



COVER STORY

SMART GRIDS



# TRONICALS

VOLUME 3 | ISSUE 1

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING  
NATIONAL INSTITUTE OF TECHNOLOGY

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## MESSAGE FROM HOD



***Dr.K.Sundareswaran***  
HOD, EEE

It gives me immense pleasure to pen a few words as prologue to the in-house newsletter of the EEE department, TRONICALS. This issue is designed to present the events that have occurred as well as technical write-ups which makes the issue resourceful and informative. I congratulate all the contributors and also the editorial board for bringing out such a nice issue. Happy reading!

**-Dr.K.Sundareswaran, HOD, EEE**

## MESSAGE FROM THE FACULTY ADVISOR



***Dr. N. Kumaresan***  
Faculty Advisor, EEEA

The conceptualization of the EEE newsletter, now named as Tronicals, was initiated in the year 2012 and the first issue was released during CURRENTS 2012. Starting from its inception, this newsletter expounds the details of major activities and accomplishments of our enthusiastic students and dedicated faculty, who always hold the aspirations of our department dear to their heart. In fact, this newsletter has been very useful as an outreach among the peers and academia and also as a link among all the stake holders. It also served as an important document, enlisting our achievements during the process of NBA accreditation of our B.Tech. and M.Tech programmes.

With unstinted efforts of all the past and present members of the editorial board, this newsletter has been successfully published for six years. At this juncture, I express my sincere thanks to everyone who has in one way or the other contributed to the organisation of the newsletter and its timely publication.

I am happy that the Electrical and Electronics Engineering Association (EEEA) has started its work for this academic year and I wish that the present team further enhances the technical content and presentation of our wide spectrum of curricular, co-curricular and extra-curricular activities. The participation of our 2013 alumnus Sri. Rajbarath. K.R in the inauguration of EEEA in 2017 will be very inspiring and a cherishing moment for our students. Incidentally, Rajbarath was also the Chairman of EEEA and hence he is the apt person for the inauguration of this year's EEEA activities. All the best to the EEEA 2017-18 team, for all the sincere efforts it will put forth in bringing greater recognition to all the activities of our department.

**-Dr. N. Kumaresan, Faculty Advisor, EEEA**



# EDITORIAL

Technology has advanced a lot in the past decade. We, being students of one of the premier technological institutes of our country, are introduced to such developments on a large scale. Also, we get opportunities to be a part of this process of development, directly or indirectly, through various internship opportunities. In recent times, the focus is on finding alternate sources of energy and energy saving techniques to counter the alarming rates at which reserves of conventional fuels are getting depleted. As students of Electrical and Electronics Engineering, in the long run, we can contribute to these ongoing researches. To introduce students to relatively new technologies in the field of renewable energy, we have included a page on Hyperloop, a means of transporting freight and people faster in an energy efficient way, and one on how wired roads may help charge electric vehicles on the go.

With the advent of smartgrids, the power transmission and distribution sector is going through major changes. For the cover story, we have tried to give a general idea on smartgrids and their implementation. Apart from all these, there are a number of articles which will help readers gain an idea about opportunities available for internships. We hope that the magazine will prove to be a good read.

Diptisikha Dash  
Chief editor  
Batch of 2014-18

## TRONICALS TEAM





# VISION AND MISSION OF THE DEPARTMENT

## ABOUT:

The Department of Electrical and Electronics Engineering, NIT, Tiruchirappalli was started in the year 1964. It offers one Under-Graduate programme (B.Tech.), two Post-Graduate programmes (M.Tech. in Power Systems and Power Electronics) and also research programmes (M.S. and Ph.D.) in the various fields of Electrical and Electronics Engineering. After the transformation from REC to NIT, the department has grown not only in terms of student and faculty strength, but also in improving the laboratory facilities for the teaching and research purposes. Thus, the department has dedicated and state of the art teaching / research laboratories. The department is recognized for excellence in research (First Department in NIT-T to be accorded QIP status for Ph.D. programme), teaching and service to the profession

The faculty members have strong sense of responsibility to provide the finest possible education for both graduate and undergraduate students. The academic strength of the faculty is reflected by the alumni, many of whom are in the top echelons of industry and academia both in India and abroad.

## VISION:

To be a centre of excellence in Electrical Energy Systems.

## MISSION:

- Empowering students and professionals with state-of-art knowledge and Technological skills.
- Enabling Industries to adopt effective solutions in Energy areas through research and consultancy.
- Evolving appropriate sustainable technologies for rural needs.



# B.TECH. PROGRAMME

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## Programme Educational Objectives (PEOs):

The major objectives of the B.Tech. Programme in Electrical and Electronics Engineering are to prepare students:

1. for graduate study in engineering
2. to work in research and development organizations
3. for employment in electrical power industries
4. to acquire job in electronic circuit design and fabrication industries
5. to work in IT and ITES industries.

## Programme Outcomes (POs):

The students who have undergone the B.Tech. Programme in Electrical and Electronics Engineering (EEE):

1. will have an ability to apply knowledge of mathematics and science in EEE systems.
2. will have an ability to provide solutions for EEE problems by designing and conducting experiments, interpreting and analysing data, and reporting the results.
3. will have comprehensive understanding of the entire range of electronic devices, analog and digital circuits with added state-of art knowledge on advanced electronic systems.
4. will have knowledge and exposure on different power electronic circuits and drives for industrial applications.
5. will have in-depth knowledge in transmission and distribution systems, power system analysis and protection systems to pursue a career in the power sector.
6. will have a good knowledge in microprocessors/microcontrollers, data structures, computer programming and simulation software.
7. will be able to develop mathematical modelling, analysis and design of control systems and associated instrumentation for EEE.
8. will be able to systematically carry out projects related to EEE.
9. will have an ability to participate as members in various professional bodies as well as multidisciplinary design teams.
10. will demonstrate the ability to choose and apply appropriate resource management techniques so as to optimally utilize the available resources.
11. will be proficient in English language in both verbal and written forms which will enable them to compete globally.
12. will have confidence to apply engineering solutions with professional, ethical and social responsibilities.
13. will be able to excel in their professional endeavours through self-education.
14. will be able to design and build renewable energy systems for developing clean energy and sustainable technologies.



# M.TECH IN POWER SYSTEMS

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## Programme Educational Objectives (PEOs):

The major objectives of the M.Tech. Programme in Power Systems are to equip the students with adequate knowledge and skills in Power Systems Engineering and to prepare them for the following career options:

1. research programmes in Power Systems Engineering
2. employment in power research and development organisations
3. to work in electric power industries and energy sectors
4. faculty positions in reputed institutions.

## Programme Outcomes (POs):

A student who has undergone M.Tech. Programme in Power Systems (PS) will:

1. have an ability to evaluate and analyse problems related to Power Systems and be able to synthesise the domain knowledge and incorporate the principles in the state of art systems for further enrichment
2. be able to critically investigate the prevailing complex PS scenarios and arrive at possible solutions independently, by applying the acquired theoretical and practical knowledge
3. be able to solve PS problems such as load flows, state estimation, fault analysis and stability studies
4. be able to develop broad-based economically viable solutions for unit commitment and scheduling
5. be able to identify optimal solutions for improvising power transfer capability, enhancing power quality and reliability
6. be able to evolve new schemes based on literature survey, and propose solutions through appropriate research methodologies, techniques and tools, and also by designing and conducting experiments
7. be able to interpret power system data and work on well-defined projects with well-defined goals to provide real time solutions pertaining to PS
8. be able to develop, choose, learn and apply appropriate techniques, various resources including hardware and IT tools for modern power engineering, including prediction and modelling with an understanding of the limitations
9. be able to develop dedicated software for analysing and evaluating specific power system problems
10. be able to participate in collaborative-multidisciplinary engineering / research tasks and work as a team member in such tasks related to PS domain, giving due consideration to economic and financial intricacies, and lead the team in specific spheres
11. be able to confidently interact with the industrial experts for providing consultancy
12. be able to pursue challenging professional endeavours based on acquired competence and knowledge
13. be a responsible professional with intellectual integrity, code of conduct and ethics of research, being aware of the research outcomes and serve towards the sustainable development of the society
14. be capable of examining critically the outcomes of research and development independently without any external drive.

# M.TECH IN POWER ELECTRONICS

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## Programme Educational Objectives (PEOs):

The major objectives of the M.Tech. Programme in Power Electronics are to equip the students with adequate knowledge and skills in Power Electronics and to prepare them for the following career options:

1. research programmes in Power Electronics and related areas
2. employment in R & D organisations related to sustainable technologies
3. to work in power electronic circuit design and fabrication industries
4. faculty positions in reputed institutions.

## Programme Outcomes (POs):

A student who has undergone M.Tech. Programme in Power Electronics (PE) will:

1. have an ability to evaluate and analyse problems related to Power Electronic Systems and incorporate the principles in the state of art systems for further improvement
2. be able to investigate critical PE problems and to arrive at possible solutions independently, by applying theoretical and practical considerations
3. be able to solve PE problems such as switching control, converter design, analysis and control of solid state drives and stability studies
4. be able to develop appropriate power converters for sustainable energy technologies
5. be able to identify optimal solutions for improvising power conversion and transfer capability, enhancing power quality and reliability through PE based solutions
6. be able to evolve new power electronic topologies and control schemes based on literature survey and propose solutions through appropriate research methodologies, techniques and tools, and also by designing and conducting experiments
7. be able to work on small, well-defined projects with particular goals to provide real time solutions pertaining to power electronics
8. be able to develop, choose, learn and apply appropriate techniques, various resources including sophisticated digital controllers and IT tools for modern power electronic system simulation, including prediction and modelling with existing constraints
9. be able to develop dedicated software for analysing and evaluating specific power electronics and control problems
10. be able to participate in collaborative-multidisciplinary engineering / research tasks and work as a team member in such tasks related to PE domain, giving due consideration to ecological and economical intricacies, and lead the team in specific areas
11. be able to confidently interact with the industrial experts for providing consultancy
12. be able to pursue challenging professional endeavours based on acquired competence and knowledge
13. be a responsible professional with intellectual integrity, code of conduct and ethics of research, being aware of the research outcomes and serve towards the sustainable development of the society
14. be capable of examining critically the outcomes of research and development independently without any external drive.



# WORKSHOPS, JOURNALS AND CONFERENCE PUBLICATIONS



## JOURNAL PUBLICATIONS

- L.Maheswari , P.Srinivasa Rao, N. Sivakumaran, G.Saravana Ilango and C.Nagamani, "A control Strategy to increase the Life Cycle of Battery in a Standalone PV System with DC Loads", IET Power Electronics, vol.10, no.9, pp.1087-1094, July, 2017.
- C. K. Aravind; Indu Rani B, M Chakkarapani , Josep Guerrero, Saravana Ilango Ganesan, and Nagamani Chilakapati, "Performance evaluation of Type-3 PLLs under wide variation in input voltage and frequency", IEEE Journal of Emerging and Selected Topics in Power Electronics, vol.5, no.3, pp. 971-981, Sep., 2017.
- Chakkarapani Manickam; Guru Praanesh Raman; Guru Raghav Raman and Saravana Ilango Ganesan; Nagamani Chilakapati, "Fireworks Enriched P&O Algorithm for GMPPT and Detection of Partial Shading in PV Systems", IEEE Transactions on Power Electronics, vol.32, no.6, pp. 4432-4443, June, 2017.
- Mohan Anitha Asha Rani; Chilakapati Nagamani and Ganesan Saravana Ilango, "Compensation of Magnetizing Current for Enhanced Operation of DFIG under Grid Unbalance" IEEE Transactions on Power Electronics, vol.32, no.7, pp. 5214-5226, July 2017.
- Venkata Rama Raju Rudraraju, Chilakapati Nagamani, and Ganesan Saravana Ilango, "A Control Strategy for Reliable Power Output from a Standalone WRIG with Battery Supported DC Link" IEEE Transactions on Power Electronics, vol.32, no.6, pp. 4334-4343, June, 2017.
- S.Mageshwari,"Implementation of grid connected Single Phase Inverter" International Journal of Electrical and Electronics Engineers,V.No.9,2017.
- S.Mageshwari and Nipun.M,"Closed loop operation of DC-AC Dual buck full bridge inverter for grid connected operation of renewable energy sources",International journal of advanced Technology in engineering science,Vol.No.5,2017.
- S Murugesan, V Murali, SA Daniel "Hybrid Analyzing Technique for Active Islanding Detection Based on d-Axis Current Injection " IEEE Systems Journal, 2017
- A. Thalamtathu Thankappan, S. P. Simon, P. S. R. Nayak, K. Sundareswaran and N. P. Padhy, "Pico-hydel hybrid power generation system with an open well energy storage," in IET Generation, Transmission & Distribution, vol. 11, no. 3, pp. 740-749, 2 16 2017.
- S. K. Murugan, S. P. Simon, K. Sundareswaran, P. S. R. Nayak and N. P. Padhy, "An Empirical Fourier Transform-Based Power Transformer Differential Protection," in IEEE Transactions on Power Delivery, vol. 32, no. 1, pp. 209-218, Feb. 2017.
- C. H. Ram Jethmalani, S. P. Simon, K. Sundareswaran, P. S. R. Nayak and N. P. Padhy, "Auxiliary Hybrid PSO-BPNN-Based Transmission System Loss Estimation in Generation Scheduling," in IEEE Transactions on Industrial Informatics, vol. 13, no. 4, pp. 1692-1703, Aug. 2017.



- M. S. Sunila ,V. Sankaranarayanan and K. Sundareswaran, "Comparative analysis of optimized output regulation of a SISO nonlinear system using different sliding manifolds" to appear in International Journal of Automation and Computing, 2017.
- R. M. Brisilla and V. Sankaranarayanan, "Extended State Observer Based Sliding Mode Control of Multi Input Multi Output System with Multiple Disturbances" Journal of Control, Automation and Electrical Systems, volume 28, Issue 1, Pages 11-25, 2017.
- Hemavathi.N, Shobhit Kumar Nagpal and Sudha S, "Impact of Rate of recurrent Communication of Sensor Node on Network Lifetime in a Wireless Sensor Network", has been accepted for publication in the journal of IET Science, Measurement & Technology, available online , DOI: 10.1049/iet-smt.2016.0290 , Feb. 2017.
- K. Arthishri, K. Anusha, N. Kumaresan and S. Senthil Kumar, "Simplified methods for the analysis of self-excited induction generators", Accepted for publication in IET Electric Power Application (SCIE indexed: Print ISSN: 1751-8660 and Online ISSN 1751-8679).
- K. Arthishri, N. Kumaresan, N. Ammasai Gounden, "Analysis and MPPT control of a wind-driven three-phase induction generator feeding single-phase utility grid", IET-The Journal of Engineering, April 2017, DOI: 10.1049/joe.2017.0091 (Online ISSN 2051-3305).
- Sumedha Mahajan, Senthil Kumar Subramaniam, Kumaresan Natarajan, Ammasai Gounden Nanjappa Gounder, Devendra Varma Borru, "Analysis and control of induction generator supplying stand-alone AC loads employing a Matrix Converter" Engineering Science and Technology, an International Journal, Vol.20, issue.2, April 2017, pp.649-661. (ISSN: 2215-0986).
- K. Navin Sam, N. Kumaresan, N. Ammasai Gounden and Rajesh Katyal, "Optimal Reactive Power Controller for Wind-Driven Stand-Alone Doubly-Fed Induction Generators" International journal of Wind Engineering, Vol.41, No.2, April 2017, pp.124-143. (eISSN: 2048402X & ISSN: 0309524X)

## **WORKSHOPS**

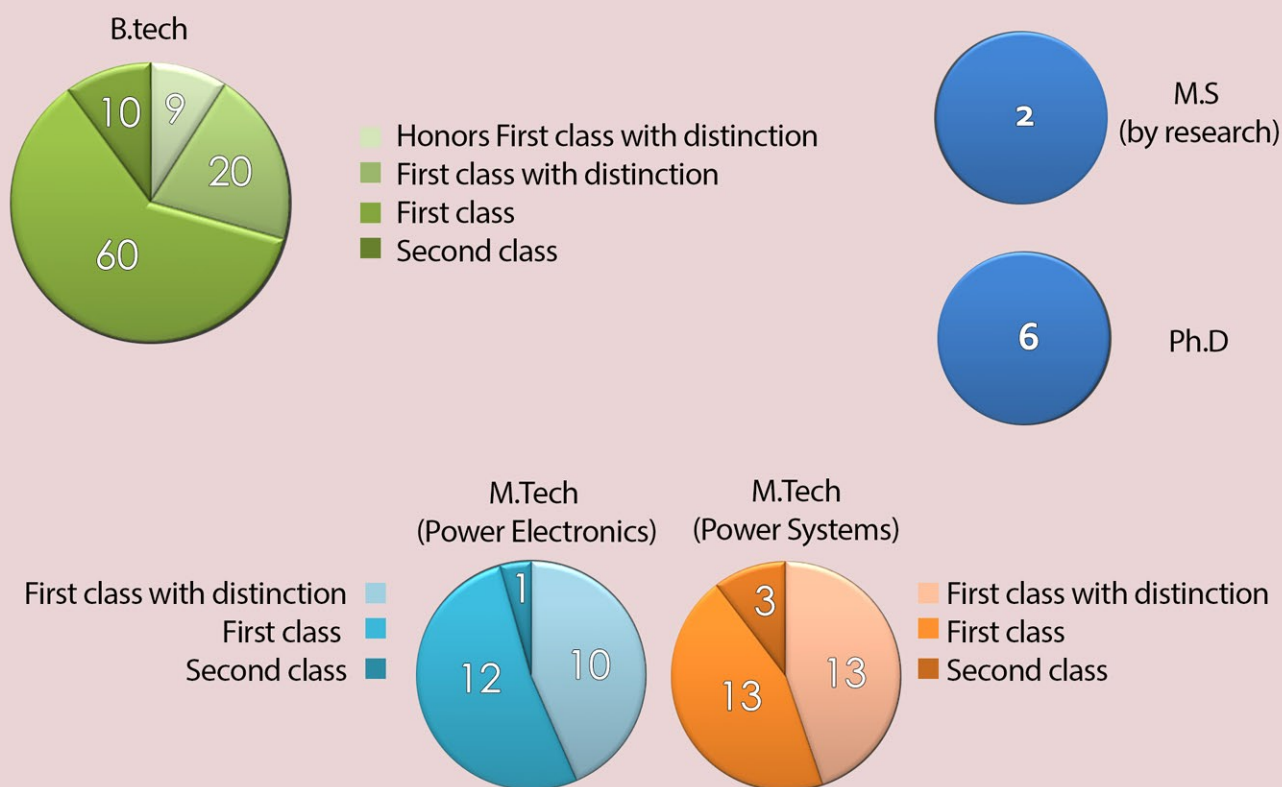
- Organized Faculty development programme on "Art of Edification: Contemporary & Innovative practices for effective teaching", Under the Self-Financed Category, during 24th – 28th April 2017 jointly with Department of Management Studies and Department of EEE.  
Programme Coordinators : Dr. N. Thamaraiselvan, Associate Professor, DoMS, Dr. B. Senthil Arasu, Associate Professor & Head DoMS and Dr. N. Kumaresan, Associate Professor, EEE.



- P.S.R. Nayak, T.A. Rufzal, "Firefly Algorithm Based Soft-Starting Scheme for Induction Motor Drives." International Conference on Contemporary Topics in Power Engineering and Aiding Technology (ICCPEAT), Pondicherry, Feb 2017.
- P.S.R. Nayak, T.A. Rufzal, "Design of Feedback Controller Employing Cuckoo Search Algorithm for Induction Motor Soft-Starting." International conference on electrical and electronics engineering (ICEEE), Singapore, July 2017.
- Kaushik Ram, N.Sai Kiran, S.Sudha. "A Mail Based Recommender System", Proceedings of the International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM), 2017.
- Sathish Kumar.A , S.Sudha. "Hardware Realization of fuzzy Logic driven PWM controller for a Cold Storage System", Proceeding Of 2nd IEEE International Conference on Recent Trends in Electronics, Information and Communication Technology, 2017.
- Shashank Singh, Arun, S.L. and Selvan, M.P., "Regression Based Approach for Measurement of Current in Single-Phase Smart Energy Meter", IEEE Region 10 Symposium (TENSYP-2017), 14-16 July 2017, Cochin, Kerala, India.
- Arun, S.L., Aravind Raj, A. and Selvan, M.P., "Demand Response in Smart Buildings Through Time-Varying Priority of Household Appliances", IEEE Region 10 Symposium (TENSYP-2017), 14-16 July 2017, Cochin, Kerala, India.
- TT Anilkumar, SP Simon, NP Padhy, "Residential Electricity Cost Minimization model through open well pico-turbine pumped storage system" Applied Energy, 2017.

# Convocation '17

The 13th convocation of NIT, Trichy was held on 12th August 2017. The chief guest was Mr. N. R. Narayana Murthy, co-founder of Infosys Ltd. Mr. N. Chandrasekaran, Chairman of Tata Sons was also present.



## Medal Winners 2017

The institute medal is given to the person with the highest overall CGPA in their respective programme.

Roll No.	Name	CGPA	Programme
107113077	Roshini Devi.K.L	9.6	EEE (B. Tech)
207115013	Hari Sanker.K	9.47	Power Systems (M. Tech)
207115017	Vaishnavi.R	9.47	Power Systems (M. Tech)
207215002	Akhil.S	9.66	Power Electronics (M. Tech)



## DOCTOR OF PHILOSOPHY (Ph.D.)

Sl. No.	Names of the Guide	Roll No.	Name	Title of Thesis
1	Dr. C. Nagamani	407112007	Asha Rani M.A	Power Control of Doubly Fed Induction Generator with Unbalanced Grid Voltage
2	Dr. V. Sankaranarayanan Co-Guide: Dr.G.Saravana Ilango	407109052	R.M.Brisilla	Nonlinear Control Techniques for Wheeled Mobile Robots
3	Dr. S. Moorthi Co-Guide: Dr. M.P.Selvan	407112002	K.Venkataraman	Design and Development of FPGA Based Embedded Systems for Online Monitoring, Power Management and Control of Power Quality Conditioners in a Micro-Grid
4	Dr. N. Kumaresan	407112003	V.Nayanar	Investigations on the Applications of Power Electronic Converters and Electrical Machines for DC Microgrid Systems
5	Dr. N. Kumaresan	407111051	Navin Sam.K	Investigations on Certain Control Strategies for StandAlone Wind-Driven DFIGs
6	Dr. S. Senthil Kumar	407913051	S.Sarojini Mary	Investigations on Static Reconfiguration Techniques of Modules and Power Electronic Controllers for Solar Photovoltaic Systems

## MASTER OF SCIENCE (BY RESEARCH)

Sl. No.	Names of the Guide	Roll No.	Name	Title of Thesis
1	Dr. P. Raja	307114001	Segu Venkata Hareesh	Design and Implementation of PMU Based Transmission Line Fault Detection, Classification and Localization
2	Dr. G. Saravana Ilango	307913002	C Nallathambi	Development of GMPPT and Dual Axis Solar Tracking for Enhancing PV Power Output



## AIESEC INTERNSHIP EXPERIENCE

I have been a member of AIESEC in NIT Trichy since its inception. Having seen four of our college students go to countries such as Egypt and China and work on interesting projects, I decided to take up this challenging 6 week stint in the winter of 2016. The decision to go to the Philippines was not ideal, but the opportunity to work with Habi Footwear - one of the leading startups in Philippines - was in my opinion an opportunity too good to leave behind. So without paying much heed to the stereotypes and rumours about Philippines, I decided to apply for the project. Once I got accepted, it dawned upon me that travelling alone to a foreign country is not easy. The students from Ateneo de Manila University (The AIESEC entity under which I had been working) received me at the airport. By the end of the day, I had seen their beautiful campus, understood their AIESEC structure and hierarchy, made comparisons with what we follow at NIT Trichy and been to the orientation at work. My work was helping HABI FOOTWEAR with their marketing strategy. Coming from an engineering background, I had no theoretical knowledge in management or economics. I was asked to submit a Business Plan at the end of my second week. After thorough research and consultation with my Senior and Coordinator at Habi, we chalked out certain feasible schemes which they could implement. I learnt new concepts. The second part of my work was to help them out with social media marketing. I was amazed to see the amount of analytics that goes into measuring the response on social media and optimising the strategy. The last part of my project involved working on business expansion. I was working on a deal which they were trying to finalise with HOPE Foundation in India. The project helped me understand several marketing and management concepts and invoke some of them into the policy of a social start up.

I celebrated Christmas and New Year with friends I made over there. I also visited a lot of places including museums and churches. The country has beautiful white sand beaches with well developed tourism and adventure sports. I learnt how to surf. I sometimes travelled alone, it gave me confidence and empowered me. I discovered a lot of things about myself. Philippines is indeed a beautiful country. It was the first time that I travelled abroad, contributed to a community, enjoyed the food, art and culture of a foreign country and developed a sense of satisfaction at having become a better version of myself.

**-Avinash Padhi, 3rd Year**













# CURRENTS 2017

The 27th edition of Currents, the annual National level technical symposium of the Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli, was held from 16th to 19th February. There were a variety of events, workshops and guest lectures which were attended by a large number of students from across the country.

Currents 2017 kicked off with an outreach event at B.M.S College of Engineering, Bangalore, where a voice controlled robotics workshop was held on the 28th and 29th of January in association with Texas Instruments. This was followed by a mock GATE examination conducted for students in and around Trichy on 29th January in partnership with The GATE academy.

Currents'17 was inaugurated on 16th February. Dr. Murthy Remilla, Deputy Project Director, XPOSAT satellite program, ISRO was the chief guest. Dr. Mini Shaji Thomas, Director, NIT Trichy, HoD Dr. Sundareswaran, faculty advisor Dr. P. Srinivasa Rao Nayak and other dignitaries were also present. A guest lecture on Engineering Challenges in Satellite Building, delivered by the chief guest, followed the aforementioned event.

During the course of three days, there were eight workshops conducted. There were workshops on Industrial Automation using PLC and SCADA, PCB design, Hybrid Power System Design, Gesture Controlled Robotics, Embedded System Design, Image Processing, EMG and FPGA. Students from various colleges attended these workshops in large numbers.. Apart from these, there were a number of events which catered to technical as well as creative minds. Capture Currents, a pre-Currents photography contest, was

aimed at identifying budding shutterbugs. Tech quiz, Line Follower, Code Currents and Electronic Arts were a few events which saw a huge participation. Apart from these, there was a paper-presentation event named Colloquium. The Dhruva award was presented to the most creative participant. There were a total of 5 guest lectures, including one on SCADA systems by the Director and one by Mr. T. Ganesh from POSOCO.

Currents 2017, which was organised and managed solely by the students of the EEE Association was spread over four days with 8 workshops, 5 guest lectures and 6 events and was a grand success.





# SMART GRIDS

Imagine yourself sitting in your balcony at night with an amazing view of the city, the breeze brushes your hair as you sip coffee from an ornate cup. You have no worries about the air conditioners or the television being left on when no one is in the room, thanks to the advent of smart power grids. As you take another sip, you see the lights vanishing in distant buildings. The blackout spreads in the direction of your house, as you have seen in movies. But this is not possible, you tell yourself as the smart meters in your house turn off and electricity is shut down.

The scary, yet highly possible, scenario described above is the most dangerous of the cons of implementing Smart Grids on a large scale. But what is a Smart Grid? Why does the 'Smart' Grid give way to such potential threats? Well, read on to find out.

## What is a Smart Grid?

A Smart Grid refers to an electric network of transmission lines, substations, transformers and other components involved in the transfer of power from the plant to the load. What makes the Smart Grid 'smart' is that it is engineered from bottom up so that one can automate the management of electric needs. To put it in simpler words, it provides communication between the load and the source in addition to the functionalities of the simpler grids. The Smart Grid houses controls, computers and equipments to assist responding to the constantly changing electric demand, digitally.

The Smart Grid promises higher efficiency of electricity transmission, quicker restoration of electricity after blackouts, lesser demands during peak hours, integration of large-scale renewable energy systems and improved security.

Upon its implementation, the Smart Grid extends its profitable nature to various fields including the economy and the environment on a national level. The implementation part proves to be tedious as it demands cautious testing, standard development and consumer education.



## Why Smart Grid?

It is a testament to the sheer skill and ingenuity of the founding engineers of our country, that we still feed most of our energy demands on the basic framework laid out 50 years ago. We have progressed immensely over the last half century—with our installed capacity increasing 80 times over, gradually lighting the whole nation with a per capita usage of 1,074.65 kWh. And the future does indeed seem promising: with sustained efforts being made at an integrated grid, measured strokes in bringing forward renewable energy sources and a general positive outlook from the public.

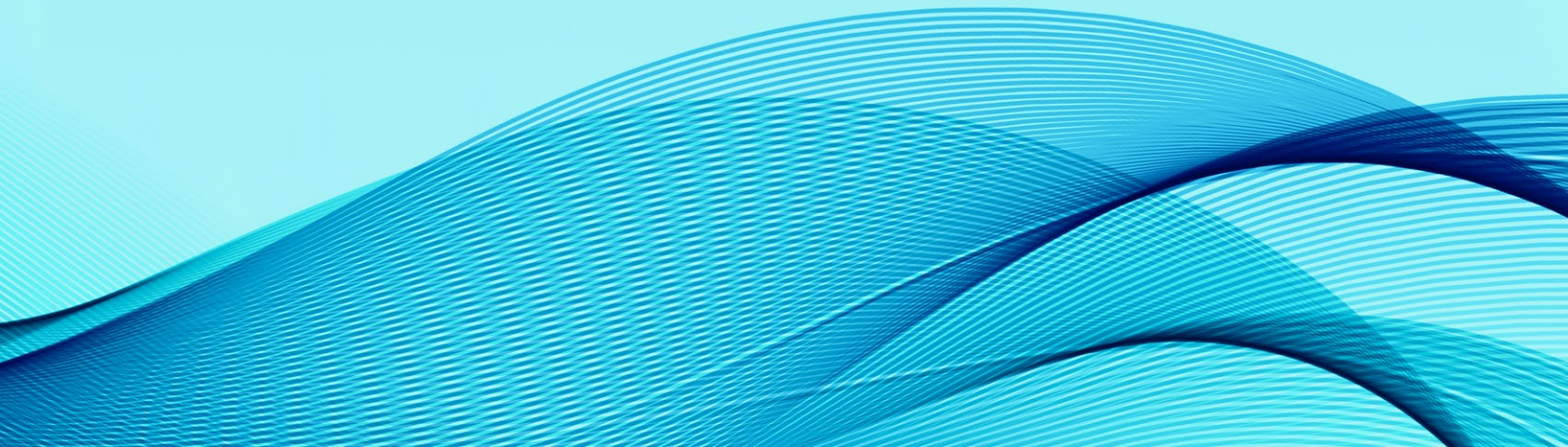
A rather understated parameter of electricity production is the power deficit: quite simply the shortage in power supply, which seems likely to drop below zero by the first quarter of 2018, i.e we will end up producing more than the peak load by 2018. It would hence be prudent to look at more ways of distributing and managing our energy. The old adage: energy saved is greater than energy produced, gains an even more important meaning now.

The most promising outlook from these facets is the potential Smart Grid. Tackling some age old problems of metering, grid wise blackouts and energy management, the Smart Grid looks poised to answer some fundamental questions pertinent to the present energy scenario. But what exactly does it offer?

The most fundamental design of any Smart Grid, aims to commandeer the various energy production sites and distribute them judiciously. For example, the drawback of most renewable sources is their unpredictability. Since storing energy has proved to be an expensive and tedious process, a Smart Grid would go a long way in reducing the burden of conventional energy, choosing the most appropriate form of energy for distribution. Another important feature of smart grids is their self healing capability. By making use of collected data, faults can be anticipated and suitable measures can be taken. Even then, if a fault occurs, detecting and clearing it is an easy process. All this is done remotely, with minimal human interference and with no further caveats.

The increased efficiency offered through the implementation of Smart Grids promises to negate the initial capital required to overhaul such a system. Moreover, the addition of smart meters, allow both the consumer and the supplier to interact better. The consumer is provided with real time data on his usage, while on the other end, the supplier can use this information to determine supply levels.

There does remain one major red flag associated with implementing Smart Grids. Digitising the grid does end the need for physical contact for malicious intent. The smart grids need to be securely designed, apprehensive of any attacks that can take out the whole system in a blink. Much discussion is going around towards this end, with engineers of various disciplines involved in making the grids safe.





**207 x**



The energy saved by the smart grid (423 Billion kWh per year) is enough to power Las Vegas 207 times over.



The total energy saved by smart grid in a year could run your fridge through several ice ages



**70M times**

With the smart grid's yearly energy savings, an electric car could be driven for 1.7 trillion miles, which would take you around the world 70 million times and would likely outlive the warranty of the vehicle.



The annual smart grid energy savings could help save upto \$42 billion in could buy business class tickets for 7.6 million round trips of air travel from New York City to Paris.



Modernizing today's grid could mean \$585 in direct bill savings for the average household each year.



The yearly energy the smart grid saves could air-condition 378 million homes or about 2 million supermarkets.

## How exactly is a Smart Grid implemented?

Overhauling such a large scale operation as our current grid, is no easy feat. The consensus aims to gradually change blocks within the system, incorporating newer sources of energy and technology. Smart grid, which has the supervisory system located far away from the actual site, is made possible by two-way communication technologies, control systems, and computer processing.

These advanced technologies include advanced sensors known as Phasor Measurement Units (PMUs) that allow operators located far away to assess grid stability, relays that sense and recover from faults in the substation automatically, automated feeder switches that reroute power around problems, and batteries that store excess energy and make it available later to the grid to meet customer demand.



For the consumers, digital meters called smart meters which are microprocessor based devices aim to provide a two way route of communication. They help homeowners and the suppliers to manage the respective electricity usage and supply in a more efficient and cost effective manner. With the help of the information provided by such smart meters, the power companies will have the capability to set up real time pricing systems for electricity.

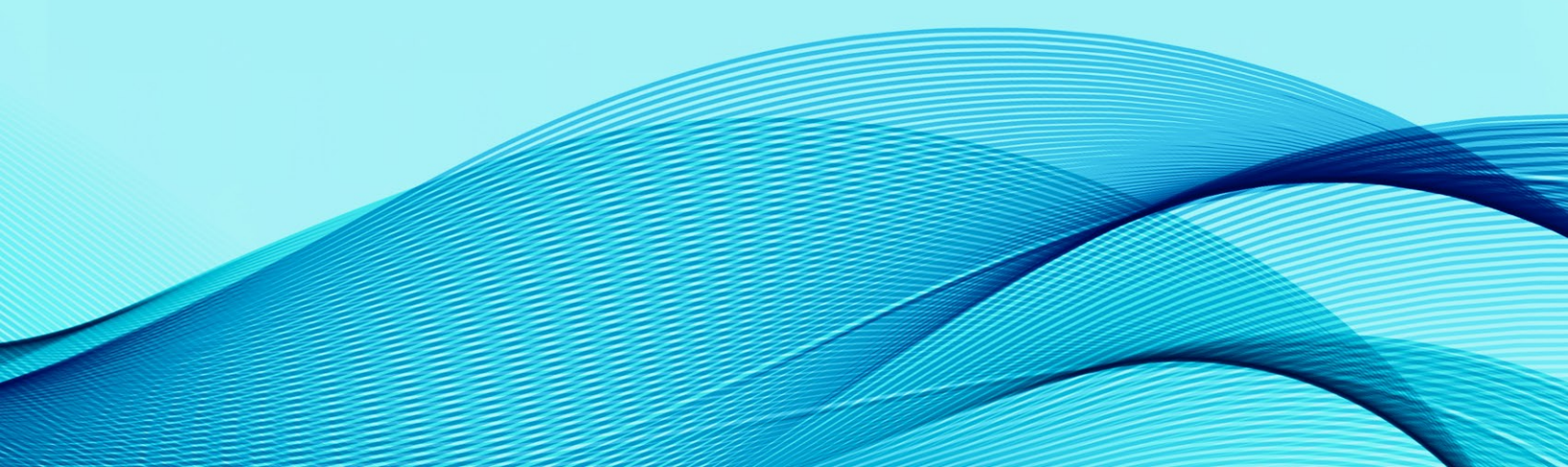
SCADA( Supervisory Control And Data Acquisition) is the heart of the smart grid's decision making capability. Apart from controlling, the SCADA system is responsible for setting up communication with each of the devices. Every SCADA system has an HMI( Human- Machine Interface) where the data, after being processed, is displayed to the operator. Through the interface, the operator can control the smart grid when necessary.

## **Vulnerability**

The concept that the Smart Grid is centered around is to establish a two way communication between the load and the supply. This gives rise to a startling possibility of misuse of the response by the consumer. What if a consumer tries to outsmart the Grid?

The scenario described earlier suggests the possibility of a blackout during a Smart Grid. Such blackouts can be man-made too. This is called as Smart Grid Hacking. Various instances of hacking have been observed around the world and the world's leading cyber-security agencies are working against such threats. The first instance of hacking in the energy sector appeared in Ukraine where 80,000 people suffered hours long of no power. The breaches have affected some countries, like Netherlands, to an extent that they have disabled remote shutting down of grids. Also, some countries have opted out of using Smart Grids and have chosen 'dumber' methods to have a safer supply.

Any technological breakthrough comes with its own set of advantages and disadvantages. Its utilisation is what decides if it is profitable or not. Had research in the nuclear sector been stopped, due to its usage in weapons of mass destruction, the energy sector might have been ages behind what it is now. Similarly, the advent of Smart Grids promises a huge breakthrough in the power transmission sector, it is unwise to shun it because of its shortcomings. Preventive methods are constantly under development to ascertain the large-scale implementation of Smart Grids. Let us, the engineering community, come together to make the process of 'Smart'-ising the society as hassle-free as possible.







**It** wouldn't be an unfair exaggeration to assert that one can, quite literally, see our power reserves deteriorate into nothingness. Such is the overwhelming burden we manage to unload on our already-taxed power generation sources. Especially in the case of transportation, where the added pressure of trying to keep emissions under check is worrying. That is why, with the advent of Tesla Inc., electric vehicles have become a lot more than an expensive novelty, and opened up new avenues to explore regarding their merger with the mainstream. But for all the technological and automotive wizardry Elon Musk's cars promise us, there is still the issue with powering all those vehicles. And Tesla can only place so many charger stations. What could be the innovative and possibly Sci-Fi-ish solution to it?

#### **Wired-up Roads that charge your vehicle on the road.**

The possibilities are endless. Your vehicles could be charged while they speed across the highway, they could be charged while they are parked, and it sidesteps any issue related to cords and cables because the transmission of energy from the roads to the vehicle would be wireless.

Laying the concept in basic scientific terms, radio waves of a certain frequency are generated by the source embedded within the roads to excite electrons in a coil of wire, called a resonant inductor. The receiver in the electric vehicle also has a resonant inductor made from a coil of wires. When the two inductors are placed near each other, the energy gets coupled from the source to the receiver. In the receiver, a rectifier converts the energy from the radio waves to usable electrical energy for the vehicle. The amazing part of this innovative idea is that the researchers who initially came up with it borrowed a few concepts from quantum physics that allows them to produce a wireless charger that can automatically tune said radio waves to match the distance between the source and receiver. And the finalized theoretical design boasts an efficiency of 100% within a range of 27 inches, which is greater than the closing limit of a commercial vehicle's ground clearance.

The quantum mechanical concept in question is called parity-time symmetry, or PT symmetry. While it is as counter-intuitive and complex as its fellow quantum concepts, a simple way of stating it would be that 'systems built based upon PT symmetry have symmetrically arranged parts that either absorb or emit electromagnetic energy'.

While in theory the idea seems flawless, a lot of the engineering concepts that can make it possible are quite difficult to accomplish, especially since quantum mechanics is involved. A lot of the equipment that the transmission requires need to possess an overwhelming amount of precision to handle the quantum processes it involves. So, for now, an actual working prototype feasible for a parked vehicle would probably achieve some degree of success.

So until the gap between theoretical quantum concepts and our current engineering expertise is bridged, this beautiful concept shall remain just that. But with the rate at which electric transportation is being considered for mainstream adoption, it's not a horizon that stretches far beyond our sight.



# HYPERLOOP

Since the beginning of time, man has sought new and efficient ways of transportation. Emphasis has always been placed on reducing the time taken to move from point A to B. An ideal means of mass transit should be one that is quick, reliable, economically benefitting and environmentally sound. For years together, human beings have overlooked the 'environmental' aspect and as a direct consequence, a good majority of today's research and development is centred on renewable energy and its uses in transportation.

Elon Musk is increasingly becoming a household name, as the days go by. Brands like Tesla and SpaceX are gaining popularity and quite rightfully so. Another one of his many ventures is the Hyperloop One - a new means of transport that could possibly meet all modern-day necessities of a mass transit system. This project came into existence after the announcement of the California "High Speed" Rail Project which aims to connect the home of Silicon Valley with bullet trains. Elon Musk (along with many others) was rather disappointed, as bullet trains tend to be both expensive-per-mile and rather slow, given the amount of distance they need to cover.

Hyperloop seems to be most advantageous to connect cities that are around 1500km apart. Beyond that distance, supersonic planes are the most viable option owing to their speeds and the already well-established infrastructure that exists worldwide. The Hyperloop aims to achieve mind-boggling speeds of around 970 km/h, enabling it to cover 560 km in approximately 35 minutes. The reduced air resistance offered by the thin layers of the atmosphere at high altitudes is where Hyperloop drew its inspiration from. By creating a near vacuum inside the tubular structure, air resistance can be decreased considerably, thus paving the way to high subsonic speeds.

In order to propel the vehicle at the desired speeds, an advanced linear motor system is being developed. The tube houses the stator, while the pods house the rotor. This motor system is coupled with magnetic levitation (maglev), to move the rotor over the stator, over a cushion of 'air'. Maglev is not new to the transportation industry and by incorporating it into this project, the researchers at Hyperloop have developed a unique technology to accelerate the capsule to over 1220 km/h at a maximum acceleration of 1g, for comfort. Adding solar panels to the top of the tube can potentially generate more energy than required by the Hyperloop for its operation. This self-powering nature of the project is essential to minimize the damages inflicted upon the environment.

With great speeds, come great limitations and it's no surprise that there exists a top speed law for a given tube to pod area ratio, known as the Kantrowitz limit. This limit can be overcome either by going really slowly or by going extremely fast. The fast speeds would result in painfully high g-loads while navigating even wide curves. Mounting a compressor fan on the nose of the pods would help transfer the high-pressure air from the front to the rear of the vessel. Adding to the limitations, making the whole project economically viable is a major concern for the Hyperloop team. The estimated cost of the passenger transport system is nearly 6 billion USD, with another billion being added for the passenger plus vehicle transport system. While this may seem like an unreasonably high amount, it is almost an order of magnitude less than the projected cost of the California High-Speed Rail project.

Hyperloop is an explicitly proclaimed, open-source concept. This paves the way for experts from various disciplines to provide valuable input to this project. Along with experts, several student-led teams are working to advance the technology. All this, in amalgamation with the efforts put in by the Hyperloop team, leads us to believe that the ideal means of transport is well within our reach!



# WHAT'S HAPPENING OUTSIDE THE EEE REALM

## IT'S MICROSOFT, IT'S AMAZON... NO, IT'S MICROSOFT AGAIN

You've seen it happen in movies. Now you see it in reality. One man becomes the richest man in the world for one day. Jeff Bezos was left feeling bittersweet at the end of an exciting day where he overtook Bill Gates to become the richest man in the world. Bezos took the top spot with a net worth of \$90.6 billion when markets opened. However, Amazon's stock dropped from \$1083.31 to \$1046 by the time the markets closed, thus knocking him out of the top spot. After spending 3-4 hours in the top position, Bezos ended the day in second spot with a net worth of \$88.7 billion while Bill Gates held the top spot with \$89.8 billion.

## O FOR OREO

The wait is finally over. Continuing its tradition of naming each of its update after desserts, Android unveiled Android 8.0 as Android Oreo. Google made the announcement during a live stream that coincided with the solar eclipse on August 21, 2017, referencing the moon-like nature of the Oreo cookie. Although it won't be available for most phones for quite some time, it has several new features to get excited about. The most significant of those would be picture-in-picture allowing you to view two apps at the same time. This marks a new milestone in multitasking in Android. Google also promises faster performance, quicker boot times and faster launching of apps with the new update. It also promises to increase battery capacity by limiting background activity to a bare minimum. Android Oreo is also getting the fully redesigned emoji set with over 60 new ones. It also supports downloadable font styles. Initially, Oreo will be available only for Pixel and Nexus mobiles but it will soon be available for other models too.

## A NEW LOOK ON PAYMENT

Payment methods have evolved a lot over time. From the barter system to the modern form of paper currency, it was a slow process. Then came plastic money- you could now pay with debit and credit cards, where the banks make the transactions for you. The latest addition to payment methods is your face. You read that right. Now, you can make payments by simply showing up at the place and showing your face. Facial recognition technology has grown leaps and bounds. Face++, a Chinese startup valued at roughly a billion dollars, is one of the companies who have developed software to enable payments using only your face as credentials. The applications for this software are limitless. Only time will tell what looms ahead of us.

## WATCHTOWER IN THE MAKING

SpaceX is poised to launch an unmanned cargo ship toward the International Space Station including a supercomputer that could direct astronauts on future deep-space missions. The supercomputer named 'The Spaceborne Computer' is made by Hewlett Packard Enterprise (HPE). The goal is to test the computer for one year to see if it can operate in the harsh conditions of space. This should enable it to be fully functional for the Mars mission planned to launch in a year.



## **WHEN YOU PLAY THE BLUE WHALE GAME, YOU EITHER LOSE OR YOU DIE**

The Blue Whale Game is an Internet game that exists in several countries. The game allegedly consists of a series of tasks assigned to the players by the administrators, with the final challenge requiring the player to commit suicide. Philipp Budeikin, a former psychology student from Russia who was expelled from his university claims to be the mastermind behind the game. He stated that his purpose in creating the game was to clean the society by pushing to suicide those he deemed as having no value. The game has been linked to over 100 cases of suicide spanning over 20 countries including tIndia

## **RISE OF THE MACHINES**

Machines have been outwitting humans in various fields ever since they were invented. Now, they have taken over strategic thinking too. A bot created by the Elon Musk-backed nonprofit startup 'OpenAI' has defeated the world champion Danylo "Dendi" Ishuti of the tactical online war-game "Defense of the Ancients 2" (DOTA 2) in two back-to-back demonstration matches. The game is continuous with hidden information and requires good strategy and positioning to win rather than just raw mechanics. This achievement marks the first AI victory over world's best in competitive eSports which are vastly more complex than traditional board games such as Chess and Go.

## **TIME FOR SKYNET? MAYBE JUST NOT YET**

Social media was abuzz with fear and excitement after the news that Facebook had to shut down two of its AI bots after they apparently created their own language and started communicating. However the truth is much less exciting. Facebook developed these two chatbots to try and make them negotiate and trade with each other. As the bots proceeded with their instructions, they started to create their own "shorthand", according to researchers. They started to conduct their negotiations in a language which used regular English words but otherwise was completely incomprehensible to humans. Contrary to wide belief, Facebook did not shut down the experiment as a result of panic, but because their aim was to create bots which could interact with humans.

## **BLURRING THE LINES BETWEEN GAMING AND RESEARCH**

Who would have thought that a bunch of gamers would contribute to space research? Players of the game EVE Online, a massively multiplayer game set in space have the opportunity to contribute to real-life astronomical research by helping scientists discover new exoplanets. The game's publisher, CCP Games, has teamed up with the University of Reykjavik, the University of Geneva and Michel Mayor, who discovered the first ever exoplanet. Gamers interested in taking part use a special mini-game called Project Discovery where they receive real astronomical data such as luminosity readings, brightness of different stars etc, from the CoRoT telescope and analyse and classify the readings.



# COMPANY INTERNSHIPS

## TEXAS INSTRUMENTS

I interned at Texas Instruments, Bangalore in Analog profile. The internship duration was 2 months. At TI, my project was on "Analog Fault Simulation". I needed to compare TI internal solution with Mentor graphics tool for the same. The people out there are very chilled out and hard working at the same time. They allocated me my project on the first day of my internship, but it started a month later. Till that time, I was doing small tasks which were assigned by my mentor. TEXINS, a recreational facility was available to employees throughout the day. Besides, Bangalore's weather is really good even in the summer. Internship at TI was an elevating experience in many ways. Challenging industrial projects of relevance were assigned to interns and will be implemented in future projects. The working hours were flexible and any inputs given by us were seriously considered by the team. All in all, this was a great opportunity.

-Diksha

## FIDELITY INVESTMENTS

My two months long summer internship was at Fidelity Investments, Bangalore. My project was to develop a 'CHATBOT' for a specific business case using Natural Language Processing and machine learning techniques in Python. Fidelity is a good place to start your corporate life. The work-life balance is awesome and you get a lot of opportunities to learn cutting-edge technologies trending in the market. Being one of the top financial companies, the work culture and ethics are great. Every one is easily approachable and helpful. You get to interact and work with senior professionals from diverse backgrounds. The stipend offered is on par with the best IT companies. Overall, the experience was quite good and fulfilling.

-Amit Ashish

Over the span of my internship with Fidelity Investments I worked on cutting edge technologies and gathered a lot of financial and business related know how. My project was based on Machine learning which comprised of data analytics, mining etc. using Python and then creating a web application using Python Flask and hosting it on a UNIX Server. All these technologies were new to me but help was always around the corner whenever I needed it. Everyone in the company was very friendly and always ready to help. The work life balance is really well maintained. The most important part of working as an intern in Fidelity was that there was something new to learn everyday. Fun activities like ethnic day, innovation challenge, coding challenges and sessions on modern technologies like Importance of Blockchain, Agile framework were also organised during the course of the internship. Overall it was a great learning experience.

-Navjot

## AXIS BANK

I interned for two months at Axis bank BIU (Business Intelligence Unit) located at Mumbai. My internship project was primarily centred around qualitative data analysis and unsupervised machine learning to get business intelligence and hence make better decisions. This was my first corporate experience and I found it insightful. I worked with the Financial Crime Unit made of people with 5+ years of experience in statistics and finance, yet they were ready to help me



out with anything. My project was "Identification and treatment of High Risk Branches and Shell companies" and I found it quite interesting since I got a chance to explore a lot in machine learning. Overall, my experience in Mumbai was refreshing and one that I'll never forget.

-Vijay Prasanna

## PEPSICO

The two month internship at Pepsico helped me unleash hidden talents. The internship was focussed on troubleshooting the servomotor used in various stages of bottle manufacturing. It helped me to understand how practical approach is different from conventional methods. The internship was perfectly balanced by developing an individual in terms of technical knowledge, interpersonal communication and management skills. It helped me communicate better with various departments of the company. I got an opportunity to troubleshoot a real time problem. The company enhances the leadership qualities in you. Mentors help you improve your presentation and approaching skills at every stage. The internship makes you act as a perfect bridge between humans and technology. Start exploring various fields, don't limit yourself to a particular field. You can know yourself better only by exposing yourself to different working fields.

-Vyshnavi

My summer internship at PepsiCo had redefined me. The learning exposure that a fortune 50 company can give is incomparable with college education. This includes practical application of theoretical knowledge, leadership, interpersonal skills, ability to handle failure and criticism and not getting carried away by success and complements. I worked in a team of two in the beverage division. We had to troubleshoot servo motors in the plant using operating equipment guidelines and total productive maintenance techniques. This is a real life techno-management project whose value if implemented is beyond 30 lakhs INR. Corporate life is not a unicorn island. It has its downside. But friends, swim against the tide. It is extremely important to do an internship in our area of interest. An internship done right will be the first step for a glorified corporate career.

-Harshavardhini

## SIEMENS

My 45-day long internship was at Siemens, Mumbai in the low-voltage switchboard factory. Mine was a study project on the use of switchboards as Conventional as well as Intelligent Motor Control Centres. I was given a few Bill of Materials from which I had to figure out the components and study about them. My mentor was very helpful which made it easier for me to go about the project. I also made a lot of like-minded friends who were as enthusiastic about travelling as I was and thus we visited quite a lot of places. On the whole, it was a fun filled experience.

-Diptisikha



I did my internship at Siemens, Building Technologies Division, Bengaluru. I worked on the project "Energy Saving Opportunities at Various Facilities". It took three weeks to gain good understanding on the Building Technologies Portfolio and the different systems involved. I was dealing with Siemens Building Management System and various Control, Safety and Security systems. I was introduced to Siemens Demand Flow, a patented Chiller Plant Optimization Technology that produces 20% to 50% energy savings with rapid investment payback while reducing long term maintenance and extending the life of Chiller plant equipment. Later I had to interact with Chief Engineers of various facilities to understand what they do for energy conservation, how they tackle day-to-day energy challenges and what Performance and Energy Conservation steps they take in their facilities. It helped me gain knowledge about the Energy Market, understand the importance of Energy Audit and the role of Automation in Commercial Spaces, Tech Parks and Hospitality Buildings. Overall, it was a good experience.

-Sai Kishore

## **SCHLUMBERGER**

My internship at Schlumberger was an altogether different experience to say the least. I was posted in Navi Mumbai at the Nerul base office. The first thing that strikes you as you walk into the cubicle space is how space and sound the environment is. Oilfield is an unpredictable place and Schlumberger went out of its way to provide assistance and care for its employees and interns too. My project in the wireline segment demanded that I went through several pages and documents of important manuals and files to get a whole rounded understanding of the intrinsics of the oilfield services field. Learning these basics was very useful and fuelled my drive to chisel out the best version of my project. Surrounded by people from all over India, the cultural diversity you're exposed to is mind boggling. Moving around with different fellow interns was in my opinion, was the most joyful part of my 1 month rendezvous. Overall, it's indeed a once-in-a-lifetime opportunity to try a hand in something different.

-Nived

## **NVIDIA**

My summer internship was in Nvidia at Bangalore. I was into the Tegra team at Nvidia. During my internship, I had many training sessions on Perl, System Verilog and Machine Learning etc. Nvidia doesn't differentiate full time employees and interns. Every intern gets a chance to work on ongoing live projects. My project was related to Virtual Performance Monitors, which is used to measure performance parameters. Nvidia follows a 5 day schedule per week and it has flexible timings. Everyone should just meet the weekly targets. And every week, weekly sync-ups will be present with mentor and manager. The mentors were very supportive. Nvidia is a very good place to work for and to learn new things.

-Rekha

## **DR. REDDY'S LABORATORY**

My internship in Dr. Reddy's was different from what I expected. My project was in automation and control. I was asked to design a new Human machine interface for the blender machine in the company. I was mentored by four senior officials, in addition to the vendor head.



Periodic reviews helped me to complete the work in time and also understand things better. This internship helped me gain practical knowledge about how an organization works and also learn about vendor management which is very essential.

- Lalitha

I did my summer internship in Dr.Reddy's Laboratories at Hyderabad. The hiring process consisted of resume shortlisting, group discussion and interview. The first 3 days was an orientation program in their Leadership Academy. My project was mainly on automation. I worked on building the logic for programmable logic controllers(PLC) and developing front end designs of human machine interfaces(HMI). The internship was a wholesome experience. The work culture in the company was a conducive one for self-improvement. The managers and workers are equally approachable for any sort of help that was required. The HR team ensured I had a pleasant stay in Hyderabad and had a hassle-free experience during the 2 months. The company's motto of constant innovation and improvement ensures that you won't be doing a monotonous desk job. Practical application of the knowledge and tackling real life issues helped me learn the way engineering is applied in the pharmaceutical industry. All my doubts of what an electrical engineer would do in a pharmaceutical industry were erased. All in all, my internship at Dr.Reddy's was a fruitful, wonderful and enjoyable one.

- Ganesh

## RELIANCE

I interned at Reliance Industries Limited, Nagothane Manufacturing Division, Maharashtra. The internship duration was for 2 months starting from the 15th of May 2017. We were initially accommodated in the Reliance Guest House in Navi Mumbai due to a major shutdown going on for a month and in the township for the next month. My project topic was "Installation, Testing and Commissioning of UPS unit at RIL-NMD". I got to visit all the substations and check out the already installed UPS units. It was more of a study project due to the shutdown but I liked the overall work. The work culture at Reliance is very chilled. Apart from the project, as it goes, Mumbai is a heaven in summer and so, the stay was blissful with various recreational activities available in the guest house. Besides, there are a lot of places to visit in and around Mumbai. To conclude with, it was a fun and enriching experience which gave me some wonderful memories for lifetime.

-Snigdha





# FOREIGN RESEARCH INTERN

## University of Stuttgart, Germany

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I had been selected for the prestigious program of DAAD (Deutscher Akademischer Austauschdienst) WISE (Working Internships in Science and Engineering) scholarship for pursuing my research internship at Germany in the summer of 2017. I worked as an undergraduate research assistant on the project “Administration and Visualization of High Resolution Frequency data using Time Series Database for Analyzing the Dynamic Behavior of European power grid” under the guidance of Prof.Dr.Ing. Hendrik Lens, in the research group of ‘Power Generation and Automatic Control’ in IFK (Institut für Feuerungs- und Kraftwerkstechnik) at University of Stuttgart, Germany. My overall idea of research in Deutschland has changed drastically after my internship. The fully flexible work culture and ambience of the workplace helped in thinking out of the box to bring innovative and novel research ideas. The supervisor as well the PhD students were very supportive and friendly and helped a lot in getting accustomed with their work environment, equipment and systems. One is supposed to work 40 hours per week as per the work contract but this is not verified as long as he/she is able to get all the results perfectly within time and update every week’s research work’s progress. I completely enjoyed the coffee breaks which we had during the working hours and after a month when I became closer to the professor and PhD students, they used to switch their language from Deutsch to English so that I could understand what they were talking. I once prepared Indian dishes for the entire research group and we all enjoyed a lot having that during lunch. The overall experience (research as well as personal) was amazing and I would recommend all the research aspirants to apply for this program and have their first hands on experience on research work which is absolutely aimed towards Industrial development.

-Diptak Pal



## Technical University of Braunschweig, Germany

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I did a 12 week long research internship at the Institute of Electrical Machines, Traction and Drives, of the Technical University of Braunschweig, Germany through the renowned DAAD WISE Scholarship programme. I worked on a project to determine the efficient operating points of a Six-Phase Permanent Magnet Synchronous Motor built for an electric sports car. The project work involved modelling and carrying preliminary measurements for the machine in Finite Element Analysis software "Opera Vectorfields" followed by implementation of MTPA and appropriate flux-weakening control strategies for the same.

It was an incredible experience professionally and personally. The work culture was very encouraging, including numerous conversations with peers daily. Members of the research team were extremely warm and open to sharing and discussing different developments and ideas.

Particularly, I admired the efficient and punctual the public transport facilities since I had to use them extensively during my stay there for travelling and commuting purposes.

Also, the people in general, were very warm, welcoming and helpful. This made my stay there easy and enjoyable. I suggest juniors to apply for the same as the knowledge and learning one gains from an experience such as this can prove to be incomparable and very insightful. Also, having some basic knowledge in conversational German could be really helpful in various situations.

-Akshaya

## University of Southern California

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I did my summer internship in the department of Computer Science at Viterbi School of Engineering, University of Southern California (USC) for a period of two months. My travel and stay was sponsored by Viterbi-India Program. The objective of my project was to use a swarm of quadcopters to write text using light. It exploited the concept of persistence of vision of a digital camera (long exposure) to register the path the quadcopter flew along. I worked with one more intern on the project. Our task was to generate trajectories for the quadcopters that would make the quadcopters move along the required paths and avoid collision with other quadcopters. We worked on simulation for the first six weeks. Then we moved to implementing the same on the actual quadcopter swarm.

The work culture was amazing. We had meetings with our professor every week, who was extremely supportive. I had the chance to acquaint myself with the other interns sponsored by Viterbi-India Program. We had a perfect balance between work and fun. Being in Los Angeles meant we had a lot of places to visit in the weekends.

The overall experience was enriching and the amount of exposure I gained is immense. It also gave me an insight into how research in robotics is being carried out. For anyone who wants to pursue research, the platform provided by Viterbi-India Program is invaluable.

-Nanda Kishore



## **A\*STAR, Singapore**

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I recently did my intern in A\*STAR Singapore. A\*STAR is not an institute that is well known in India and I had my qualms about doing my research there but it turned out to be a very enlightening and enriching experience. I worked on the Improvement of the Institute's self designed counter using SMDs. I was involved in the designing and fabrication of the circuit from scratch. The project helped me realise my in-expertise and shortcomings in certain areas and hone my skills in electronics as well as software.

-Sahana

## **Nanyang Technological University, Singapore**

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This summer, I had the privilege to work on a project at the school of Computer Science and Engineering, Nanyang Technological University, Singapore. My project involved development of a generic neuro feedback training system for Brain computer interfaces. Brain computer interface is an interesting blend of neuroscience, coding, signal processing and machine learning. A Brain-Computer Interface (BCI) is a direct communication pathway between an enhanced or wired brain and an external device. BCIs acquire brain signals, analyse them and translate them into commands that are relayed to output devices that carry out the desired actions. Neurofeedback (NF) is a biofeedback technique that involves providing information to an individual about his or her brain activity in the form of visual, audio or tactile feedback, updated in real time. In my project, a preliminary neurofeedback training system for training Alpha and SMR brain waves was developed which can be used as a prior step in BCI experiments. This enhances the quality of the subject's brainwaves which improves the subject's performance in the experiment. The overall internship was amazing. NTU is a beautiful campus with very good infrastructure and efficient space utilisation. It provides a wonderful study environment for students. The people there are also very helpful and they never hesitate to guide you when you are lost. During leisure periods I set out to venture various parts of Singapore. A beautiful, well organised and meticulous country, Singapore has an amazing blend of different Asian cultures while granting the same feels of home. It was really interesting to try different cuisines (it's a haven if you are a seafood lover). Overall, it was an enriching and challenging experience, living alone, getting accustomed to a new environment etc. but it was an enjoyable ride and clearly one of the best summer breaks of my life!

-Asha

My internship experience was wholesome in Energy Research Institute of NTU(Nanyang Technological University), Singapore. My internship period was for 9 weeks which exposed me to a completely new way of work culture and living. I was working under a large team with several professors, research associates, project officers and co-interns. My project was titled "Energy Management System of Hybrid AC/DC Microgrids" and was implemented using commercial simulation



like CYME and ETAP. The work was closely related to the subjects of Power System Analysis, Protection and Switchgear. I had meetings on a nearly daily basis with my supervisors and weekly presentations which ensured systematic work flow. NTU provided me a lot of resources to work such as access to IEEE research papers, journal papers and library e-books which played an important role. NTU gave me a lot of opportunity to interact with a lot of international students which was a wonderful experience. The campus has a lot of amenities and a smooth transport system. A large Indian diaspora in Singapore ensured that I could find Indian food quite easily. I acquired this opportunity via an internship program called NTU-India Connect which selects a group of Indian (and NITT) students for 9 weeks of internship. I suggest everyone to keep a look out for that as it has a very good acceptance rate from NITT.

-Vivek Aditya

## **Christian-Albrechts-Universität zu Kiel, Kiel, Germany**

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We interned at the Power Electronics Chair of Christian-Albrechts-Universität zu Kiel in Kiel, Germany this summer. The Chair is one of the leading research centres in the world on power electronics and related fields such as micro-grids and smart transformers. The internship was not part of the DAAD WISE program so all the process, right from mailing the professors to obtaining the VISA had to be done by ourself and to be self funded.

One of our projects was based on Smart Transformers and was industrially termed as HEART ( Highly Efficient And Reliable smart Transformer ), a new Heart for the Electric Distribution System. It is a 5 year project (2014-2019) with an ERC Consolidator Grant (European Union) with a funding of 2 Million Euro. My part in the project was to create a control and communication algorithm for the Cascaded H bridge used in the Smart transformers with CAN (Controller Area Network) Protocol. The other's work was a part of an ongoing project which involves analysis and selection of power converter topologies for compact On-board battery chargers in Hybrid Electric Vehicles. It included conducting tests on a Gallium Nitride (GaN) device based Phase-Shift Full Bridge converter circuit prototype to address issues which reduce the efficiency. The work culture in Germany is primarily concerned only with your work and its related deadline. Everything else is left to the student's leisure. That gave us the liberty to travel the European continent without any boundaries. An EURail pass was our ticket to the canals of Amsterdam, Belgian Chocolates, the lights of Paris and other German cities like Berlin, Hamburg, Munich and Stuttgart. We were fortunate to feel the affection of Kiel by the famous Kiel week which hosts the world's largest sailing festival. We left for Germany with much scepticism as we were not at all equipped with the language of German. But the fellow colleagues made sure that it was never a barrier in our interaction and were kind enough to give us a glimpse of the language. Learning the language beforehand would be of great help during one's stay at Germany. Apart from getting acquainted with people of different cultures, we also learned to be independent in all aspects, from buying groceries to paying rent for our place of stay. Nonetheless this kind of an experience would surely be a kickstart to the enriching journey of adulthood and its responsibilities.

-Siddharth Nandhan and Sarath



# IEEE-Explained

For anyone stepping into the realm of Electrical and Electronics Engineering, IEEE(Institute of Electrical and Electronics Engineers) is the one stop shop for all the information you're going to need along the way. It is also for all those whiz kids out there to share your research with the EEE community.

## HISTORY

In the late 19th and early 20th century, there were two organizations called AIEE (American Institute of Electrical Engineers) and IRE (Institute of Radio Engineers). The former was involved in wired communications and power systems whereas the latter studied radio engineering. As the field of electronics grew after World War 2, the gap between these two fields were closed down and they became increasingly competitive. In order to avoid conflict, on January 1st, 1963, with their amalgamation, IEEE was born.

## LOGO

The IEEE logo is a diamond-shaped design which illustrates the right hand grip rule embedded in Benjamin Franklin's kite, and it was created at the time of the 1963 merger.

## FUNCTIONS

Major functions of the organization are:

- Major publisher of scientific journals and organizer of conferences, workshops, and symposia
- Standards development organization for the development of industrial standards
- Educational activities such as accreditation of electrical engineering programs in institutes of higher learning.

IEEE also manages an online digital library named IEEE Xplore. Access is restricted only to members, but our institute is a member, so you can access papers using NIT login credentials. If you write a paper, submit it to them and they find it interesting, you will be invited to present it before a panel of experts at an IEEE conference.



## MEMBERSHIP

There are many levels of memberships in IEEE that reflects on your achievements in the scientific community:

**-Student Members:** Student membership is available for a reduced fee to those who are enrolled in an accredited institution of higher education as undergraduate or graduate students in technology or engineering.

**-Graduate Student Members:** Graduate Student Membership is discounted but members at this level have greater privileges than Student Members.

**-Members:** Professional membership requires that the individual has graduated from a technology or engineering program of an appropriately accredited institution of higher education or has demonstrated professional competence in technology or engineering through at least six years of professional work experience.

**-Society Affiliates:** Some IEEE Societies allow a person who is not an IEEE member to become a Society Affiliate of a particular society within the IEEE, allowing a limited form of participation in the work of that particular Society.

**-Senior Members:** This is the highest level of recognition that a professional member can directly apply for. Applicants must have at least three letters of recommendation from Senior, Fellow, or Honorary members and fulfill other rigorous requirements of education, achievement, remarkable contribution, and experience in the field.

**-Fellow Members:** The Fellow grade of membership is the highest level of membership, and cannot be directly applied for ;the candidate must be nominated by others. The membership is conferred by the IEEE Board of Directors in recognition of extraordinary accomplishments in any of the IEEE fields of interest.

**-Honorary Members:** Individuals who are not IEEE members but have demonstrated exceptional contributions, such as being a recipient of an IEEE Medal of Honor, may receive Honorary Membership from the IEEE Board of Directors.

**-Life Members, Life Senior Members and Life Fellows:** Members who have reached the age of 65 and whose number of years of membership plus their age in years adds up to at least 100 are recognized as Life Members, Life Senior Members or Life Fellows, as appropriate.



# M.S. APPLICATIONS

Final year students opting for higher studies abroad usually have a lot of doubts regarding the application process. To make things easier, we have categorised the entire process into 7 steps.

1

## BEGIN THE JOURNEY

This is not a journey outward, but a journey inward. Keep calm, breath deep and ask yourself what you really want to study. This is vital because you are going to invest a substantial amount of money irrespective of which university you finally get into.

2

## HEAD HUNTING

Once you are sure about what you want to do, the next step is searching for relevant programs. While rankings aren't the only criteria, you could use websites like <https://www.topuniversities.com/university-rankings>. The best practice would be to consider the individual program courses and then decide.

3

## QUALIFYING EXAMS

All universities need students to take up the GRE and an English proficiency test (TOEFL or IELTS). While most universities don't have a minimum requirement for GRE score, they almost invariably do have a requirement for the TOEFL (or IELTS) exam. Be sure to use the free 4 universities they send scores to wisely.

4

## WORKING WITH THE FACULTY

All universities require applicants to have at least 2 letters of recommendation from their faculty/ project guides. Be sure to approach the faculty early for the recommendation letters as most of them have an upper limit as to how many they can give per student.

5

## STATEMENT OF PURPOSE

The Statement of Purpose (SoP) is a manifestation of how thorough you are about what you want to do. It is your chance to tell them who you are, what you are truly interested in and what you want to do in the university you are applying to. Be sure to have your SoP checked by a senior or two before submitting.

6

## RESUME / CV

While the NITT placements format is functional enough, it is not attractive enough when pitted in open competition. To have a killer looking resume, you can draft one using LaTeX. If the coding seems tedious, you can also check out formats available online on websites such as [www.overleaf.com](http://www.overleaf.com).

7

## FINAL SUBMISSION

The final application form, along with all the relevant documents (in the required format) should be submitted online. Be sure to conform to the deadline specified.



# RESEARCH INTERNSHIP OPPURTUNITIES

Let's first introspect on why we need to do a research internship. A research project or a research topic is something that has not yet been made available to the public. Every product around you right from your light to your smart phones was once a research topic and had to go through various iterations before becoming a product. Research internship is an opportunity for you to work on a project and invent or discover something new in the process. If your internship is fruitful enough, even a research paper can be published consisting of your findings.

A word of caution, it's better to pursue something that you love rather than something that is influenced by peer pressure or something that can add to your resume.

Given below are a few national and international research internships for Indian students, particularly for students from NIT. Stipend is applicable for all the below mentioned internships. (separate mailing to professors may or may not result in a stipend). Only SRFP is for second years, rest are for third years. Second years will have to mail profs in IIT and Ilsc and get an internship. In addition IIT Gandhinagar also provides an internship with stipend for second years.

## **Mitacs Globalink Research Internship:**

It's a research internship in Canada for a period of 12 weeks. You will be competing with students from various other countries. More than 2,000 projects are available for the students and hence you have a fair chance.

**Eligibility:** CGPA of 8/10 and above

- Registration to the Mitacs Globalink Portal. The registrations have already started for this academic year.
- Resume: You can choose to have your own Resume structure or follow the structure provided by Mitacs. It is better to follow the structure provided by them.
- A partial transcript upto 4th sem will have to be uploaded in the application process.
- There will be an optional English proficiency exam requirement, but it won't affect your chance of getting the internship in anyway.
- Statement of Purpose: The SOP for Mitacs will be split into three to four sections and you will have to fill each of them meticulously. You will have to adhere strictly to the word limit provided for each question. To complete this section you will have to introspect a lot and think about how your skills and attitude is unique when compared to others.
- One of the most important factors is choosing the projects. You will have to narrow down 7 projects from more than 2000 projects. A good combination of projects is vital for getting selected. There will have to be a trade-off between good university and good project. Choose a combination of good and moderate universities.
- 1 letter of recommendation
- Various other documents mentioned in application form



### **Viterbi-India Program:**

It's a research internship in University of Southern California, Viterbi for a period of 8 weeks. Only 20 odd students will be selected from across India.

**Eligibility:** CGPA of 8.5/10 and above, Only for Electrical and Computer Sciences (EEE, CS, ECE, ICE).

- Registration to the Viterbi-India Portal. The registrations close by November during your sem exams.
  - 2 letters of recommendation (one should be a prof who is aware of your scholarly abilities)
  - No objection Certificate from college
  - SOP split into 3 questions each with a maximum word limit of 1000 words.
- Various other documents mentioned in application form

# USC Viterbi

## School of Engineering

### **DAAD WISE Scholarship:**

It's a research internship in Germany for a period of 8 weeks. You will be competing with students from across India. Only 150 odd students will be selected. Closes by November during semester exams.

**Eligibility:** CGPA of 8.5/10 and above.

**Prerequisite:** Acceptance from a German professor

#### **Process:**

- Before applying for the process, you will have to mail to various German professors and should have a gotten acceptance from them. While mailing professors have a well structured cover letter and attach your Resume. Create a doc of shortlisted professors and follow up with the professors if they fail to respond. Optionally you can attach your transcript and recommendation letter.
- You may face a lot of rejections, but that shouldn't put out the fire inside you.
- No separate SOP needed as you will already have acceptance from a professor
- 1 letter of recommendation
- No objection Certificate from college
- Various other documents mentioned in application form





**SN BOSE:**

It's a research internship in any university of your choice in the USA for a period of 10 weeks. Closes by November during semester exams. Stipend will be provided.

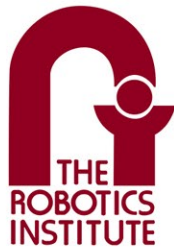
**Eligibility:** Only two people from each department recommended by our college can apply. Our college recommends people based on CGPA which means only the top two in each class will get recommended.

**Process:**

- SOP is split into two questions, each with a word limit of 1000 words.  
2 letters of recommendation (one should be a prof who is aware of your scholarly abilities)
- Transcript
- No objection Certificate from college
- Various other documents mentioned in application form

**Robotics Institute Summer Scholars Program:**

The most prestigious internship for students passionate about robotics. It's a research internship in Carnegie Mellon University – Robotics Institute for a period of 3 months. Only 30 students are chosen from around the world. Closes in even semester.

**Process:**

- SOP is with a word limit of 1000 words.
- You should mention the professors that you would like to work with. Mention a maximum of three professors.
- You will be required to choose three research areas in Robotics.
- 1 letter of recommendation, second LOR is optional
- Transcript
- Resume
- Various other documents mentioned in application form
- The details of the internships mentioned below will be available in their respective websites.

**Charpak:**

It's a research internship in France for a period of 2-3 months. You will be competing with students from across India. Closes only in the even semester.

**Eligibility:** No CGPA criteria

**Prerequisite:** Acceptance from a French professor



Before applying for the process, you will have to mail to professors from various universities across France and should have a gotten acceptance from them. While mailing professors have a well structured cover letter and attach your Resume. Create a doc of shortlisted professors and follow up with the professors if they fail to respond. Optionally you can attach your transcript and recommendation letter.

**University of Tokyo Research Internship: University of Tokyo, Japan**

One of the top 20 universities in the world. Mostly for natural and biological sciences, but electrical and computer science projects are also being pursued.

**A\*STAR** : Research internship at various labs in Singapore.

**CERN**: Internship related to computer science in CERN, Europe.

**Osaka University**: Mostly for pure sciences, but semiconductor physics is also being researched.

**NTU-India Connect**: NIT, Trichy had signed an MOU with NTU, Singapore to send 10 students from NIT to NTU to pursue research internship. The online form will open in even sem and there are some procedures that NIT, Trichy will want students to do.

**Summer Research Fellowship Program(SRPF)**: for Indian universities with professors who are members of the prestigious INSA (For both 2nd and 3rd years).

**Summer Fellowship Program(SFP) and Surge**: Internship at IIT Madras and IIT Kanpur respectively.

Due to limited funding and grants for international students, the foreign research internship opportunities are limited. But, you can land a foreign internship by mailing profs and you may get stipend. This is a highly recommended way for applying for internships.





# WORDS OF WISDOM

(for Third Years)

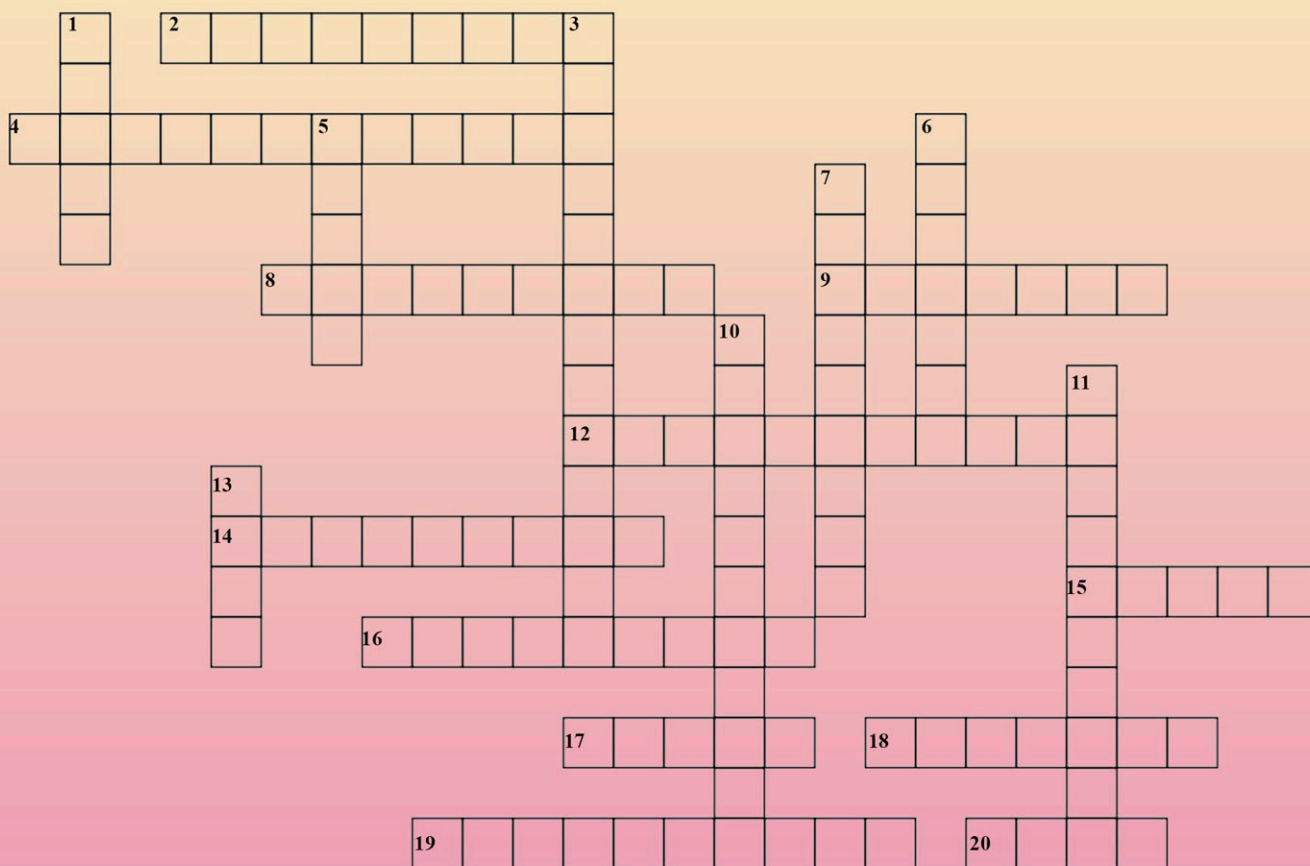
Company internships, Research internships, CPC's.....come pre-final year and these words suddenly gain importance in a student's life. While some may have a clear idea on what they want to do after graduation, a large number of people are still confused. Fret not, because at this stage, future plans keep changing. However, there are some points to keep in mind:

- Campus Placement Committee (CPC ) examinations are conducted in the sixth semester and appearing for them is a prerequisite for sitting for placements. Therefore, to be on the safer side, it is better to appear for these examinations even if you have planned to go for higher studies so that if you do not get a college of your choice, you have an option of sitting for placements.
- CPC examinations are designed to train students for placements. There are written tests( five different papers, namely aptitude, analog,digital,software and electrical), group discussions and interviews. To clear CPC's, one needs to pass in two profiles( apart from management) out of the three( electrical, electronics and software).
- If you pass CPC's, the Training and Placement Department will take the responsibility of getting you placed. In case you do not pass the CPC exams in the first attempt, re-CPC's will be conducted in July.
- If you haven't started preparing for placements, worry not. Decide which your area of interest is and make use of the winter vacations to study.
- For those who have landed an internship, a Pre-Placement Offer(PPO) is just a possibility. Therefore, do not stop your preparations.
- In case you get a PPO, you can neither reject it nor sit for other companies. Rejecting a PPO will lead to the student getting banned from the Placement Process. Therefore, be very careful.
- Electrical companies are easier to crack, but they pay less. Electronics companies, on the other hand, are difficult to crack, so prepare accordingly.
- Companies coming for electronics profile usually have a high CGPA cut-off. Keep this in mind while deciding the profile.
- By the beginning of final year, your resume should have at least one major project in your area of interest. Apart from the companies that visit campus and DAAD/MITACS, there are innumerable opportunities available for internships. Discuss with your seniors about the same.
- In case you land a job, you cannot leave it to go for higher studies. If you do so, you will not get a Letter of Recommendation.
- Group Discussions are also an important tool used for filtration by many companies. Apart from communication skills, body language also matters. Watch videos on YouTube to improve. As GD topics are mostly based on current affairs, read newspapers regularly.
- A resume is essential as it gives the interviewer a glimpse of who you are. Therefore, spend ample time on it. Ensure that it is of the right format and has no grammatical or spelling errors.
- Do not lie on your resume. Interviewers have years of experience so it is very difficult to fool them.
- For the questions asked in HR interviews, frame your answers beforehand. The list of such questions can be easily found on the internet.
- Decide by the beginning of final year whether you want to go for higher studies or sit for placements. It is near impossible to do both.
- You may face a lot of rejections, but never give up. Keep studying and putting in efforts. After all, fortune favours the brave.

**Good Luck!**



# CROSSWORD



## ACROSS

- 2 The effective resistance of an electric circuit or component to alternating current
- 4 Instrument used to display and analyze waveforms of electronic signals
- 8 Electrical grid which includes a variety of operational and energy measures
- 9 Flow of electric charge
- 12 Device that transfers electrical energy between two circuits by electromagnetic induction
- 14 Elementary building block of a digital circuit
- 15 Allows current passage in one direction
- 16 Device that stores electrical charge
- 17 Converts electrical energy to mechanical energy
- 18 The first digital, programmable robot
- 19 Amplifies electronic signals and electrical power
- 20 Switch that connects a common terminal to one or the other of two terminals

## DOWN

- 1 Father of modern technology
- 3 Force that causes attraction or repulsion of particles or objects because of their electric charge
- 5 DC-coupled high-gain electronic voltage amplifier with a differential input and, usually, a single-ended output
- 6 Device used to rotate an internal-combustion engine so as to initiate the engine's operation under its own power
- 7 Converts AC to DC current
- 10 AC Motor used for constant speed application
- 11 A construction base for prototyping of electronics
- 13 A cleaning agent used to prevent oxidation of the base and filler materials during soldering

**Answers:**  
**ACROSS**  
 2. Impedance 4. Oscilloscope 8. Smartgrid 9. Current 12. Transformer 14. Logic gate 15. Diode 16. Capacitor 17. Motor 18. Unimate 19. Transistor 20. SPDT  
**DOWN**  
 1. Tesla 3. Electrostatic 5. Opamp 6. Starter 7. Rectifier 10. Synchronous 11. Breadboard 13. Flux





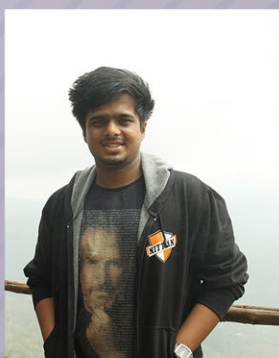
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