at IIT Delhi which offers highly specialized research facility which is one of it’s kind in the country. It’s focus areas are MMIC & RFIC Design, RF MEMS, Microwave antennas & RF power amplifier.

**Lab Facilities:**

- VNAs up to 1000GHz
- Spectrum Analyzers up to 40 GHz.
- Microwave Signal Source up to 20 GHz.
- Mask making facility with computer controlled coordinatograph
- MIC fabrication facility
- 200 mm Probing system for submicron probing
- On-chip Antenna Measurement Facility
- Quasi-Optical table with 67 GHZ VNA for Dielectric Constant Measurement
- Advanced RF, MEMS and EM simulation Tools viz. Ansoft HFSS, Agilent ADS, CST Microwave Studio
- Anechoic chamber with automatic platform controller for antenna testing and characterization
- Photolithography facility for MIC & Metal deposition using RF sputtering/vacuum evaporation

**Microwave:**

- 280-Ghz Heterodyne imager based on 40nm CMOS Technology
- mmWave Antennas for 5G mobile terminal and base station
- GaN Power Amplifier
- Biomedical Applications of mm to sub mm waves
- High Sensitivity Bolometer design at Thz frequency range
- W-band MMIC Power Amplifier

**Microelectronics:**

- Oscillator Circuit design for Ultra low-power Applications
- Bi-stable MEMS memory for low-power computing
- SOI switch simulation in TCAD
- High power RF MEMS switches
- Schottky diode-based Thz Frequency Mixer
- Design of area efficient sot memory

**Microwave:**

- Design and Simulation of Nanowire Re-configurable MOSFET
- Design and simulation of junction less nanowire MOSFETS in TCAD
- AIN on SOI PMUT for ultrasonic Power transfer
- Artificial neural network using spintronic devices
- Ferrimagnet dynamics due to spin orbit torque

**Ongoing Projects**

- Dual Band Filtering Antenna
- W-band Mixer Design
- Phase Equalization Metasurface
- Frequency Reconfigurable Filtering Antenna
- Design of SIW components in millimetre waves
- Unmanned Air Vehicle Tracking
- THz components and systems using synthesized sources and phase coherent techniques

**Signal Processing:**

- Speech Enhancement and Voice Activity Detection using Machine Learning on IOT devices
- Active noise Cancellation using Acoustic Beamforming
- COAST – deep learning based detection algorithm
- Beamforming/DOA estimation using sparse arrays

- Underwater Acoustic Sensor Networks
- Image Reconstruction / processing from acoustics
- Mobile Phone Position detection
- High Quality Digital Voice Communication using 3G UWACS
- Processing of data from Array of Sensors and enhanced sequence
Placement Statistics

PLACEMENT STATISTICS 2019-2021

- Hardware Design: 75%
- Software: 12%
- RF: 13%

PLACEMENT STATISTICS 2018-2020

- Hardware Design: 72%
- Communication: 14%
- Software (AI): 7%
- RF: 7%

PLACEMENT FIGURES FOR 2019-2021 BATCH

- Avg. CTC in LPA: 26
- Highest CTC in LPA: 43.72

Past Recruiters

- Intel
- Analog Devices
- Qualcomm
- Texas Instruments
- MaxLinear
- AMD
- Beceem
- Micron
- Global Foundries
- Cadence
- Silicon Labs
- TSMC
- MathWorks
- Bosch
- Samsung
- Marvell
- MediaTek
- Oski Technology
- Mavenir
- Applied Materials
- Cypress
- Sasken
- Fujikura
- Nokia
- HCL
- Tejas Networks
- Reliance Jio
- COMEXANS
- John Deere
- Bharat Electronics
- Powerwave
Collaborations

**International**
- Keysight Technologies, USA
- 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
- Cadence
- CEL
- DRDO (DEAL, LRDE, RCI, NPOL, NSTL, SASE, CABS)
- GAETECH Hyderabad
- Honeywell Bangalore
- Indian Navy
- NPMASS
- Space Application Centre (SAC-ISRO), Ahmedabad
- Tektronix

Faculty Profiles

<table>
<thead>
<tr>
<th>Faculty Name</th>
<th>Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Arun Kumar (HOD)</td>
<td>Digital signal processing, Speech &amp; Audio processing technologies for man machine interaction, underwater acoustics, acoustics for air and media.</td>
</tr>
<tr>
<td>Prof. Ananjan Basu</td>
<td>Microwave &amp; millimeter wave engineering.</td>
</tr>
<tr>
<td>Prof. Monika Agrawal</td>
<td>Signal Processing and Communication.</td>
</tr>
<tr>
<td>Prof. Mahesh P Abegaonkar</td>
<td>Microwave and Millimeter wave Engineering.</td>
</tr>
<tr>
<td>Prof. Samresh Das</td>
<td>Nano Electronics and Optoelectronics</td>
</tr>
<tr>
<td>Prof. Prabhu Babu</td>
<td>Signal processing and communications, Machine learning, Big Data analysis.</td>
</tr>
<tr>
<td>Prof. Pushparaj Singh</td>
<td>Microelectromechanical systems (MEMS) sensors and micro-systems.</td>
</tr>
<tr>
<td>Prof. Kirti Dhwaj</td>
<td>Antenna Systems, Microwave Filters, Terahertz On-Chip Antennas</td>
</tr>
<tr>
<td>Prof. S K Koul</td>
<td>Microwave Integrated circuits, Microwave Phase Shifters, Optical and millimeter waves dielectric integrated guides and circuits, CAD.</td>
</tr>
<tr>
<td>Prof. Rajendar Bahl</td>
<td>Signal &amp; image Processing, Acoustic imaging, Target definition, Sensor System simulator and design, bio Sonar</td>
</tr>
<tr>
<td>Prof. Ulrich L. Rhode</td>
<td>Microwave circuits, (Amplifiers, Oscillators and Mixers ) as well as Frequency Synthesizers.</td>
</tr>
<tr>
<td>Prof. Vikram Kumar</td>
<td>Experimental Solid-State Physics, Structure and Growth of Thin Films, Plasma Processing of Materials, Solid Interfaces</td>
</tr>
<tr>
<td>Prof. Rahul Mishra</td>
<td>Nanoelectronics, spintronics, neuromorphic devices</td>
</tr>
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Recruitment Procedure

Student-in-charge or placement officer, Office of Career Services (OCS) shall provide the company a Job Notification Form (JNF) [https://tnp.iitd.ac.in/](https://tnp.iitd.ac.in/)

JNF requires details of the job offer – role offered, pay package, place of posting, eligible departments.

Once the filled-in-JNF with all the required details is received, companies are assigned username/password to access their online account at [https://tnp.iitd.ac.in/](https://tnp.iitd.ac.in/)

Companies are also assigned space on the server on which they may upload any presentation, videos, data or other information they want the students to see.

The JNF must be frozen on the OCS website by the company till a deadline

Students shall be able to view all the details, and the eligible candidates may apply.

After the application deadline for the students, the resumes are visible to the company. The company submits shortlist on its online account before a deadline.

Short-listed students get notified and OCS allots the dates for the campus interviews

After the completion of the selection procedure on campus, company is required to announce the final list of the students on the same day itself.

Resume Verification: All claims made by students in resumes submitted for campus placements are duly verified by OCS. For

Further details regarding Recruitment Process:

Ms. Anishya Madan
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