

# ECE NEWSLETTER

March 2019



## *Inside the Issue*

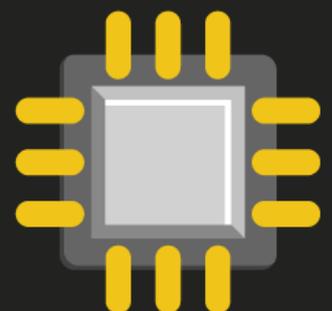
<b>HOD'S MESSAGE</b>	<b>2</b>
<b>RESEARCH HIGHLIGHTS</b>	<b>2</b>
<b>SEMINARS &amp; EVENTS</b>	<b>5</b>
<b>AWARDS</b>	<b>7</b>
<b>PLACEMENT STATS</b>	<b>7</b>
<b>STUDENT INTERVIEWS</b>	<b>8</b>
<b>DEPARTMENT'S GROWTH</b>	<b>9</b>
<b>EDITORIAL TEAM</b>	<b>10</b>

## **RESEARCH HIGHLIGHTS**

Our ECE department carries out research activities in diverse domains including VLSI, Communication, Radar, Signal Processing, Control & Robotics etc. A few samples of research outcomes of the department in each of these sub-domains are subsequently described.

## **STUDENT INTERVIEWS**

From  
Gaurav Duggal  
Sysha Girdher  
Anant Sharma



# HOD'S MESSAGE



**DRSUJAYDEB**

It is a true honour and pleasure to share with you the latest edition of our own ECE newsletter. I am particularly proud of our thriving student community for their involvement in shaping this newsletter.

ECE students along with the support of a very dynamic editorial team present this excellent edition of the Newsletter.

It has been our intention to use the newsletter for highlighting the on-going activities in the department and like always this edition captures it succinctly. We as a department have also introduced key changes to grow and be one of the best places to study ECE.

- We have enabled a semester-long internship for UG students without semester leave.
- Students can earn IP credits by participating in reputed technical challenges/ design contests/ hackathons etc.
- Industrial visit, Alumni meet, Departmental seminars, Puff talks etc. are organized regularly.
- For PG students we have unique evaluation strategies for thesis and yearly progress.
- The newly designed departmental website contains detailed course flow for different specializations, templates for BTP, MTP etc.

In this edition only a fraction of the research areas pursued by different groups are highlighted, we promise to bring more in the subsequent editions. We are looking forward to receiving a lot of feedback as well as the involvement of every stakeholder in every upcoming event. We hope that you will enjoy the content and also get new ideas and most importantly feel proud of being part of the vibrant ECE community. Have a great time reading this newsletter and beyond.

## RESEARCH HIGHLIGHTS

Our ECE department carries out research activities in diverse domains including VLSI, Communication, Radar, Signal Processing, Control & Robotics etc. A few samples of research outcomes of the department in each of these sub-domains are subsequently described.

# PUBLICATIONS

Wazir Singh and Sujay Deb, "Biopotential Acquisition Unit For Energy Efficient Wearable Health Monitoring", IET Cyber-Physical Systems: Theory & Applications, vol. 3, no. 2, pp.73-80, Mar 2018.

Sri Harsha Gade, Sidhartha Sankar Rout, Mitali Sinha, Hemanta Kumar Mondal, Wazir Singh, and Sujay Deb, "A Utilization Aware Robust Channel Access Mechanism for Wireless NoCs", IEEE International Symposium on Circuits and Systems (ISCAS) 2018.

Sri Harsha Gade and Sujay Deb, "HyWin: Hybrid Wireless NoC with Sandboxed Sub-Networks for CPU/GPU Architectures", IEEE Transactions on Computers (TC), vol. 66, Issue. 7, pp. 1145-1158, July 2017.

# PUBLICATIONS

P. Aggarwal and V. A. Bohara, "End-to-End Theoretical Evaluation of a Nonlinear MIMO-OFDM System in the Presence of Digital Predistorter," IEEE Systems Journal, pp. 1-11, 2018.

P. Aggarwal and V. A. Bohara, "Analytical Characterization of Dual-Band Multi-User MIMO-OFDM System with Nonlinear Transmitter Constraints," IEEE Transactions on Communications, vol. 66, no. 10, pp. 4536-4549, Oct 2018.

P. Aggarwal and V. A. Bohara, "On the Multi-Band Carrier Aggregated Nonlinear LTE-A System," IEEE Access, vol. 5, pp. 16930-16943, 2017.

# ADVANCED MULTICORE SYSTEMS LAB IN VLSI

Advanced Multicore Systems Lab (AMS Lab) focuses on designing high performance, energy efficient, secure and reliable multi-core systems. Our research mainly targets optimal memory management solutions for accelerator-rich environments, efficient cache coherence protocols for heterogeneous platforms, and robust validation mechanisms for secure systems. We also work on developing a single chip solution for low power wearable continuous health monitoring systems. Our other research areas include energy efficient wireless Network-on-Chip architectures and on-chip wireless channel modelling.

The group received many awards and recognition at various national and international platforms, few of them are :

1. Winner of India-US grand challenge for the project "Affordable cuff-less blood pressure measurement technologies"
2. BIRAC SRISTI appreciation in the year 2017 for "Energy efficient wearable health monitoring system"
3. Demonstrated a floor-planning tool and won the VLSI Design Contest 2017
4. Best paper award in IEEE iNIS 2017 conference ("Energy efficient NoC router for high throughput applications in many-core GPUs")
5. Filed two Indian patents on cuff-less BP monitoring and are in the process of filing another Indian patent on NoC validation using wireless links.
6. Delivered tutorials at VLSI Design Conference 2017 and VDAT 2016.

# WIROCOMM LAB IN COMMUNICATION

Advancement in seamless wireless connectivity has led to an exponential increase in digital wireless services that allows more than 1.5 billion people to connect ubiquitously. As a consequence, there is an upsurge in data traffic over the wireless networks which necessitates the efficient utilization of available resources. To satisfy the above requirement, each generation of wireless standards proposes to improve Quality-of-Service (QoS) and network capacity. One of the suggested solutions is using a multi-carrier modulation scheme which is still not enough to satisfy the demand for high data rate transmission. Hence, new features have been proposed in 3GPP Long Term Evolution-Advanced (LTE-A). Some of the distinctive features of LTE-A standard are 1) carrier aggregation and 2) multi-user multi-input-multi-output (MU-MIMO). Both these techniques along with a multi-carrier modulation scheme significantly improve the capacity performance of wireless networks. However, this performance is limited by non-ideal hardware present in the transceivers of the wireless networks. The non-ideal hardware not only compromises the reliability but also restricts the capacity of the system. Motivated by this, the work is mainly focused on analyzing the performance of carrier aggregated and MU-MIMO systems with multi-carrier modulation scheme such as orthogonal frequency division multiplexing (OFDM) in the presence of nonlinear power amplifiers and non-ideal oscillators. This framework can easily be utilized in various wireless standards and will be useful for a communication engineer to design a link budget for MIMO-OFDM based wireless systems without performing extensive simulations or tedious experiments.

# PUBLICATIONS

S. Vishwakarma and S. S. Ram, "Detection of multiple movers based on single channel source separation of their micro-Dopplers," *IEEE Trans. Aerosp. Electron. Syst.*, vol. 54, no. 1, pp. 159-169, Feb. 2018.

S. Vishwakarma and S. S. Ram, "Dictionary learning with low computational complexity for classification of human micro-dopplers across multiple carrier frequencies," *IEEE Access*, 2018.

S. Vishwakarma, V. Ummalaneni, M. S. Iqbal, A. Majumdar, and S. S. Ram, "Mitigation of through-wall interference in radar images using denoising autoencoders," in *Radar Conference (RadarConf18)*, 2018 IEEE. IEEE, 2018, pp. 1543-1548.

# PUBLICATIONS

Priya Aggarwal and Anubha Gupta, "Low rank and sparsity constrained method for identifying overlapping functional brain networks," *PLOSOne Journal*, 2018.

Anubha Gupta, S.D. Joshi, and P. Singh, "On the approximate Discrete KLT of Fractional Brownian Motion and its applications", Accepted, *The Journal of Franklin Institute*, Elsevier, Sep. 2018.

Neha Jain, Vivek Ashok Bohara and Anubha Gupta, "iDEG: Integrated Data and Energy Gathering Framework for Practical Wireless Sensor Networks using Compressive Sensing", Accepted, *IEEE Sensors Journal*, October 2018.

Naushad Ansari and Anubha Gupta, "WNC-ECGlet: Weighted Non-Convex Minimization based Reconstruction of Compressively Transmitted ECG using ECGlet", Accepted, *Biomedical Signal Processing and Control*, Elsevier, October 2018.

March 2019

# RADAR

Radars have been used to detect and track human activities for various applications. These include indoor radars for security and surveillance purposes or biomedical applications such as fall detection and ground penetrative radar for search and rescue operations. Radars have been employed in outdoor line-of-sight environments for automotive purposes. In our research lab, we investigate hardware as well as signal processing solutions to enable the transition of radar from the laboratory to real life scenarios as well as addressing limitations.

We are motivated to gather both simulation and measurement for studying the performance of our proposed systems and algorithms. The simulation data form a means for preliminary evaluation, for pinpointing cause and effect of radar phenomenology and for generating a large amount of training data. The measurement data, on the other hand, is used for more detailed studies of the effect of hardware limitations. Our objectives:

1. To generate and release a dataset of simulated and measured micro-Dopplers of multiple humans of different periodic motions, in line-of-sight and through-wall scenarios, vehicles such as cars, bicycles as well as pedestrians for automotive applications.
2. To propose signal processing algorithms for clutter mitigation, detection and disaggregation of radar returns from multiple targets, classification, to propose a set of metrics to evaluate both the system and signal processing performance in terms of detection and classification and simulation of radar cross section of moving humans using virtual reality data and ray tracing.

## SIGNAL PROCESSING AND BIOMEDICAL IMAGING LAB IN SIGNAL PROCESSING

Cancer genomics is an area of research that makes use of recent developments in the sequencing technology of DNA and RNA to study the human genome. Its goal is to reveal the genetic abnormalities that promote the growth of cancer by comparing the genomic information from tumour and normal tissues from the same patient. Identification of cancer-causing genetic alterations provides better insight into the molecular basis of cancer. Treatment could be tailored according to the need of the patient (precision medicine).

The lab is working on identifying driver mutations in blood cancer particularly Multiple Myeloma and on discovering biological pathways affected by the identified genetic alterations. One of the most prominent challenges in cancer genomics is to distinguish driver mutations, which confers the advantage of clonal growth leading to carcinogenesis, from passenger mutations, which do not contribute to cancer development. Although all these genomic alterations are highly diverse in nature, however, they tend to affect a limited number of biological pathways. These biological pathways which are frequently perturbed within tumour cells often lead to the acquisition of carcinogenic properties. Therefore, the second challenge is to identify biological pathways which are frequently altered by driver mutations and explore the role of the driver pathways in cancer progression.

# PUBLICATIONS

Gautam, A., Ratnoo, A., & Sujit, P. (2018); Log polynomial velocity profile for vertical landing; *Journal of Guidance, Control, and Dynamics*, 1-7

Gautam, A., Sujit, P., & Saripalli, S. (2017b); Autonomous quadrotor landing using vision and pursuit guidance; *IFAC-PapersOnLine*, 50 (1), 10501-10506

Gautam, A., Sujit, P., & Saripalli, S. (2014); A survey of autonomous landing techniques for UAVs; *Unmanned Aircraft Systems (ICUAS), 2014 International Conference on*, 1210- 1218

# CONTROLS & ROBOTICS

Quadrotors nowadays have many applications like mapping, object delivery, tracking, patrolling, and communication relay, etc. The vehicle is required to perform these tasks autonomously. Landing is the most crucial task in the mission, which has a direct impact on the physical safety of the vehicle. Further, mostly the vehicle landing area is constrained and hence requires precision landing capability. External disturbances like winds and visibility add to the challenges in landing scenarios.

Typically, fused INS (Inertial Navigation System) and GPS information are used for localisation. However, the altitude measurement from GPS is inaccurate, and hence additional sensors are also required. Similarly, since GPS-based measurement has errors within 3-5 meters and the vehicle may not land at the desired location with only GPS-based navigation, camera vision is used to provide information about the target location in the form of a landing pad with a distinct colour.

The primary concern of a guidance strategy is to enable persistent tracking of the landing target (stationary or moving), and accurately land on the target. Also, for a moving target, the relative velocity of the UAV and the target must be the same to achieve zero closing velocity at touchdown. A visual representation of the choice of the velocity profile, maximum velocity constraint, and engagement time in two-dimensional design parameter space helps in devising the landing behaviours and can give insights to the overall landing process to suit the needs of the application.

# SEMINARS & EVENTS

27 Sep'18

Wavelet Transform Learning & Applications

Dr Anubha Gupta (Associate Dean of Academic Affairs and Associate Professor (ECE), IIITD) gave a talk on Wavelet Transform Learning and Applications. Of late, there has been a lot of work on transform learning (TL) in inverse problems. She discussed a number of exciting methods for wavelet transform learning, specifically, from the point of view of inverse problems and some proposed multirate signal processing based design formulations that lead to closed-form solutions and are DSP hardware friendly. These designs can be utilized conveniently in hardware device development in real-life applications.

Idea to Product

30 Aug'18

Mr Raunaque Mujeeb Quaiser from STMicroelectronics delivered an interactive talk on "Idea to Product" where he discussed the various aspects of product development right from the idea. He also discussed the different technologies offered by STMicroelectronics and different tools available to build Smart IoT products.

36 Oct'18

### Dr. Aaron Franklin visits IIITD

Dr Aaron Franklin from Duke University visited IIITD. He discussed how the inherent versatility of CNTs can be appropriately harnessed for enabling certain applications. He described how the tremendous progress in solution-phase processing of nanotubes has opened a path for their most suitable, near-term use as printed thin films. He presented a variety of recent advances from his research group on printed CNT electronics and shared information about other major research thrusts and opportunities in the Duke ECE program.

15 Nov'18

### Generating entangled photons in different degrees of freedom and their characterization

Dr Ravindra Pratap Singh, faculty member of Atomic, Molecular and Optical Physics Division in PRL, Ahmedabad, conducted a seminar on “**Generating entangled photons in different degrees of freedom and their characterization**” where he discussed a method to produce entangled photons in the laboratory and how one can generate entanglement in different degrees of freedom such as polarization and orbital angular momentum along with hybrid entanglement. He concluded the talk by describing methods to characterise the entanglement and their applications in quantum communication, particularly in satellite quantum communication.

### Is it difficult to be ethical and successful as an engineer?

25 Oct'18

Dr Subrat Kar from IIT Delhi delivered a talk on how being ethical and being successful are closely related yet quite distant concepts. He discussed a thought-provoking question - Is it difficult to be ethical and successful as an engineer?

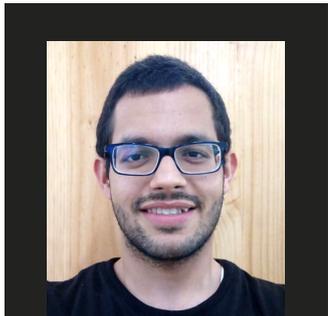
### TinkerHACK 2 Nov'18

**TinkerHACK**, the Hardware Design Hackathon was organised on 2nd November 2018 by ECE Labs in association with IEEE Student Chapter, VLSID2019, GitHub, Coding Blocks, PayTM and the Electroholics Club. It was a 24-hour event aimed at students, professionals and entrepreneurs to showcase their innovative and creative side by displaying problem-solving skills. The event witnessed huge participation with people from all over India applying to be a part of it. There were a total of 41 teams shortlisted from various parts of the country like Jammu and Kashmir, Himachal Pradesh, Ajmer. Verily Virtual of Guru Gobind Singh Indraprastha University was declared the winning team. The winners received a cash prize of Rs. 10,000 along with free VLSID student memberships.

### Talk by Mr Larry Stone 16 Nov'18

**Mr Larry Stone Chairman of BT India**, delivered a talk in IIITD to discuss the opportunities and challenges facing a modern telecoms company in the face of constant change – from technology, from competition, from customer expectations, from investors and government stakeholders. In particular, he focussed on the vital need to attract and retain talented people in a diverse and inclusive workforce.

# STUDENT INTERVIEWS



**GAURAV DUGGAL**

*Gaurav is a 2nd-year M.Tech student with the ECE department. He did his B.Tech from BITS Hyderabad and worked in the industry for a couple of years before joining IIITD.*

## What is it that you like about IIITD academics?

Here students are very focused and hardworking. Most of them actually want to pursue engineering or research. IIITD believes in quality over quantity, unlike other colleges which open multiple courses while hardly being able to cater to all.

## What are the things that need to change on the academic front at IIITD?

I feel there is still a gap between what students study and what the industry wants. Reason being, a lot of students focus on getting a good GPA and hence often take courses that might not add value to their profile.

Students in ECE need to be more informed about the roles that the industry requires and train themselves accordingly.

## Are you currently working on any project? What is it about?

Yes. Currently, I am working on integrating WiFi and Radar systems.

## What is it that you are passionate about?

Well, cycling it has to be. I enjoy participating in cycling races/marathons. I recently led a team in 50km Delhi NCR race. (His team participated in the elite category at Deli Velo and won the first prize).



**SYESHAGIRDHER**

## What motivated you to take ECE? Do you wish to continue in this domain?

Ever since I was in school, I was intrigued by simple electronic projects involving motors and found circuits quite interesting, and I knew ECE is my thing.

Yes, I wish to continue with ECE, and as a matter of fact, I even landed a job in Multimedia Processing with Qualcomm.

## Any academic difficulty you faced at IIITD?

I did not take up coding in 11th and 12th, so in the first semester, when I was introduced to coding in IP, I was overwhelmed by the course, and it really tested my limits. It was very challenging for me.

## Since you are heading the Placement Committee, any tips for ECE students?

After observing ECE students closely during their placements for two years, I have noticed certain things, and I suggest the following:

**1. Allowing 6-month internships:** Most ECE core companies look forward to taking a student as a 6-month intern before hiring them.

**2. Making a specialisation necessary for B.Tech. students:** This will be useful while applying for jobs.

**3.** As of now, I see that students take easy courses in all fields and in the end, they know very less about a particular field. This does not help them, and in the end, they go for non-tech or CSE profiles and blame the college for not getting more ECE jobs.



**ANANT SHARMA**

## What motivated you to take ECE over the other branches?

I wanted to learn and create things; that's why ECE might be a better option for me rather than becoming a corporate slave. Also, ECE is the only reason why our country is not rising from where it already is. There are very less product based companies coming up in our country while most of them are service based.

## Can you share something about the projects you worked or are working on?

My IED project was the first project and surely the kickstart. It was a "Shadow bot". In the second year, I did a project on Signals and System. It was a software-based project involving music. We took a music file and split it out in its sources, and the sources were made available in VR. It showed the instruments played in the whole music and the user can listen to the instrument which he is looking at.

Recently I have done a project with Prof Dr Aman Parnami named Jamoora which garnered the attention of media coverage, and it was published in a local newspaper.

The Project which I am currently working on is an assistive coach to sports people.

## Do's and Don't for placement and pursuing higher studies?

For pursuing higher studies, the student should keep in mind the following:

- Your GPA is fundamental if you dream of higher studies outside India.
- Try to publish papers.
- Decide whether you want to pursue a Masters or PhD.

For placement, Computer Architecture is necessary. Companies ask about it, and ECE students have no idea whatsoever.

Programming, especially CP is non-negotiable because this is what will land you a better job, no matter what your stream is.

# 2018 GRADUATING BATCH

## AWARDS

### BEST B.TECH PROJECT

#### ENTREPRENEURSHIP

Mukesh Gupta  
(2014149)  
Sujeet  
(2014108)

#### RESEARCH

Divam Gupta  
(2014038)  
Akshay Sethi  
(2014133)

#### ENGINEERING

Himanshu  
(2014144)  
Vahini Ummalaneni  
(2014133)

### BEST M.TECH THESIS

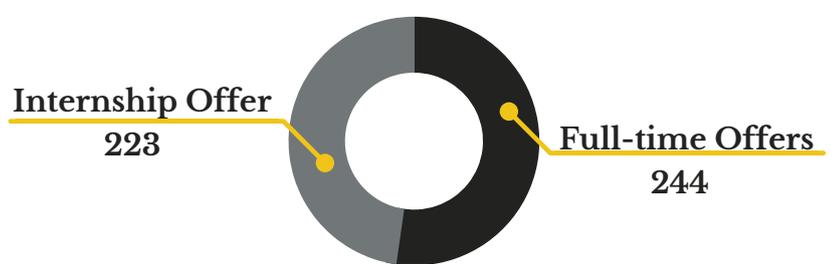
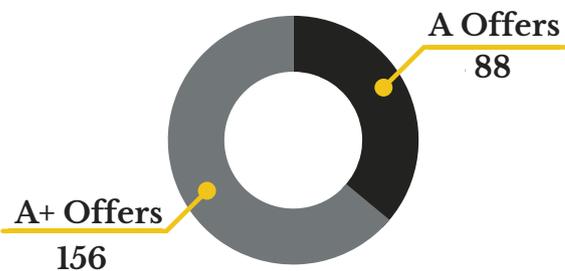
#### ANKUSH MAMGAIN (MT16086)

Thesis Title:  
Active Control of  
Retention Voltage of  
SRAM

#### SAPTAK BANERJEE (MT16110)

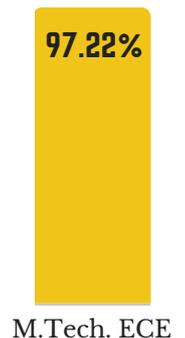
Thesis Title:  
Realizing AND  
functionality using single  
Tunnel Field-Effect  
Transistor

## PLACEMENT

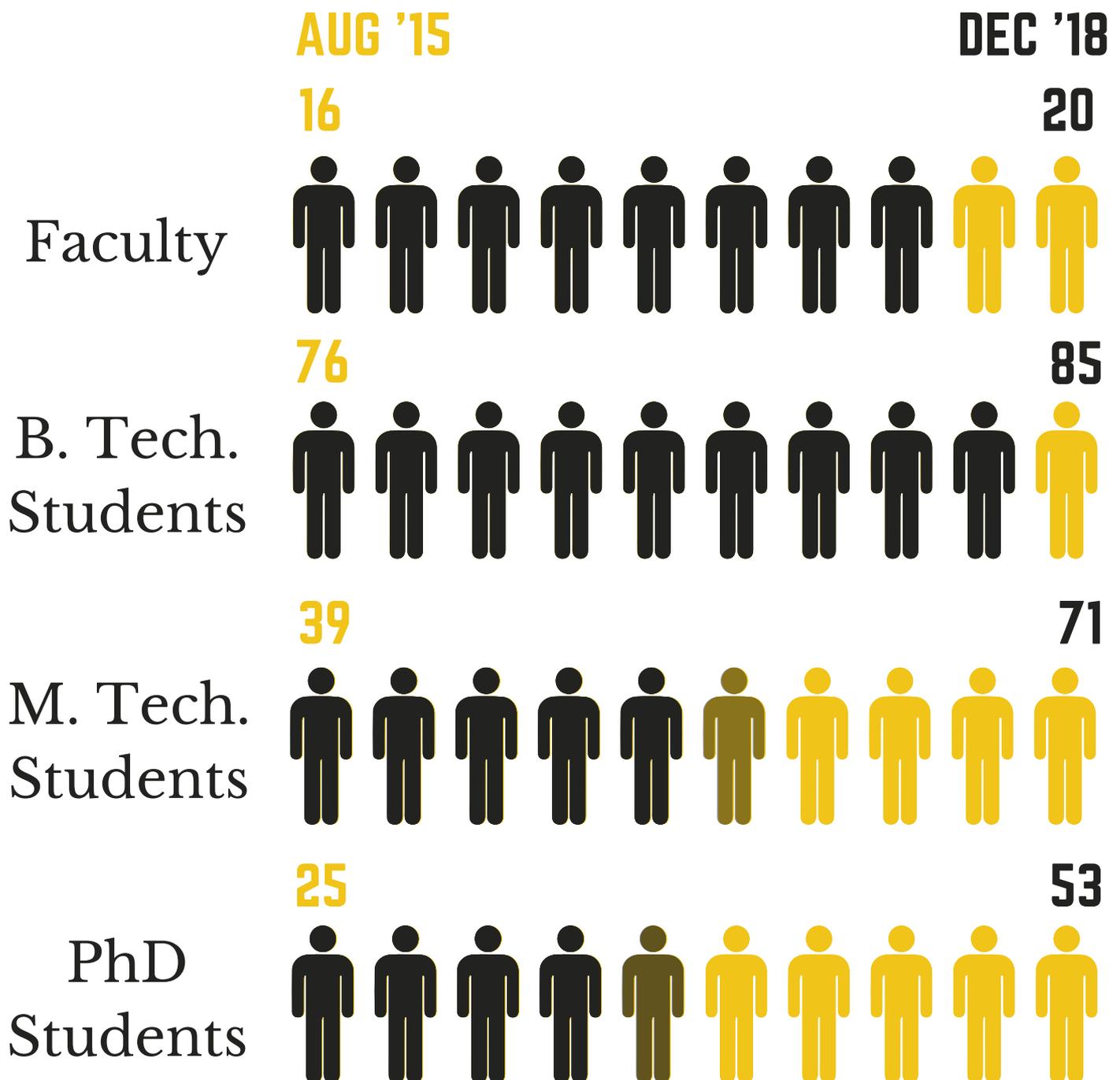


**A+ OFFERS** | CTC  $\geq$  10 lpa  
**A OFFERS** | 5lpa < CTC < 10lpa

### PERCENTAGE OF STUDENTS PLACED



# DEPARTMENT'S GROWTH



# EDITORIAL TEAM

**CONTENT**



**KHALID LODHI**

**CONTENT**



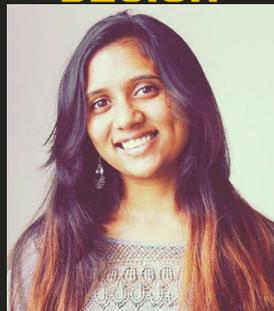
**SRIJA ANAND**

**CONTENT**



**TANISHA GOSAIN**

**DESIGN**



**NISHTHA SINGHAL**

**ADMINISTRATIVE  
MANAGER**



**SANJNA KHOSLA**

**EDITOR**



**SAYAN BASUROY**