MINCHU

Newsletter

Department of Electrical & Electronics Engineering

Volume 2 | Issue 3 | Dec-2018

Vision and Mission of the Institute

Vision

- To be one of the premier Institutes of Engineering and Management education in the country.

Mission

- To provide Engineering and Management education that meets the needs of human resources in the country.
- To develop leadership qualities, team spirit and concern for environment in students.

Objectives

- To achieve educational goals as stated in the vision through the mission statements which depicts the distinctive characteristics of the Institution.
- To make teaching-learning process an enjoyable pursuit for the students and teachers.

Vision and Mission of the Department

Vision

- To be a premier department for education in Electrical and Electronics Engineering in the state of Karnataka, moulding students into professional Engineers.

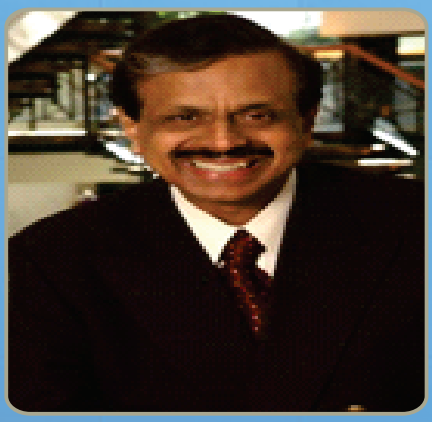
Mission

- To provide teaching/ learning facilities in Electrical and Electronics engineering better than prescribed by University for easy adaptation to industry and higher learning.
- To provide environment for self-learning to meet the challenges of changing technology and inculcate team spirit and leadership qualities to succeed in professional career.
- To empathize with the societal needs and environmental concerns in Electrical Engineering practices.

Program Educational Objectives (PEOs):

After 2/3 years of graduation, the students will have the ability to:

- Analyze, design and propose solutions in the field of Electrical and Electronics Engineering and adapt to changes in technology by self learning.
- Work effectively as individuals and exhibit leadership qualities in a team to meet the goals of the program or the organization.



This edition of Minchu is dedicated to the memory of **Dr. Prabha Kundur (1939-2018)**. He was a widely-known figure in the electric power industry holding senior level positions at Ontario Hydro and serving as president & CEO of Powertech Labs Inc., the research and technology subsidiary of BC Hydro. To his family, he was a source of great positivity, inspiration and generosity. His legacy will continue through the many students he has educated through his courses, papers and seminar book, through the colleagues he has mentored and supported over the decades and through his family whom he has inspired to live with a strong sense of purpose and service.

CONTENTS

B. N. M. Institute of Technology

(Approved by AICTE, Affiliated to VTU, Accredited as grade A Institution by NAAC

All UG branches - CSE, ECE, EEE, ISE & Mech.E Accredited by NBA for academic years 2018-19 to 2020-21 & valid upto 30.06.2021)

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Vidyaya Amrutham Ashnuthe

EDITOR'S DESK

Dear Readers,

MINCHU, the newsletter of the department of Electrical and Electronics Engineering has come alive for its 2nd volume and 3rd edition with the active support of the management, faculty and the editorial team.

This edition of the newsletter provided us a chance to reflect on what the department has achieved in the past six months. It has also given us the opportunity to present and share knowledge acquired either through the realm of education or otherwise.

Considering the increase in the application of Artificial Intelligence in Electrical Power Systems, we chose this area as the basis on which the articles are presented. The authors have taken great care to cover trending research aspects of Power Systems and Machine Learning, making them informative and interesting.

John Wooden rightly said, "*The main ingredient of stardom is the rest of the team*". Apropos, we would like to thank everyone who travelled, guided and supported us in this endeavor. Wishing the readers, a very happy reading.

Editorial Team

"Department of EEE has been accredited by National Board of Accreditation (NBA) for 3 years (2018 - 2021)"

ABOUT THE DEPARTMENT

Soon after starting in the year 2002, within a short span of time, the Electrical Department of BNMIT got a respectable name both in region and state. The Department of Electrical Engineering offers an undergraduate course in Electrical and Electronics Engineering and postgraduate course in Computer Applications in Industrial Drives. The programs offer technical insights directly to the students with backgrounds in industrial and societal needs.

The faculties of Electrical Engineering are blessed with highly acclaimed individuals with the skill set, covering a wide area of industrial research. They endure that the courses foster deeper learning and increased engagement amongst the students. Such commitments from our fraternity not only gives our graduates an edge in deciding which career path is right for them but also guarantees that by the time they graduate with a degree, they will have hours of hands-on, real-world experience in Electrical and Electronics Engineering.

The department takes pride itself on connecting its students with research, scholarships, internships, fellowships and local industry as soon as they step inside the building on the first day of college. In EEE Department freshsers are engaged in hands-on, project-based activities while studying topics in Electrical and Electronics Engineering even in the very first semester.

There's always something exciting happening in the campus of BNMIT. There are student co-ordinators making their presence felt and making those events successful. The project funding provided by NewGen Innovation and Entrepreneurship Development Centre has added motivation for our students. As an additional feather to our crown, the department of EEE has been accredited by the National Board of Accreditation (NBA) quite recently. Undeniably, under the able guidance of Dr. R V Parimala, HOD, bright days are coming ahead.

DEDICATED TO THE MEMORY OF PROFESSOR PRABHA S KUNDUR

Dr. Prabha S. Kundur was a prominent and well-known personality in the electric power industry. He was most recently President of Kundur Power System Solutions Inc., where he performed international consultation and delivered advanced level technical courses for utilities, manufacturers and universities around the world. Dr. Kundur is the author of the book, *Power Stability and Control*, which is the standard reference of that subject and is being used by academicians and practicing engineers worldwide. Hence it is considered an industry classic.

Born in Bangalore India, Dr. Kundur studied Electrical Engineering, obtaining a B.E. degree in 1959 from Mysore University and M.E. degree in 1961 from the Indian Institute for Science. On a Commonwealth Scholarship, he began his studies in Canada in 1963. He obtained an MASc Degree in 1965 and Ph.D. in 1967 in Electrical Engineering from the University of Toronto.

For over 40 years, he created and developed technology that has made the operation of large-scale inter-connected power systems more safe, secure, and reliable. Dr. Kundur's development and validation of comprehensive power plant models for dynamic analysis and control design have been incorporated in software packages that address transient stability, small signal stability, voltage stability, and dynamic reduction for large-scale power systems. Dr. Kundur served as Adjunct Professor at the University of Toronto (1979 to 2017), University of British Columbia (1994 to 2006), University of Manitoba (2006 to 2017) and Western University (1991 to 1999).

Dr. Kundur was an IEEE Life Fellow. He has chaired numerous committees and working groups of IEEE Power and Energy Society. As an IEEE distinguished lecturer, he has given lectures on "Sustainable Electric Power Systems in the 21st Century" in many countries around the world. He is also a recipient of awards such as the Nikola Tesla Award - 1997 and the Charles Concordia Power System Engineering Award - 2005.

He served as the Chairman of the CIGRE Study Committee C4 on “System Technical Performance” from 2002 to 2006. He was the recipient of the CIGRE Technical Committee Award in 1999. He was bestowed by CIGRE title of Honorary Member in 2006.

Dr. Kundur has been an excellent mentor and teacher to many people, who fondly remember him to this day. We, the newsletter committee of the Department of Electrical and Electronics Engineering, BNMIT, dedicate this edition of *Minchu* to him, recognizing his unflagging efforts and outstanding achievements in the field of Power Systems.

TECHNICAL ARTICLES

Machine Learning: An Exciting Beginning

WHAT IS MACHINE LEARNING?

Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it to learn for themselves.

History

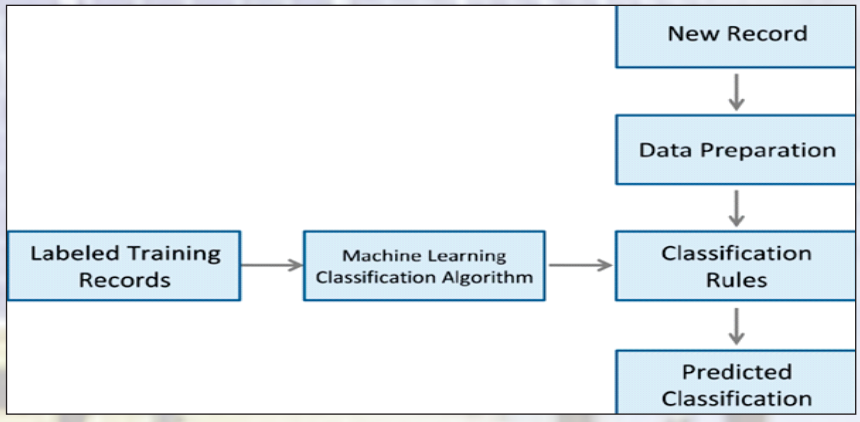
It was in 1940s when the first manually operated computer system ENIAC was invented. At that time, the word “computer” was being used as a name for a human with intensive numerical computation capabilities, so, ENIAC was called a numerical computing machine! In the 1950s, we saw the first computer game program claimed to beat the checkers’ world champion. This program helped checkers players a lot in improving their skills! At the same time, Frank Rosenblatt invented the Perceptron which was a very simple classifier but when it was combined in large numbers in a network, it became a powerful monster. Well, monster is relative to the time and in that time, it was a real breakthrough. Then we see several years of stagnation of the neural network field due to its difficulties in solving certain problems. Thanks to statistics that machine learning became very famous in 1990s. The intersection of computer science and statistics gave birth to probabilistic approaches in AI. This shifted the field further toward data-driven approaches.

Present Day Challenges:

If we break down the typical machine learning project into its stages, it becomes immediately obvious that the learning part is a single step out of many that all together makes for a successful launch. High value predictive use cases must be identified with plenty of involvement from business analysts and domain experts. As a first step, the chosen cases must be stated as logical learnable problems. Data from disparate sources must be corralled, cleaned and conditioned before it gets fed to the tools that can efficiently train generalizable models.

There are many challenges in using machine learning. Let us discuss some of the big challenges faced in machine learning. Supervised machine learning works very well in the present days. But, if we don't know the labels of the data then we try to solve it by using the data available on the internet. This data is unlabelled data which is a big breakthrough. This unlabelled data is not helpful in any way because the actual machine learning goes on a completely labelled basis. This is one of the major challenges being faced in machine learning in the present day.

The other problem is the artificial neural networking. The Artificial Neural Networks are algorithms of machine learning inspired by the way, the human brain works. These are made of individual virtual neurons that are connected to one another with edges just like the neurons in our brain are connected by synapses. As we train the artificial neural networks with data, the so called back propagation algorithm adjusts the strength of the links between the neurons in the right way. These artificial neural networks have become state of art for many of the classical machine learning problems like face detection, natural language processing, translations, driving cars etc. But the artificial neural networks which work so well in practice are difficult theoretical questions. Is there no solution for this problem? Or will the solution be found five years down the line? Well we justify the statement; nobody really can because no one really understood why neural networks work so well. We can't really make any theoretical statements of how the neural networks work. This is a challenge that people are trying to work at present.



Stages Involved in Machine Learning

The other challenge is that machine learning works particularly on the program given to it. If we design it to distinguish it a cat and a dog, we can't use the same program to identify any other object or image. Machine learning is very specific. It's a challenge to train these networks to do other jobs. The last challenge will be creating these networks on a larger system. This helps it collect larger data, which in turn helps in improving the reliability of the machine learning networks. This not only requires more data but also requires sophisticated means to do many jobs with just one code.

Conclusion

This article gives details about the history of machine learning and the challenges faced by machine learning in the present days.

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Digitization of the Indian Grid

"After a storm comes calm" is not the case for power systems. The increasing trend of natural disasters and emerging security threats, call for devising efficient strategies for pre and post-disaster management of the power infrastructure. There are several types of external shocks to the power grid, most notably extreme events which include adverse weather events and natural disasters that are known to cause considerable negative impacts not only on the system itself but also on the society in general.

Resilience denotes the capability of a system to absorb and to adapt to external shocks, which is an important characteristic expected from critical lifeline systems such as electric power grids. A resilient power system encounters minimum possible outages and will quickly return to its normal operating state. Mitigating the aftermath of disasters by improving the power grid resilience, as one of the critical lifeline systems, is of utmost importance for utility companies and governments.

Grid operators commonly face two challenges in response to the damaged power grid due to disasters: first, in planning stage to design more reliable networks, and the second, in operation stage which they attempt to manage the restoration process in an efficient way. Smart distribution systems establish micro-grids and apply smart grid to the establishments for managing 1) Storage technologies, 2) Demand-responsive proactive consumers, and 3) Decentralized control of energy resources and distribution feeders resulting from the formation of micro-grids.

Micro-grids are often connected to distribution feeders and offer load and generation control to provide continuity of supply in the event of utility grid disturbances. Such micro-grid control has a hierarchical structure for enhancing the security, controllability and flexibility of distribution network operations. Micro-grids can be operated in a grid-connected mode, in which their loads are partially supplied by the distribution system, or in an island mode in which the local generation supplies the entire micro-grid load in case of a major outage at the utility distribution system.

The digitization of the Indian grid is well underway with focused efforts now on digitalization, including real-time control and asset management—which is all important for self-healing. The National Smart Grid Mission is creating a wider awareness of this concept across diverse locations. With greater focus on power distribution, utilities are now deploying self-healing concepts using artificial intelligence in densely populated metros such as Mumbai and New Delhi to reduce the time taken for power restoration to less than a minute. That too, with minimal or no human intervention, thus reducing the impact of hurdles like geographical challenges. By efficiently managing their assets, utilities can better cope with the continually changing world of distribution—improving reliability and efficiency for reducing the impact of outages.

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The Rise of the Smart Grid

A smart grid is an electricity network based on digital technology that is used to supply electricity to consumers via two-way digital communication. This system allows for monitoring, analysis, control and communication within the supply chain to help improve efficiency, reduce energy consumption and cost, and maximize the transparency and reliability of the energy supply chain. The smart grid was introduced with the aim of overcoming the weaknesses of conventional electrical grids by using smart net meters.

As numerous sensors, such as Smart Meters and Phase Measurement Units (PMU's), continue to be added to the grid, the emerging information collected is becoming a valuable source to researchers and grid operators who seek to conduct advanced analytics on the smart grid. This system combines the latest machine learning and big data analytics techniques with the domain knowledge of the smart grid to explore the added value of the emerging power system data.

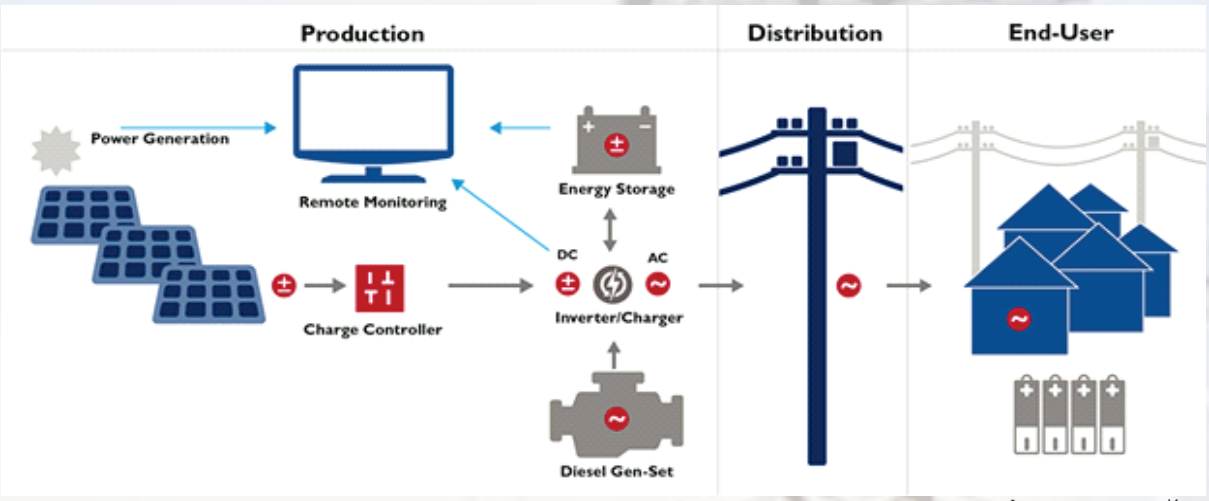

Image courtesy –www.usaid.gov

What Makes a Grid "Smart"?

The concept of machine learning or artificial intelligence plays an important role in making a grid smart. The most transformative application of machine learning for grid balancing comes from unlocking and utilizing flexibility in demand-side power consumption. Such algorithms can find creative ways to reschedule the power consumption of many demand and generation assets in synchrony to keep the grid in balance while helping to minimize the cost of consuming that power for energy users.

In recent times, Artificial Neural Networks (ANN) is finding increased applications in the power grid management. Electric power systems can be classified in multiple different ways: non-linear, dynamic, discrete, or random. Artificial Neural Networks attempt to solve the most difficult of these problems, the non-linear problems.

Demand Forecasting.

One application of ANNs is in demand forecasting. In order to operate grids economically and reliably, demand forecasting is essential, because it is used to predict the amount of power that will be consumed by the load. This is dependent on weather conditions, type of day, random events, incidents, etc. For non-linear loads though, the load profile isn't smooth and as predictable, resulting in higher uncertainty and less accuracy using the traditional Artificial Intelligence models. Some factors that ANNs consider when developing these sort of models: classification of load profiles of different customer classes based on the consumption of electricity, increased responsiveness of demand to predict real time electricity prices as compared to conventional grids, the need to input past demand as different components, such as peak load, base load, valley load, average load, etc. instead of joining them into a single input, and lastly, the dependence of the type on specific input variables. An example of the last case would be given the type of day, whether its weekday or weekend, that wouldn't have much of an effect on Hospital grids, but it'd be a big factor in resident housing grids' load profile.

This article offers commentaries on the smart grid and some of its aspects followed by a non-exhaustive sample of new research directions as perceived by its author.

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Graph Theory in Power system

Development! How is development possible??? Do we need a base??? Yes the meaning of development itself says "to grow and become more mature, advanced, or to elaborate". In other words you have something at hand and you need to take it to the next

In the process of development is there a need to incorporate different field together to achieve a better optimized and economist's outputs?? In this world every field is interrelated. For example, a mechanical engineer need to have knowledge regarding electrical motors. Similarly, in electrical power system we implement mathematics and artificial intelligence.

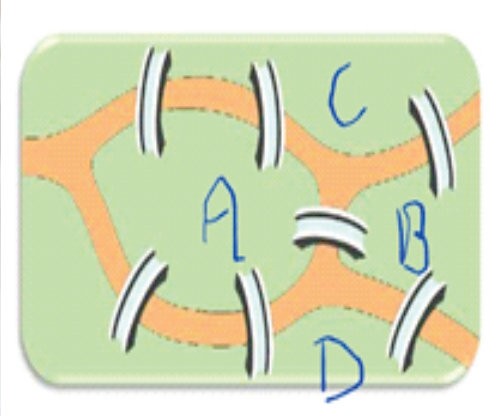

Fig 1

Graph theory is a graphical representation of a set of objects which are connected by links. The Seven Bridges of Königsberg (fig.1) is a historically notable problem in mathematics. Its negative resolution by Leonhard Euler in 1736 laid the foundations of graph theory and prefigured the idea of topology. According to the problem, there are four pieces of land A, B, C and D connected by seven bridges. Now, the task is to start at one island, cross over each bridge only once and come back to the island you started. Well if it sounds easy, why don't you try it?

After you have given it several tries, it seems impossible but Euler provided the solution. Now let's assume each land mass with an abstract "vertex" or node, and each bridge with an abstract connection, an "edge", which only serves to record which pair of vertices (land masses) is connected by that bridge. The resulting mathematical structure is called a “graph”.

However, all four of the land masses in the original problem are touched by an odd number of bridges (one is touched by 5 bridges and each of the other three is touched by 3). Since, at most, two land masses can serve as the endpoints of a walk, the proposition of a walk traversing each bridge once, leads to a contradiction.

Euler showed the possibility of a walk through a graph, traversing each edge exactly once, depends on the degrees of the nodes. The degree of a node is the number of edges touching it. Euler's argument shows that a necessary condition for the walk of the desired form is that the graph be connected and have exactly zero or two nodes of odd degree. This condition turns out also to be sufficient result stated by Euler and later proved by Carl Hierholzer. Such a walk is now called an Eulerian path or Euler walk in his honour. Further, if there are nodes of odd degree, then any Eulerian path will start at one of them and end at the other. Since, the graph corresponding to historical Königsberg has four nodes of odd degree, it cannot have an Eulerian path.

Now let's apply this into power system consider any network representing all the buses as nodes and all the transmission or distribution lines as edges. Now doesn't it feel look easy to solve. Each edge can be given weighting in electrical terms the impedance or admittance of the transmission lines. We can design a network which is optimum and economic by Euler's rules.

In the beginning of this article, we said that we were going to see the relation between power system, graph theory and machine learning. Now, we know how graph theory simplifies our work; what role does machine learning have??? Let's give an example: Consider a system with multiple sources and multiple sinks just like our one grid system of India. If a fault occurs at a point and the power to the loads connected to the fault point are shut down that would be the best and economic alternative path available to power up the lost sink, obtained by graph theory. Machine learning helps to achieve this by automatically predicting the fault beforehand by the enormous amount of data available and prepare for the alternative path connections.

To sum up all the above lines, Graph theory is used to solve the problems related to the electrical system and provide data to machine learning which studies the data, learns from it and prepares our system to overcome the difficulties.

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DEPARTMENT ACTIVITIES

Workshop

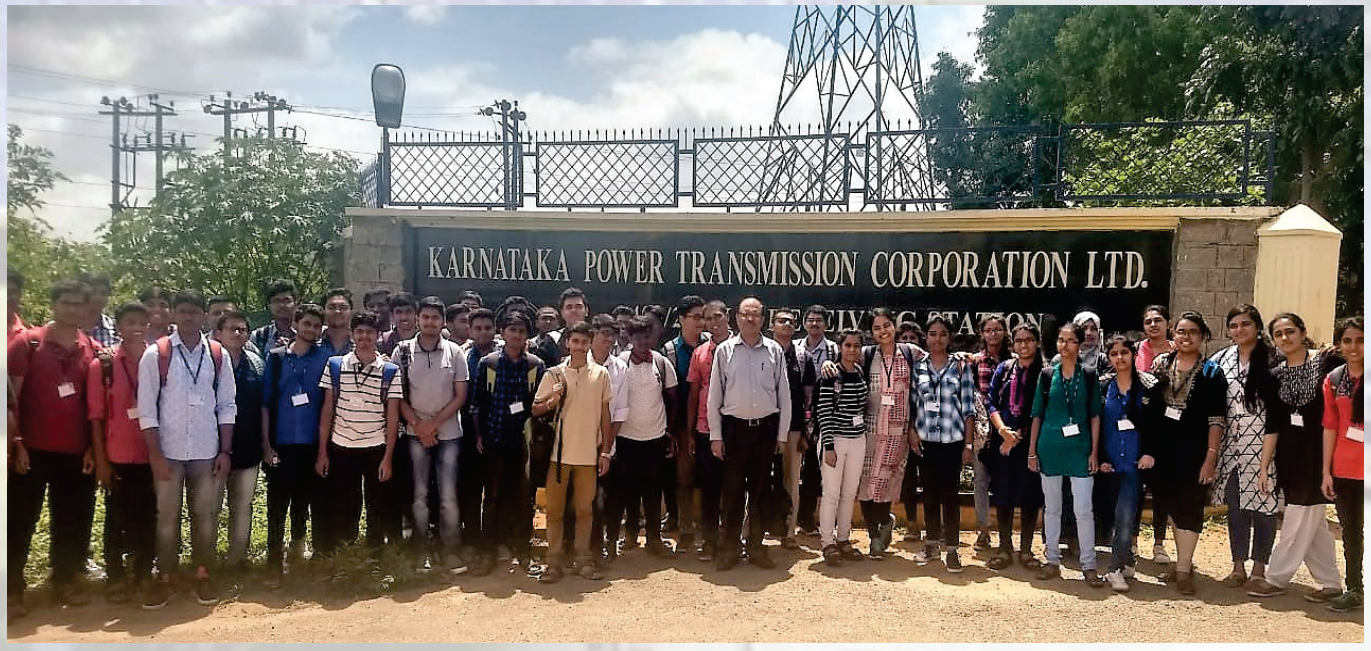
A workshop on **"Design & Development of Embedded Systems for Real Life Application"** was organized by the department of EEE, BNMIT, sponsored by NSTEDB, DST, Govt. of India from 10th to 13th of July 2018 for the 5th semester EEE students.

Sri. Sreenivasa Setty, CTO & Founder, SST Technologies, Bengaluru provided hands-on training to the students on installation of Aurdino IDE and interface of Aurdino with various applications (10th – 11th July, 2018). Sri. Hayavadan V Panchamukhi, M/s TechKnow labs consulting, Bengaluru provided training on MSP430 EVMs (12th – 13th July, 2018).

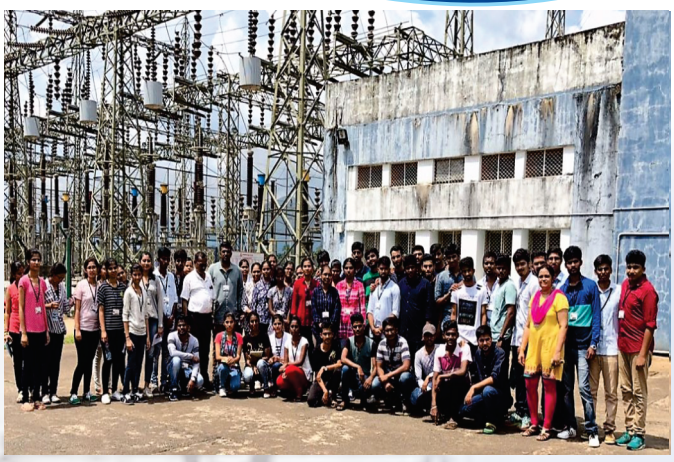
Sri.Sreenivasa Setty Addressing the Students during the Workshop

Sri.Hayavadan V Panchamukhi Interacting with Students during the Workshop

Industrial Visit



The students of 1st Sem, EEE visited 400/220kV receiving station, Nelamangala on Tuesday 21st August, 2018 as a part of their first year induction program.



The 5th Sem students of EEE department visited Varahi powerhouse, Kadra powerhouse and Supa powerhouse as a part of their industrial visit from 28th September - 2nd October, 2018.

An Industrial visit to Solar Power Park at Pavagada was organized on 13th November, 2018 for 7th Sem students. The capacity of solar power park is 20MW with an area covering around 40 - acre. The visit is to empower students' insight on the working and operation of the solar power plant.

Seminal Talk

Mr. Prakash Magal, Founder Director, ENERTECH Technologies, Bengaluru Chief Guest for FCD function with Dr. R.V. Parimala, HoD, Dept of EEE

Mr. Prakash Magal delivering technical talk to students

A technical talk on **"A Review on Renewable & Non-renewable Sources of Energy"** by Mr. Prakash Magal, Founder Director, ENERTECH Technologies, Bengaluru, was organized by the Department of EEE, BNMIT under ISTE student chapter on 26th October, 2018. The students securing First Class with Distinction (FCD) in VTU exams of June/July 2018 were felicitated with a memento by the chief guest.

FACULTY ACHIEVEMENTS

- **Sri. Venkatesha K,** Associate Professor, Dept. of Electrical & Electronics Engineering had successfully defended his Ph.D. research work under Visvesvaraya Technological University entitled "**Modeling and Design of Single Phase and Three Phase Bi-directional AC/AC Converter for Power Quality Improvement Using FPGA Real Time Controller**" on 22nd December 2018.

- **Smt. Priyashree S,** Associate Professor, Dept. of Electrical & Electronics Engineering has submitted Ph.D. thesis titled "**The Mathematical Modeling and Power Quality Improvement for Industrial Furnaces**" to Visvesvaraya Technological University and waiting for final defense viva.

STUDENTS' ACHIEVEMENTS

- **BNM Institute of Technology secured First place amongst 212 colleges across Karnataka** in VTU Youth Fest held at BKIT, Bhalki from 2nd - 4th November, 2018.

- **Arpitha B M** of 7th Sem, EEE secured First place in Folk/Tribal Dance (Group), Third place in One Act Play and participated in Skit in VTU Youth Fest held at BKIT, Bhalki from 2nd - 4th November, 2018.

- **Shobhita Rajashekar** of 7th Sem, EEE participated in Installation and secured a Second place in Western Group Song in VTU Youth Fest held at BKIT, Bhalki from 2nd - 4th November, 2018.

- **Bhavana C** of 3rd Sem, EEE won KATA (Individual) & KUMITE (Team) events in Inter DOJO Karate Championships held at Rashtrotthana Yogic Sciences & Research Institute on 1st & 2nd December, 2018.

- **Suparna Bose** of 7th Sem presented a paper on "Green Campus Initiative", Idea Conclave for Better Bengaluru held on 2nd & 3rd of November, 2018 at M.S.Ramaiah College of Arts, Science and Commerce, Bengaluru.

- **Bhavana C** of 3rd Sem, EEE secured runner-up in Throw Ball Inter-collegiate held at Vemana Institute of Technology, Bangalore on 9th & 10th October, 2018.

- **Nishanth S** of 7th Sem, EEE secured runner-up in 100 mts & 200 mts breast stroke Inter-collegiate Swimming Competition held at BMSCE, Bangalore on 3rd & 4th October, 2018

- **Swetha S** of 7th Sem, EEE secured first place in Prof. Mukherjee Memorial Table-tennis Tournament at BMSCE held from 20th - 24th September, 2018.

- **Swetha S** of 7th Sem, EEE secured runner-up in Inter-zonal Table-tennis Tournament at Sapthagiri College of Engineering on 6th & 7th September, 2018.

- **Swetha S** of 7th Sem, EEE secured first place in Inter-collegiate Table-tennis zonal Tournament at BNMIT on 3rd & 4th September, 2018.

- **Harshitha T A, Divyashree N** of 3rd Sem, EEE secured silver medal in Karnataka state Inter-school, Inter-collegiate and open category 10 mts, Open Sight Air Rifle Competition under - 19 girls (Team) category organized by Seshadripuram Institute of Commerce and Management, Bangalore from 27th – 29th August, 2018.

- **Sanjeev B** of 3rd Sem, EEE secured a silver medal in Karnataka State Inter-school, Inter-collegiate and Open category 10 mts, Open Sight Air Rifle Competition under - 23 (Mix Team) category organized by Seshadripuram Institute of Commerce and Management, Bangalore from 27th – 29th August, 2018.

- **Krithika K V** of 3rd Sem, EEE secured bronze medal in Karnataka State Inter-school, Inter-collegiate and Open category 10 mts, Open Sight Air Rifle Competition in under 19 girls (Individual) category organized by Seshadripuram Institute of Commerce and Management, Bangalore from 27th – 29th August, 2018

- **Bhavana C** of 3rd Sem, EEE represented Karnataka state and won KATA event (above 18 years category) in All India Hakuakai Open Karate Championship, 2018 held at Koramangala Indoor Stadium on 11th &12th August, 2018.

EDITORIAL TEAM

Faculty

Dr. S. Sudalai Shunmugam, Associate Professor
Smt. Ashwini A, Assistant Professor

Students

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Namya C A, V Sem
B Sanjeev, III Sem

For your kind suggestions & advice, kindly email to: ashwiniasrinivas@gmail.com