

Electromagnetics, RF and Photonics

Devices, Circuits and Systems

MS & PhD (By Research)

M.Tech. (Microelectronics & Photonics)

January 2017

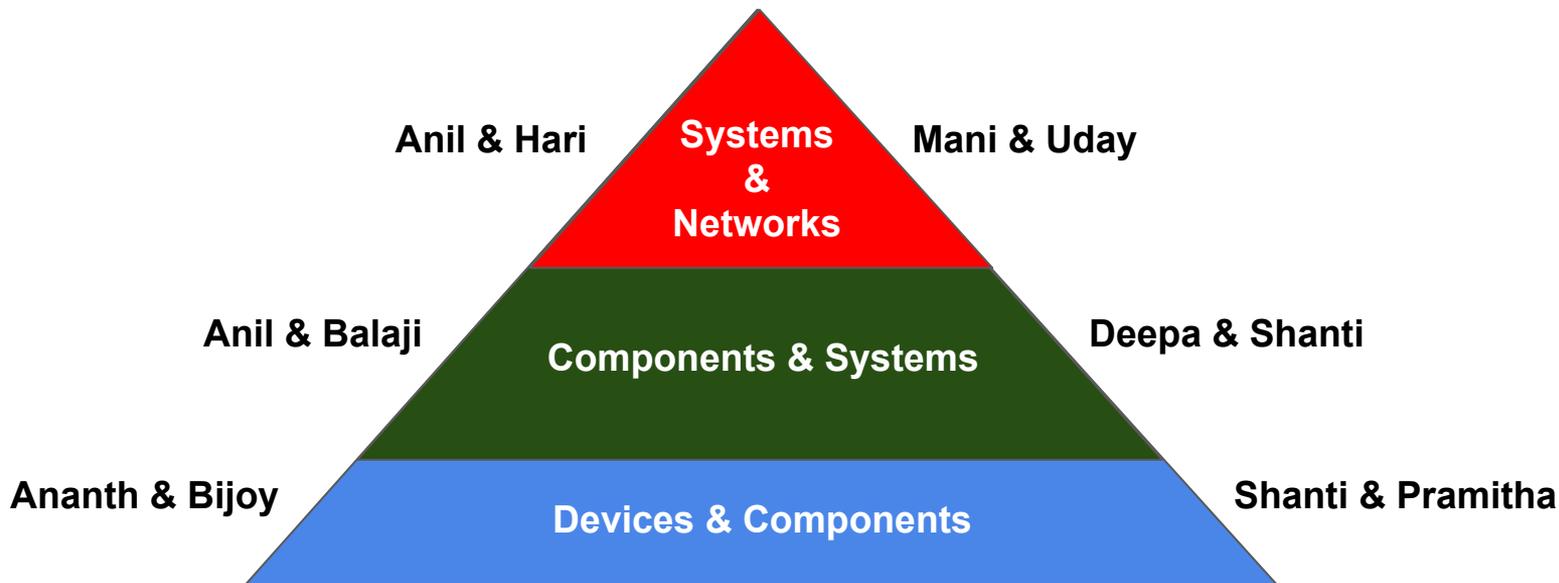


Department of Electrical Engineering



Photonics Research Group

The faculty pyramid at a glance





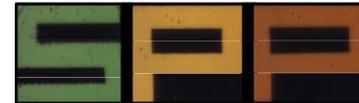
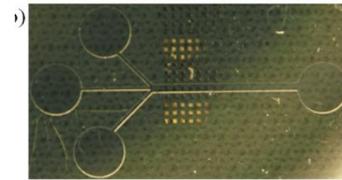
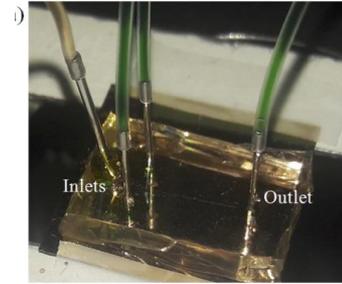
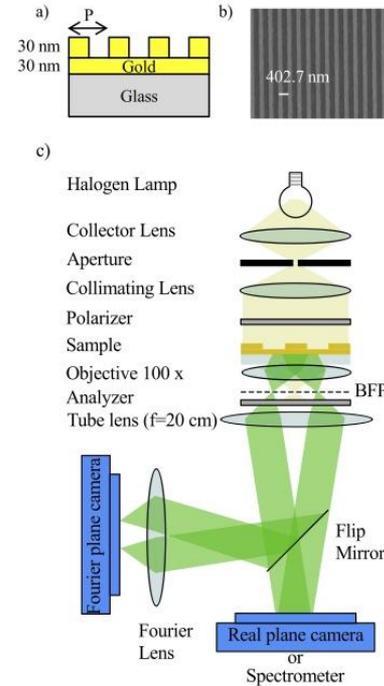
Ananth Krishnan

PhD, Texas Tech University (USA)

Email: ananthk@ee.iitm.ac.in

RESEARCH AREA

- **Planar Optical Sensors**
 - Plasmonic bio-sensors
 - Surface Enhanced Raman substrates for sensing
 - Integration with microfluidics
- **CMOS compatible visible filters**
 - Color filters for CCD cameras
- **Electrochemical sensors & Instrumentation**
 - Low cost potentiostat
 - Trace chemical detection





Anil Prabhakar

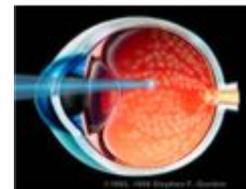
PhD, Carnegie Mellon University (USA)

Email: anilpr@ee.iitm.ac.in

RESEARCH AREA

- Lasers (Research Scholars)
 - Picosecond and femtosecond fibre lasers
 - fs excitation of RF spin waves
 - Biophotonics, surgery, imaging (Shree, Ikram)
 - LIGO-India (gravity wave observatory)
- Instrumentation:
 - Optoelectronics + embedded systems
 - Optofluidics for healthcare, bioengineering (Rudra, Ambili)
- Beyond 100 Gbps Communication
 - Quantum Key Distribution - cryptography (Gautam, Shashank)
 - 150 Gbps time division multiplexing for INO
- Computational electromagnetics (micromagnetics)
 - RF generation using spin wave devices (Nikhil, Guru)

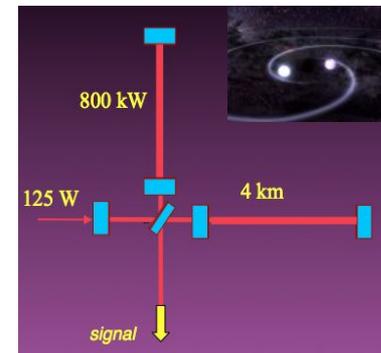
Ophthalmology



Optofluidics



Gravity Waves





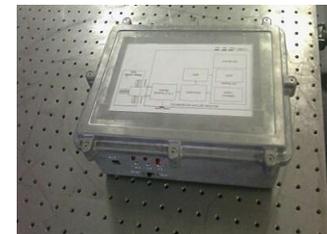
Balaji Srinivasan

PhD, University of New Mexico (USA)

Email: balajis@ee.iitm.ac.in

RESEARCH AREA

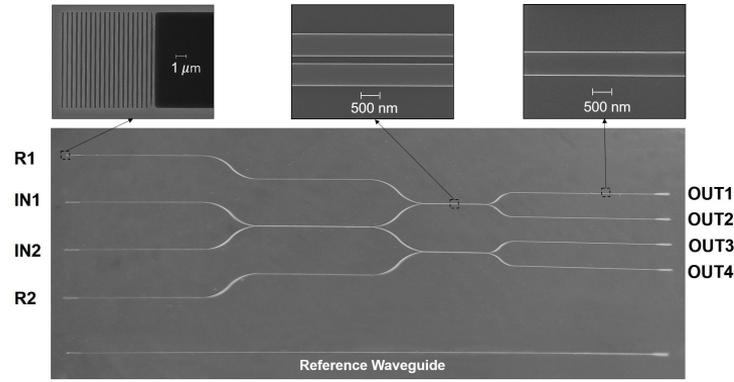
- Fiber Lasers
 - High power fiber lasers and amplifiers (Yusuf)
 - Coherent beam combining (Waqgas)
 - Mode-locked fiber lasers (Manas)
 -
- Fiber Bragg Grating-Based Acoustic Sensors
 - NDE of metallic/composite structures (Pabitra/Jagadeesh)
 - Partial discharge detection in power transformers (Srijith)
 - Combustion instability in gas turbines (suma)
 -
- Distributed Fiber sensors
 - Strain/temperature discrimination in Brillouin OTDA (Shahna)
 - Dynamic strain monitoring using Brillouin OCDA (Bhargav)
 - Real-time power monitoring using Raman OTDR





Bijoy Krishna Das
PhD, University of Paderborn (Germany)
 Email: bkdas@ee.iitm.ac.in

Silicon Photonics Devices and Circuits



RESEARCH AREA

- Optical Interconnect Devices & RF Photonics Circuits

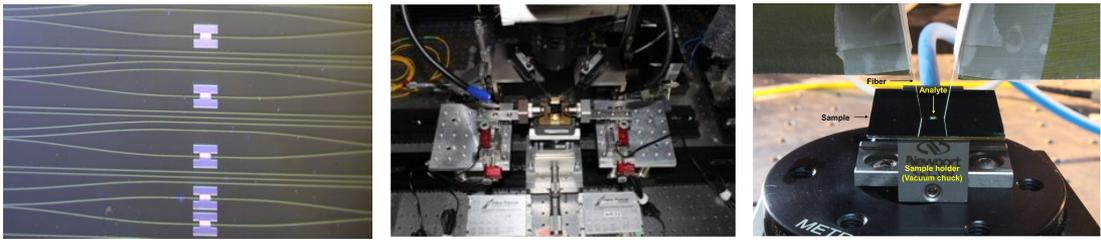
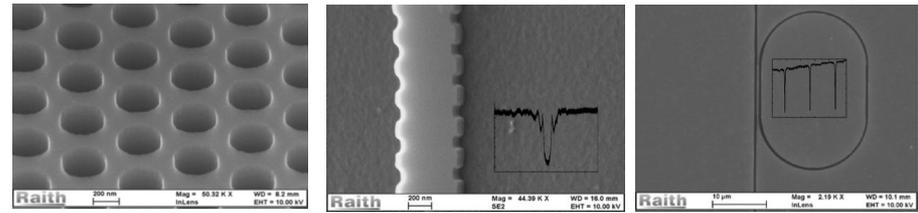
Research Scholars: Riddhi, Sreevatsa, and Keerthana

- Lab-on-Chip Sensor Devices and Systems

Research Scholars: Sujith, Ramesh, and Sumi

- Integrated Nonlinear and Quantum Photonics Devices

Research Scholars: Parimal, Arijit, and Sooraj



VISIT OUR WEBSITE FOR MORE INFORMATION
<http://www.ee.iitm.ac.in/mems/iolab/index.html>

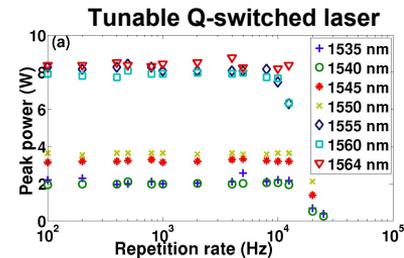
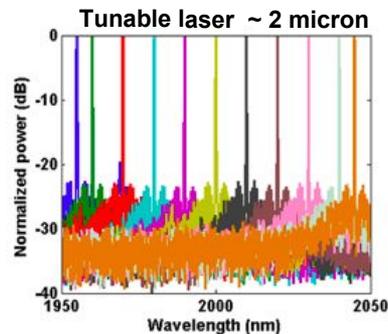


Deepa Venkitesh
PhD, IIT Bombay (India)

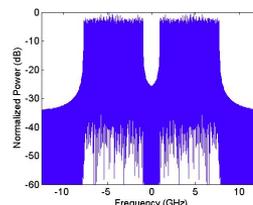
Email: deepa@ee.iitm.ac.in

RESEARCH AREA

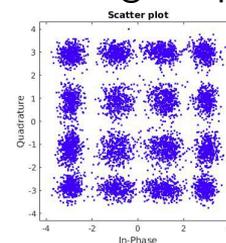
- Optical Signal Processing
 - Wavelength Conversion
 - Phase sensitive amplification
 - Clock Recovery
 - Logic Gates (Manas, Aneesh)
- Optical Communication
 - High-speed optical links for access, long-haul, free-space
 - Advanced modulation formats
 - Mode division multiplexing (Smaranika, LM)
- Fiber Lasers
 - CW and pulsed lasers in the 1900 - 2100 nm range
 - Wavelength tunable Q-switched lasers (Anjali)
- Optical Sensing
 - Cavity ring down spectroscopy
 - Distributed Brillouin Sensing (Kavita, Bhargav)



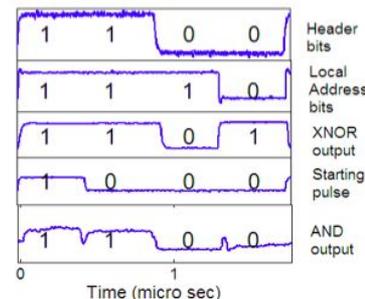
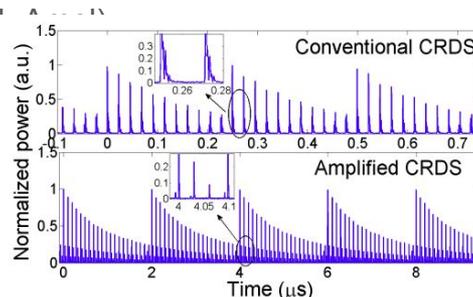
Optical OFDM



16QAM @ 200 Gbps



Optical Header Processor





Harishankar Ramachandran

PhD, University of California Berkeley (USA)

Email: hsr@ee.iitm.ac.in

RESEARCH AREA

- **Optical Communication**
 - Quantum statistics of optical links
 - Modelling of optical devices
 - Link design
- **Computational electromagnetics**
 - Simulation of distributed devices
 - Improved computational algorithms
 - Beam propagation in statistical media
- **Plasma Physics**
 - RF interaction with ionic systems and plasmas
 - Statistics of particle bursts due to magnetic events in Van Allen Belt
- **RF**
 - Antenna design with finite ground planes
 - Eddy currents in irregular objects



Manivasakan Rathinam

PhD, IIT Bombay (India)

Email: rmani@ee.iitm.ac.in

RESEARCH AREA

- **All Optical Networks - PHY Layer**
 - All Optical Plasmonic Switches
 - Timing & Synchronization in Tbps Networks
 - Performance Bounds in All Optical ULH links with all Optical Regenerators
 - Statistical Modelling and Analysis of Quantum Light Sources for QKD
 - Quantum Key Distribution (QKD) for Network Security
- **All Optical Networks - Layer 2**
 - Performance of Bufferless Networks
 - Virtual Optical Bus (VoB) - Performance Analysis
 - GPoN for the India-based Neutrino Observatory (INO)
- **Intermediate Phase to Emerging All-Optical Networks**
 - TDM over PSN: Algorithms Design and Performance Analysis
 - Queueing Models for Jitter Control
 - TDMA as a Solution for Pseudo All-Optical Networks



Pramitha V

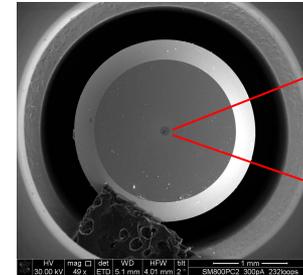
PhD, CUSAT (India)

Email: pv@ee.iitm.ac.in

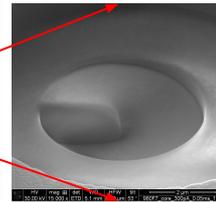
RESEARCH AREA

- Fibre optical vortices
 - Generation using diffractive optics
 - Optical vortex tweezers
 - Optical vortex driven micromotors
- Graphene based hybrid devices for flexible optoelectronics
 - Graphene with perovskites and metal oxides
 - Fabrication of perovskite solar cells

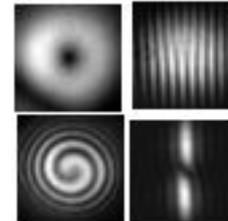
Structured Fibre optic patch cable



Spiral Phase Plate (Charge 1)



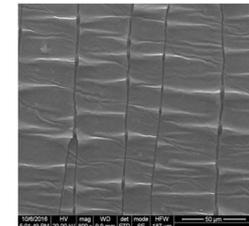
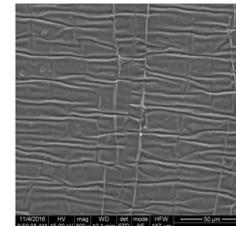
Output beam Profile & Interferograms



Trapped Silica bead



Reduced Graphene Oxide-PDMS films under strain



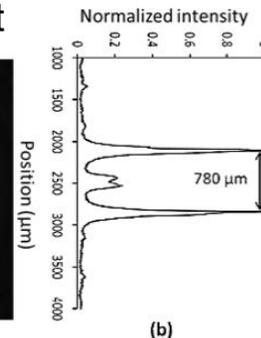
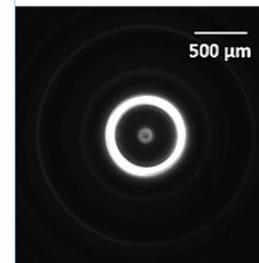
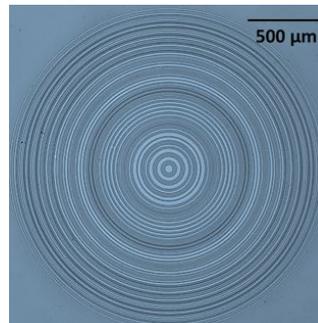


Shanti Bhattacharya

PhD, IIT Madras (India)

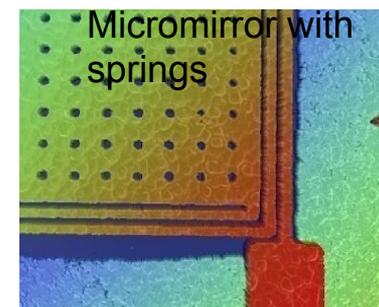
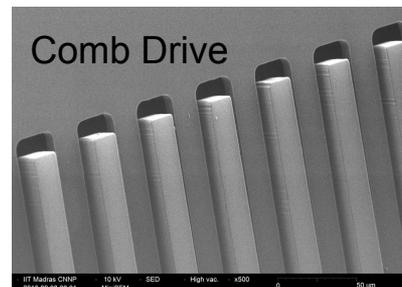
Email: shanti@ee.iitm.ac.in

Ring Focus Fresnel lens and Output

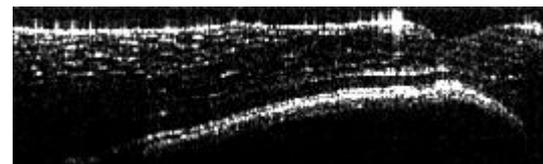


RESEARCH AREA

- **Diffractive Optics** (Gayathri, Raghu, Sruthy)
 - Fabrication with electron beam and Focused Ion beam lithography
 - Creation of Complex Light
 - Beam shaping
- **Optical MEMS** (Manu, Meenakshi)
 - Lamellar Gratings
 - Micro-mirrors
- **Fibre Interferometry/Metrology** (Athira, Kavita)
 - Optical Coherence Tomography
 - Fourier Transform Spectroscopy
 - Cavity Ring Down Spectroscopy
- **Imaging**
 - Multimode fibres for biomedical applications



FDOCT Image of a cucumber peel





Uday Khankhoje

PhD, California Institute of Technology (USA)

Email: uday@ee.iitm.ac.in

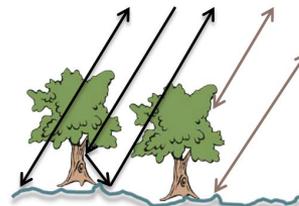
RESEARCH AREA

- Remote Sensing for observing a dynamic Earth
 - Synthetic Aperture Radar (SAR) studies
 - Computational Electromagnetics for modelling RADAR-Earth interactions (e.g. soil, ice, snow, vegetation)

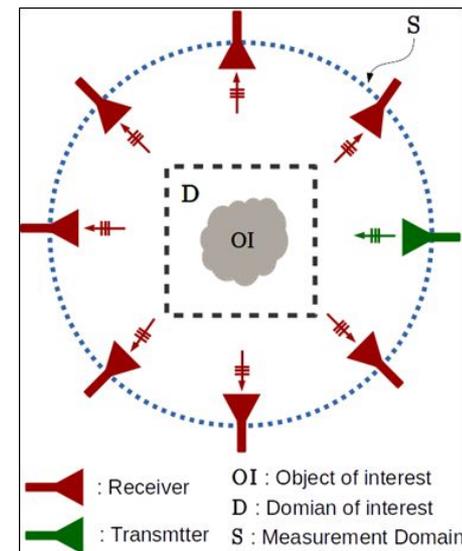
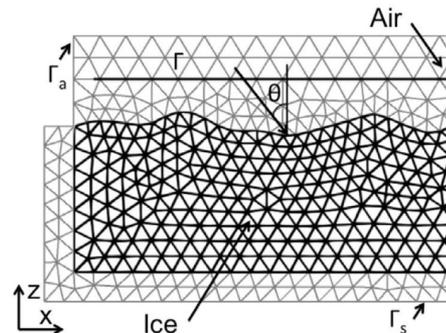
Funding expected from ISRO

- Inverse Imaging using microwaves for breast cancer detection
 - Computational approaches for solving this problem: mix of electromagnetics and signal processing (Currently 1 research scholar working)
 - Pilot studies for creating hardware setup

Funded by DST



More details at <http://www.ee.iitm.ac.in/uday/>



M.Tech. Program

Microelectronics & Photonics

SEMESTER - I

No.	Title	L	T	E	P	O	C	Cat
EE5500	Introduction to photonics	2	1	0	3	6	12	P
EE5505	Wave propagation	3	1	0	0	5	9	P
EE5313	Semiconductor Device Modeling	4				8	12	P
EE5312	VLSI Technology	4				8	12	P
Elective - 1	See proposed list of electives						9/12	

M.Tech. Program

Microelectronics & Photonics

SEMESTER - II

No.	Title	L	T	E	P	O	C	Cat
EE5400	Analog and Digital Ckts	2	1	0	3	4	9	P
Elective - II	See proposed list of electives						9/12	
Elective - III	See proposed list of electives						9/12	
Elective - IV	See proposed list of electives						9/12	
Elective - V	See proposed list of electives						9/12	

M.Tech. Program

Microelectronics & Photonics

SUMMER + SEMESTER III + SEMESTER IV

No.	Title	L	T	E	P	O	C	Cat
	Research Project	0	0	0	0	0	85	P

Total Credits: 190 (Core - 54 ; Project - 85; Elective - 51)

M.Tech. Program

Microelectronics & Photonics

PROPOSED LIST OF ELECTIVES

EE5340: Microelectromechanical Systems (MEMS)
EE5341: MOS Device Modelling and Characterizations
EE5343: Solar Cell Device Physics & Material Technology
EE5347: Electronic and Photonic Nanoscale Devices
EE5404: Fiber Optics Communication Technology
EE5430: Foundation of Optical Networking
EE5502: Optical Engineering
EE6420: Optical Communication Networks
EE6470: Optical Signal Processing and Quantum Comm
EE6500: Integrated Optoelectronics Devices and Circuits
EE6501: Optical Sensors
EE6505: Waveguide, Microwave Circuits and Antennae
EE6506: Computational Electromagnetics
EE6700: Advanced Photonics Labs

EE5011: Computer Methods in EE
AM5100: Biomedical Laser Instrumentation
EE5104: Instrumentation Engineering
EE5105: Intro. to Digital Signal Processing
EE5109: Digital Signal Processing
EE5110: Prob. Foundations for Signal Processings
EE5140: Communication Networks
ED5316: Antenna Theory and Design
ED5511: Lasers in Msrmnts. & Micromanufacturing
PH5620: Coherent and Quantum Optics
PH5660: Nonlinear Optics and Devices
EE5700: DSP Application Laboratory
PH5814: Laser Physics and Applications
PH5890: Ultrafast Laser and Applications

M.Tech. Program

Microelectronics & Photonics

ONE YEAR M.TECH. RESEARCH PROJECTS : BROAD AREAS

- ❑ **Plasmonics & Metamaterials**
- ❑ **Diffraction Optical Components & MEMS**
- ❑ **CMOS Electronics, Silicon Photonics & Integrated Optics**
- ❑ **Optofluidics & Biophotonics**
- ❑ **Fiber-Optics & Free-Space Communications**
- ❑ **High Power Lasers : Development & Industrial Applications**
- ❑ **Computational Electromagnetics & Remote Sensing**

Visit our Websites.....



<http://www.ee.iitm.ac.in/optics/>



<http://www.ee.iitm.ac.in/cnnp/>

M.Tech. Program

Microelectronics & Photonics

ELIGIBILITY CRITERIA + APPLICATION PROCESS

Who can Apply? <http://mtechadm.iitm.ac.in>

- A. GATE qualified candidates (EC, EE, PH, IN)
- B. IIT Graduates with B.Tech. Degree (ECE, EE, EP)
- C. Candidates sponsored by various organizations recognized by DST as Research and Development units, candidates sponsored by NIOT or from educational institutions approved by AICTE/UGC/Government or from Government/Public Sector Undertakings
- D. QIP and defence sponsored candidates

How to Apply:

Application can be submitted only **ONLINE**. The application fee is Rs.250/- for SC/ST/PwD candidates and Rs.500/- for others (to be paid online). Instructions on how to apply are available on the IIT Madras Website: <http://mtechadm.iitm.ac.in>

In case of difficulty in applying, please contact:

The Chairman, M.Tech Admission Committee, GATE OFFICE, IIT Madras, Chennai - 600036
Phone No.044-22578200, Fax:044-22578204
Email: mtechadm@iitm.ac.in

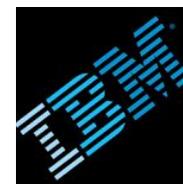
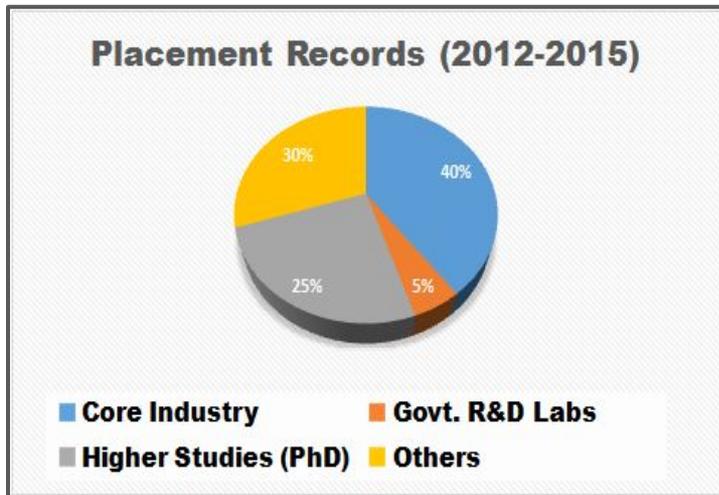
M.Tech. Program

Microelectronics & Photonics



सेंटर फॉर डेवलपमेंट ऑफ टेलीमैटिक्स
भारत सरकार का दूरसंचार प्रौद्योगिकी केन्द्र
Centre for Development of Telematics
Telecom Technology Centre of Govt. Of India

PLACEMENT/EMPLOYERS



M.Tech. Program

Microelectronics & Photonics

HIGHER STUDIES + RESEARCH OPPORTUNITIES @ IIT MADRAS

M.Tech. students will be eligible to upgrade to a Ph.D. if they satisfy the following criteria:

1. The candidate has successfully completed a minimum of 2 semesters in the M.Tech. Programme
2. The candidate has a CGPA of 8.0 or more in the prescribed courses

PHOTONICS NEWS + JOB OPPORTUNITIES (GLOBAL)

<http://www.osa-opn.org/home/>



<http://www.nature.com/nphoton/>



<http://www.photonics.com/>

<http://spectrum.ieee.org/>



<http://optics.org/>



<http://www.photonicsjobs.com/>



<http://photonicsmanufacturing.org/>



Our Major Funding Agencies

Sponsored Research & Consultancy



Ministry of Electronics & Information Technology
Government of India