



**ECE Department of HITK presents**

# AMPERE

*Talents Amplified Problems Rectified*

**SEPTEMBER, 2019**



## Vision

The degree holders of the department will carry the image of the institute and the department in India and the world through their commitment and success. They will prove themselves to be good, sincere and successful professionals and teachers. They will prove themselves as good, caring and responsible citizens.

## Mission

Students with degrees from Electronics and Communication Engineering (ECE) will:-

- acquire specialized knowledge in the desired domains
- be able to analyse any problem and solve it in a cost-effective way
- have confidence and knowledge to start new business activities and show entrepreneurship skills
- develop passion for more studies and R & D
- inherit leadership qualities for society and workplace

## From the HOD's desk:



It is once more time for our own Ampere. The whole department looks forward to the publication of this magazine eagerly. It provides a platform for everyone of the department to express his or her thought, creative expressions, new dreams.

I thank everyone involved for the effort. I appreciate the endeavour since I have some idea about what it entails to bring out a quality publication like Ampere.

Best of luck,

**Prof. (Dr.) Prabir Banerjee**  
**Head, ECE Department**

# Mentors' Message

## ➤ Message from Prof. Sayantani Datta:

“Congratulations to this Editorial Team! Without your involvement and dedication, this second edition of ECE e-Magazine would have never seen the light of the day. Do continue with your efforts involving students from junior batches. Wishing u all the best.”



## ➤ Message from Prof. Siladitya Sen:

“I am extremely pleased to congratulate this editorial board who has taken great pains to make this project a reality. I do hope they continue with their efforts and pass on the baton to their juniors to make this ECE e-Magazine a continuous process. Best of luck!”



## Editor's Message:

It's been a real pleasure to work for the Department, to work for our own people. We are much delighted to launch **Ampere**, a bi-annual magazine that shows the work, passion and dedication of the students of ECE department of HITK.

This magazine mainly focusses on the achievements of the faculty members and students of the department who are interested in presenting the new ideas in front of the world.

We thank the adroit and diligent Associate Editors, Graphic designer and the Writers who have made this magazine possible.

We wish to see Ampere develop more and achieving more success in the upcoming years. It will be a real success for the team when you give the honest response. We would really appreciate your feedback.

Thanking you,

Chief Editors :

Ankit Kumar[ECE 3rd Year]

Supriya Maji[ECE 3rd Year]

## **MEMBERS OF THE EDITORIAL BOARD:**

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The background features a complex network of glowing blue circuit traces and particles. The traces are composed of thin, interconnected lines that form a dense, maze-like pattern. Small, bright blue dots and larger, glowing spheres are scattered throughout, creating a sense of depth and movement. The overall color palette is a range of blues, from deep navy to bright cyan, with a soft glow emanating from the central text area.

# CONNECTING WITH ELECTRONICS



# Cognitive Radios – the radios with brains

---Prof. (Dr.) Prabir Banerjee

Head, ECE Department

A time has come when life cannot be thought of without communication or more precisely wireless communication. We are used to communicate on the move, we see streaming videos while travelling in a bus or car or train, we talk to our relatives and friends at the other end of the globe effortlessly. Curiously, the situation was not so even fifty years or so ago. People were used to wireless communication courtesy exclusive radio receivers in some homes.

A radio, by popular notion, was taken to be a radio receiver which could receive wireless communication, broadcast from stations far apart. The earlier generation radios required antennae, which had to be spread across the rooms- from one corner to another for good reception. It was necessitated by the fact that radio stations used very low frequencies (Medium wave band) and as we know, the antenna dimension has a direct relationship with the frequency of the channel.

The MW bands used amplitude modulation (AM) technique and the links were vulnerable to static and any man-made electrical noise. The success of frequency modulation (FM) technique enhanced the popularity of radios. The private use of radios started around 1980 and the license fee for use of frequency was abnormally high. Still, the use of wireless communication caught the imagination of people and the demand for wireless communication increased

phenomenally within the first 2 decades. The pressure on available radio frequency spectrum was tremendous.

On one hand, the technology for radios was evolving and on the other the solution for frequency scarcity was being searched for.

The invention of microprocessors and controllers and matching memory technology in the 80's paved the way for development of software controlled radios. The end 90's saw the arrival of software defined radios. This family welcomed the idea of reconfiguring the hardware (by use of FPGAs) as per field requirement.

The demand for more and more channels for use led to the development of the idea of frequency reuse in end 80's itself and culminated in the cellular radios. It was preceded briefly by the introduction of Pagers in mid 80's. The exorbitant price of cellular radios and the call rates slowed the arrival of cellular radios in India. The GSM models were launched in India in mid 90's, almost 5 years after global launch. Once they became aware of the benefits of fast and reliable mobile communication, there was no stopping the craze for the latest technologies in the wireless communication domain.

However, it was only the beginning for thinking about new applications, development of Ad Hoc networks, Wi-Fi LANs and so on. The result was very high density of radio transmitters and receivers. It was causing radio frequency interference and the reliability of radio communication suffered.

The scientists and radio engineers were working frantically to overcome the challenges, huge number of radio users were generating. They thought of a radio design which will be cognitive. Cognition means that a thing can take a decision on its own based on ambient conditions. Now, what was the logic behind developing

such a radio, which will be able to overcome the interference problem among many other problems.

Obviously, the design will be by human beings. So, the intelligent radio must have a processing and decision making capability to choose a particular mode from amongst many possibilities.

Let us take an example. A radio has 4 operating radio frequency channels and it finds that the default channel 1 has strong interference. The quality of service is, therefore, very poor. In old classical design, there would have been no solution to it and the radio had to wait till the channel became free from external interference. But in the cognitive radio concept, the radio will check on its own the performance on other channels and will be able to select the best channel at the same time directing the paired radios to switch to the new, common channel. It is just one of the exciting possibilities for a cognitive radio. It is a vast subject already and ripe for research work.

The GSM was the first fully digital technology and it was based on 2G standard. Now, we are on the verge of 5G technology. In about 30 years, we have travelled from 1G to 4G. The next 30 years will definitely see more exciting activities and developments because communication is the lifeline of present civilization.

# Evolution of Electronics

---Shreeparna Debnath

ECE-A 3<sup>rd</sup> Year

## **DO YOU KNOW HOW ELECTRONICS EVOLVED?**

It is very difficult to predict how old electronics is. In the 21<sup>st</sup> century we are enjoying the blessings of well developed electronics that made our life easier and comfortable. So, it is in fact necessary to know the past. The history of any scientific invention inspires its current and future generations. This electronic world was not just the effort of some years or decades, rather it is the result of hardwork of numerous great minds since hundred of years.

### History of Electronics

Pre- Historical Era

Historical Era

#### i. Pre-Historical Era

- In around 600 BC, Thales of Melitus, a Greek philosopher discovered the phenomenon of attraction, by rubbing together Loadstone and Amber.
- In 1600 AD, English Scientist William Gilber coined a new latin word "electricus" from Greek word for Amber "elektron", from which later the word "Electricity" evolved.
- In 1831 AD, English Scientist Michael Faraday discovered "Electromagnetic Induction" which is the basic working principle of generators, motors and transformers.
- In 1879 AD, Thomas Alva Edison invented the most stable and reliable form Electric Bulb and patented it in USA.

#### i. Historical Era

### Vacuum Tube Electronics

- The history of Electronic begins with the invention of two terminal vacuum tube – the diode by James Ambrose Fleming in 1904, which is used as a rectifier.
- In 1906, American inventor Lee De Forest and Robert von Lieben independently invented a three terminal vacuum device called “triode” which is used as an amplifier .The discovery of diode and triode paved the way to the development of radio communication devices.
- In 1912, Edwin H.Armstrong invented the regenerative feedback amplifier and oscillator. He also invented the super heterodyne radio receiver.

The vacuum tubes had shortcomings like bulk size, higher power consumption, large amount of heat generation etc.

### Modern Electronics

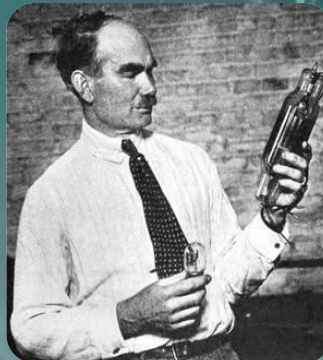
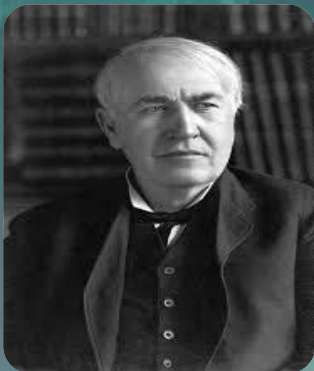
- In 1947, John Bardeen, William Brattain and William Shockley of Bell Laboratories invented the first bipolar transistor.
- In 1958,Jack Kilby of Texas Instruments demonstrated the first Integrated circuit (IC) –bipolar transistor, resistors, capacitors fabricated on a single piece of germanium.
- In 1960, the first working MOSFET which had been anticipated by Liliebfeld,Heil,Shockley and others was demonstrated by John Atalla and Dawon Kahng at Bell Labs.
- In 1965, Gorden Moore came up with a new paper which states that “the number of transistors used on a microchip doubles every 18 months “
- In 1968, Gorden Moore and Robert Noyce cofounded a new company - “Intel Corporation” to work in the field of microelectronics. In 1971, they invented the world’s first microprocessor4004 comprising 2300 transistors in a single chip.

- Henry Edward and Forest Mims started an electronics company named Micro Instrumentation and Telemetry Systems (MITS) in 1969 to manufacture electronic calculator. Later they developed Altair 8800 personal computer that used new Intel 8080 microprocessor in 1975.
- In 1978 Intel launched world's first 16-bit microprocessor named 8086.

### Microelectronics Evolution

| Year            | Technology                              | No. of transistors     | Example                            |
|-----------------|---|------------------------|------------------------------------|
| 1947-1950       | Transistor                              | 1                      | -                                  |
| 1951 -1960      | Discrete Component                      | 1                      | FET, Diode                         |
| 1961 -1966      | SSI<br>- Small scale integration        | 10                     | Logic Gates, Flip-flop             |
| 1967-1971       | MSI<br>- Medium scale integration       | 100 – 1000             | Counter, Multiplexer               |
| 1972-1980       | LSI<br>- Large scale integration        | 1000 – 20,000          | RAM, Microprocessor                |
| 1981 -1990      | VLSI<br>- Very large scale integration  | 20,000 – 1,000,000     | 16 bits and 32 bits Microprocessor |
| 1990-2000       | ULSI<br>- Ultra large scale integration | 1,000,000 – 10,000,000 | Graphic microprocessor             |
| 2000 - nowadays | GSI<br>- Giant scale integration        | > 10,000,000           | Pentium Dual Core Microprocessor   |

### Some of the snapshots:



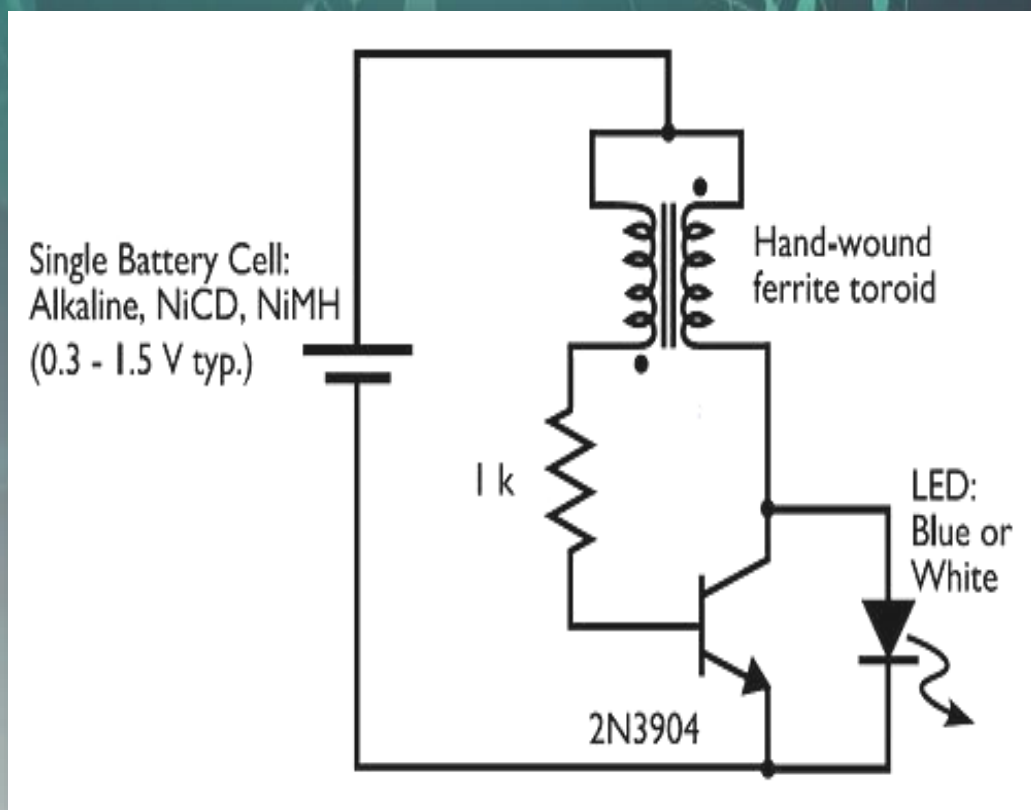
# JOULE THIEF

---Rohan Nandy  
ECE-A 3<sup>rd</sup> Year

We all know that electricity theft is a punishable offence. So how did “thief” get attached with J.P.Joule? It is nothing but a simple voltage booster circuit. This circuit can increase the voltage and current coming from a battery (normally considered discharged) used to drive small load; hence the name, suggesting that the circuit is stealing energy or "joules" from the source.

Requirements: A used battery, 1kilo ohm resistor, Ferrite toroid core, NPN transistor (2N2222, 2N3904, or similar), LED (blue or white) and few wires.

Circuit Diagram:



**Working Principle:** A small amount of electricity goes to the base of the transistor, through the first coil and the resistor. This partially opens up the collector-emitter channel of the transistor. Electricity is now able to travel through the second coil and the collector-emitter channel. The electricity through the second coil generates a magnetic field that induces a greater amount of electricity in the first coil. Due to this cumulative effect of increase in magnetic fields between the coils the base of the transistor gets saturated and the collector-emitter channel is fully open. Now, there is a lot of energy built up in the magnetic field of the second coil. Since the electricity in the second coil is no longer increasing, it stops inducing the first coil. This causes less electricity to go into the base of the transistor and thus gradually, part of the energy that was stored in the magnetic field of the second coil drains out. However there is still a lot of energy stored up. So it has to go through the load (usually an LED). Thus the LED glows. After that the circuit is effectively reset and starts the whole process all over again. In a typical Joule Thief circuit this happens 50,000 times per second (50 kHz).



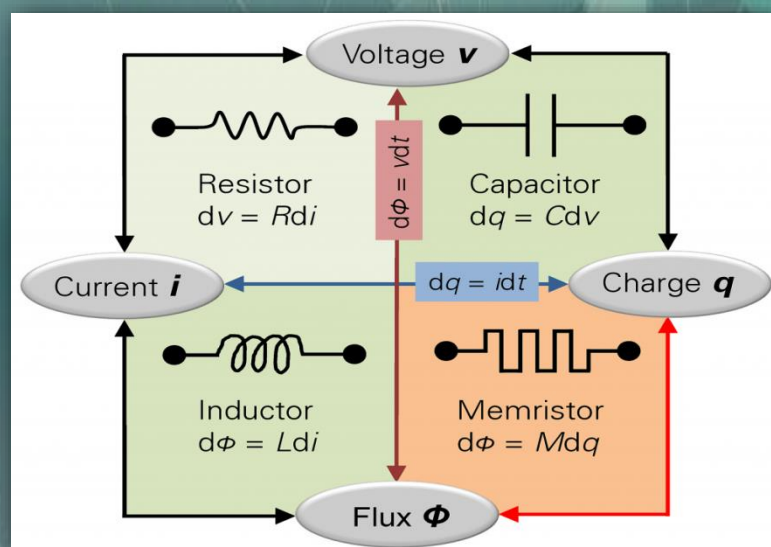
# Memristors

---Shivam Acharya

ECE-C 4<sup>th</sup> Year

For a very long time, only three fundamental two terminal passive circuit elements were considered, namely, capacitor, inductor and resistor. These are defined in terms of the relationship between two of the four fundamental variables, namely, the current  $i$ , the charge  $q$ , the voltage  $v$ , and the flux linkage  $\Phi$ . Out of all the possible combinations, one remained undefined, the relationship between  $\Phi$  and  $q$ . Based on the symmetry of the equations that govern these elements, Dr. Leon

Chua in 1971 hypothesized the fourth passive element that hold the



relationship between magnetic flux and charge, i.e. the memristor.

Memristor or 'Memory Resistor' is a type of resistance switch in which its internal states depends on the history of current/voltages it has experienced. Its resistance depends on the charge that flows through it. When current flows in one direction the resistance

increases and when the current flows in opposite direction the resistance decreases. When the current stops flowing, the resistance remains in the same value that it had earlier. The major feature of memristor is, it has the capability for remembering its state history.

The first memristor device was fabricated by HP Labs in 2008. Memristor has a great potential in neural network applications. They have been extensively studied as a next-generation nonvolatile memory candidate, known as resistive random access memory (ReRAM) by virtue of their excellent features, such as ultrafast speed (<100ps), long endurance (up to  $10^{12}$  write-erase cycles), and scalability (scale down to 2nm contact dimension) with a simple structure. Analog signal storing capability is a key factor of using them as synaptic connections. These chips can be laid down in layer upon layer, creating three-dimensional structures that can store and process data and can extend Moore's law for decades.

The advantages of memristor mainly include the following:

- It has very high storage as well as speed.
- Capable of restoring both hard drives as well as DRAM

The disadvantages of memristor include the following:

- These are not available commercially.
- The memristors performance & speed will not match transistors and DRAM.

**Memristor Applications:**

- Memristors are used in Programmable Logic & Signal Processing.
- They have their own ability for storing analog and digital data in an easy as well as power efficient method.
- Low-power and remote sensing applications.

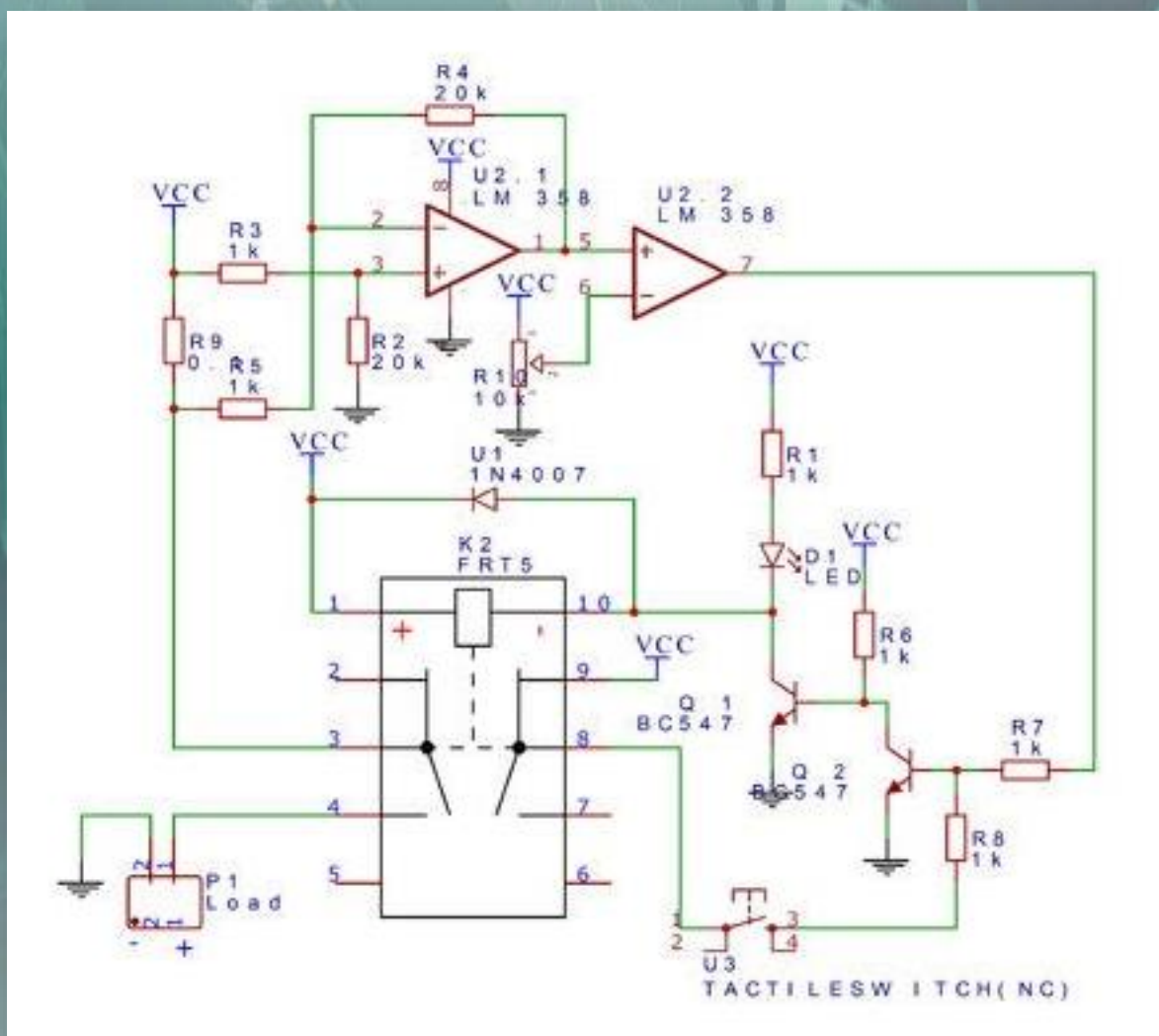
# SHORT CIRCUIT PROTECTION

---Sudip Bandyopadhyay

ECE-A 3<sup>rd</sup> Year

Short circuit is a very common problem in all levels of electronics and electrical circuits. There are many devices like circuit breakers available in the market for short circuit protection but they are costly and bulky too, so we can design a small and low cost circuit for the over current protection.

Circuit diagram:



**Required components: Perfboard , FRT5(Relay) , LM358(OPAMP) , BC547(npn transistor) , LED , 1N4007(Diode) , Push switch(Normally closed) , Resistors , Potentiometer**

### **Working principle:**

**FRT5 is a dual change over relay which means it connects pins 3 and 4 when no voltage is applied to the coil and connects pins 3 and 2 when at least 3.8V is applied to the coil .Transistor Q1 ensures current flow through the coil thus connecting power supply to load .When over current occurs transistor Q2 shorts and no current flows through coil and thus power source is detached from the load. Resistor R9 (0.1 ohm) provides voltage proportional to current which is amplified and compared by LM358 OPAMPS with our desired preset reference voltage adjusted by potentiometer, this helps to set a desired maximum current value. Switch U3 holds the transistor Q2 in ON state thus not allowing over current to enter the load again. Switch U3 can be pressed after necessary corrections in the circuit to again connect power supply to the load. LED D1shows if an over current has occurred or not. If LED is ON it indicates normal operation, but if it is OFF it indicates that an over current has been detected. Diode U1 is a flyback diode connected to protect the circuit from high transient voltage peaks produced by the relay coil. This zcircuit is a cheap replacement for costly breakers and current limited power supplies. This circuit can be a savior and can protect costly devices.**



By Supriya Maji

ECE 3<sup>RD</sup> Year



*Reet's Photography*

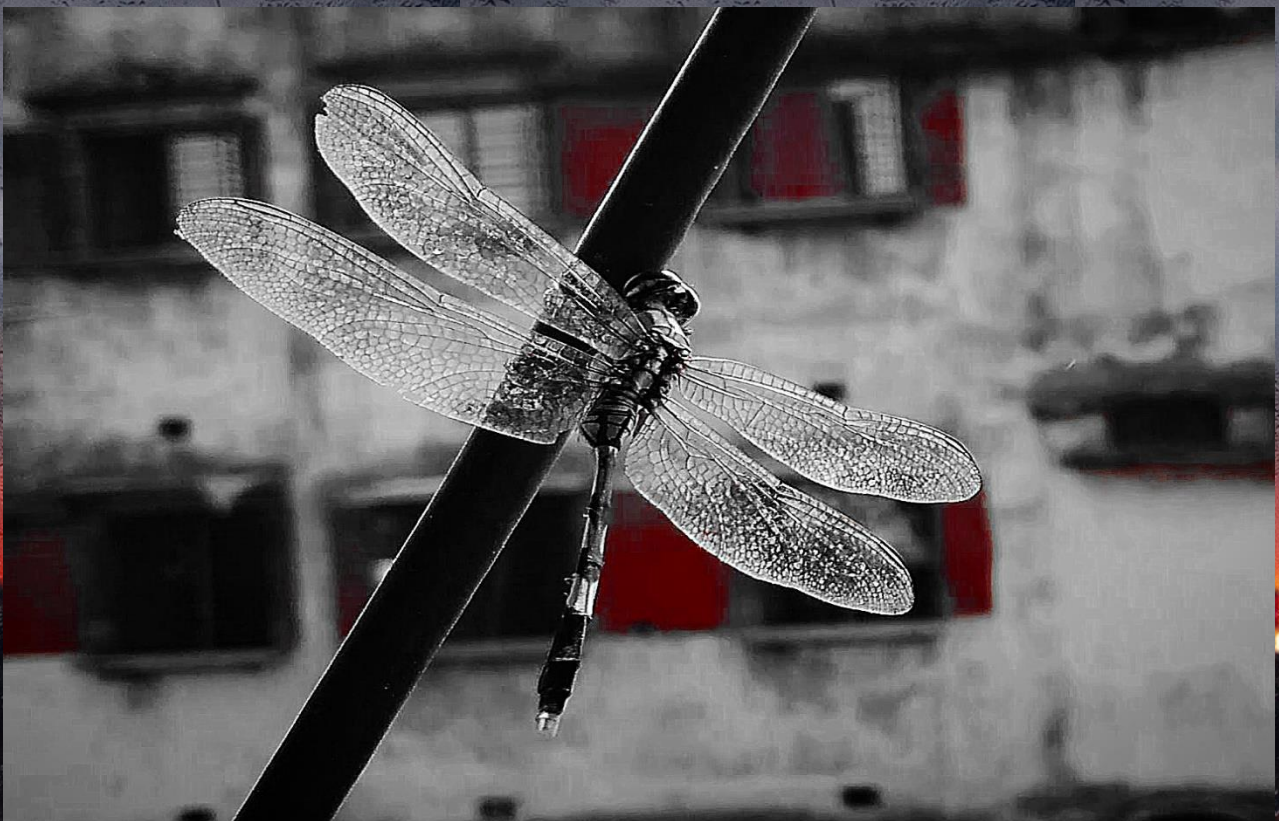
By Akash Roy

ECE



By Sohan Saha

ECE 1<sup>ST</sup> Year

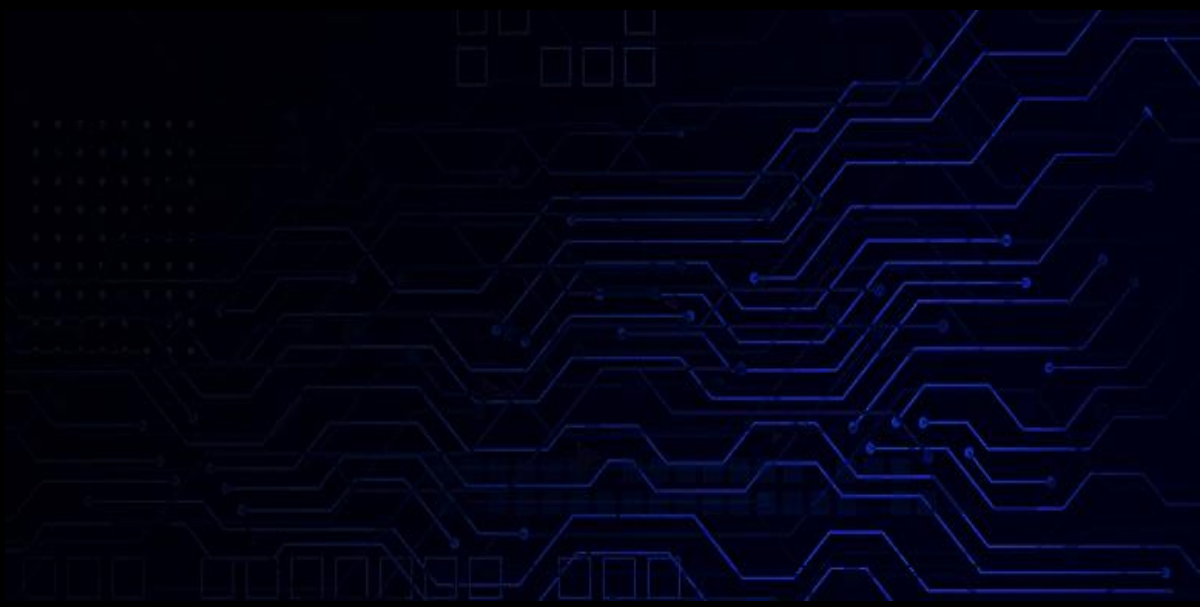


By Debyansh Shaw

ECE



# TECHNOLOGY



# 5G: The Future of Mobile Communication

--- Prof. Siladitya Sen,

*ECE*

All mobile users are familiar with the letter "G" as applicable to mobile networks. Here "G" represents "Generation" Since my topic today is 5G or 5th Generation, let us first take a look at the earlier ones.

**1G or first generation:** Evolved in 1981, analog system, first started by NTT, Japan, used for mainly voice.

**2G:** first Digital Network, introduced in 1991. The first cellular call was made in India on July 31st, 1995 over Modi Telstra's Mobile Net GSM network of Kolkata.

**3G:** In 2008, India entered the 3G arena with the launch of 3G enabled Mobile and Data services by Government owned MTNL and BSNL. Later from November 2010 private operators entered into this. Data rate: 384Kbps to 42Mbps (Theoretical maximum speed)

**4G:** or 4G LTE (long Term Evolution): Launched in 2009 with enhanced data rate of 12 Mbps going up to 100 Mbps. On 10 April 2012, Airtel launched 4G services through dongles and modems using TD-LTE technology in Kolkata, becoming the first company in India to offer 4G services. The Kolkata launch was followed by launches in Bangalore (7 May 2012), Pune (18 October 2012), and Chandigarh, Mohali and Panchkula (25 March 2013). 3G & 4G operated simultaneously for some time.

## **The 5th Generation Network (5G)**

Now, I will highlight the revolution of 2020 which is 5G. It promises a speed of 10 Gigabits per second with almost zero latency. It is expected to be launched during the Olympics in Japan 2020. It will be the first Ultra high speed and first commercial next gen network (NGN) with next to no latency.



Network latency is an expression of how much time it takes for a packet of data to get from one designated point to another. In some environments (for example, AT&T), latency is measured by sending a packet that is returned to the sender; the round-trip time is considered the latency.

Beyond the Olympics 2020, our future world of 5G will look something like this:

- **5G + Cars:** Cars will interact with each other on smart roads. Safety & Traffic Control Requires low latency
- **5G + Homes:** Encourage in-building coverage. Home router = cell site
- Device to Device communication, Small, inexpensive, low-power devices

Some new terminologies will be free flowing with the users. These are:

- **Augmented reality (AR)** adds digital elements to a live view often by using the camera on a smart phone. Examples of augmented reality experiences include Snapchat lenses and the game Pokémon Go.
- **Virtual reality (VR)** implies a complete immersion experience that shuts out the physical world. Using VR devices such as HTC Vive, Oculus Rift or Google Cardboard, users can be transported into a number of real-world and imagined environments such as the middle of a squawking penguin colony or even the back of a dragon.
- Also, concepts of "**Remote Surgery**" will become a reality.

So, at this stage, let us gear up ourselves for this new 5G revolution and start planning for 6G.

# Reinforcement Learning as a Subfield of Artificial Intelligence

---Geetanjali Aich

ECE A 3<sup>rd</sup> Year

With the dawn of the new era of technological advancements, the word 'Artificial Intelligence' is increasingly becoming popular. It is a buzz word in almost all academic institutions. Since, AI is like a tool, it has become popular even in non-technology fields like healthcare, banking, medicine, finance, business etc. These tools are used to make predictions or identification either out of large amount of data or insufficient amount data.

Artificial intelligence is in itself a vast field that contains other sub fields like:

- Neural Networks – e.g. Time series prediction, classification
- Evolutionary Computation – e.g. genetic algorithms
- Vision – e.g. image understanding
- Robotics – e.g. intelligent control
- Speech Processing– e.g. speech recognition and production
- Natural Language Processing – e.g. machine translation
- Planning – e.g. scheduling, game playing
- Machine Learning – e.g. decision tree learning, version space learning

Where each field provides different set of advantages as observed.

## **Reinforcement learning as a subfield under Machine Learning**

Tom Mitchell, a pioneer in AI domain, defined ML as follows:

A Computer is said to learn from experience  $E$  with respect to some task  $T$  and some performance measure  $P$ , if its performance on  $T$  as measured by  $P$ , improves with experience  $E$ .

To make it simple, suppose a computer learns to play a game of chess. In such a case,  $T = \text{Playing of chess}$ ,  $E = \text{playing 100k games against itself}$ ,  $P = \text{probability of winning the next game}$ .

Machine Learning has evolved in the recent years and has new sub fields under it. Reinforcement Learning (RL) is a subfield of Machine Learning where a system learns by interacting with its environment, observing the results of these interactions and receiving a reward (positive or negative) accordingly. This way of learning emulates the fundamental way in which we humans (and animals) learn.

Reinforcement learning is all about making decisions sequentially. Or, we can say that the next input depends on the output of the previous input. Example: teaching an autonomous system to stand, playing a game of chess etc.

It may seem Reinforcement learning is similar to supervised learning. But, supervised learning decisions are independent of each other.

There are two types of Reinforcement learning: Positive and negative.

**Positive Reinforcement learning:** Suppose an event occurs and due to a particular behaviour. This event (say) increases the strength and the frequency of the behaviour. Then, this is said to be a positive event.

**Negative Reinforcement Learning:** Negative reinforcement occurs when a certain stimulus (usually an aversive stimulus) is removed after a particular behaviour is exhibited.

### **Features of Reinforcement Learning:**

- **Input:** These refer to the initial conditions from which the model will operate
- **Output:** There are many possible output as there are variety of solution to a particular problem

- **Training:** The training is based upon the input, the model will return a state and the user will decide to reward or punish the model based on its output.
- The model learns from each output and its repercussion
- The best output is decided based on the maximum gain

### **Usage in Robotics**

To quote J. Kober et al.'s paper: Reinforcement learning (RL) enables a robot to autonomously discover an optimal behaviour through trial-and-error interactions with its environment. Instead of explicitly detailing the solution to a problem, in reinforcement learning the designer of a control task provides feedback in terms of a scalar objective function that measures the one-step performance of the robot. For a robot to successfully operate in a given environment it must make sense of it somehow, plan its actions and execute those plans using some means of actuation, while using feedback to make sure everything proceeds according to plan. It turns out that each of those components is a very hard problem, and things that we humans do easily (like recognizing objects in a visual scene and predicting to some degree people's intents) are often incredibly challenging for a computer. The curse of dimensionality mentions that there may be too many states in which a system can be and processing each of them can be difficult. A robotic arm has, for example,  $10^{20}$  states. Moreover in real world, the machinery used to achieve such a system can be complex and expensive. Applying reinforcement learning in robotics demands safe exploration which becomes a key issue of the learning process, a problem often neglected in the general reinforcement learning community (due to the use of simulated environments). This effect is called curse of real-world samples. As a lot of unexpected factors may arise in the local environment. Using simulated environment also cause the robot to underperform in real environment due to model uncertainty.

The challenges of applying RL to real-world robotics problems are still far from being declared solved, but much progress is being made and hopefully we will continue to see further breakthroughs in this exciting field.

## 10-Minute Cancer Test

---Pradepto Addya

ECE C 3<sup>rd</sup> Year

Scientists at University of Queensland, Australia have developed a Universal Cancer test that can detect traces of cancer in bloodstream. This test can be referred as 'ground-breaking' or 'revolutionary' because of the fact that it is cheaper and faster than conventional tests. Reportedly, this test has a sensitivity of about 90% which means it could detect 90 out of 100 cases of cancer. The team of scientists working on this test found that cancer DNA and normal DNA sticks to metal surfaces in markedly different ways. DNA inside normal cells has methyl groups dotted all over it while the DNA inside cancer cells is largely bare, with methyl groups found only in small clusters at specific locations. This test uses a colour-changing fluid which shows presence of malignant cells anywhere in the body. The suspect DNA is added to water containing tiny Gold nanoparticles. Despite of made of gold, the nanoparticles turn the water 'pink'. If cancer DNA is added, it sticks to the nanoparticles in such a way that the water retains its original colour. However, if normal DNA is added, the DNA binds to the nanoparticles differently and turns the water 'blue'.

While this test might not locate the exact location or the type of cancer (subsequent tests with other techniques still required to locate and identify the type of cancer), it would give a pivotal answer to whether a person has cancer or not, which indeed can save thousands of lives.

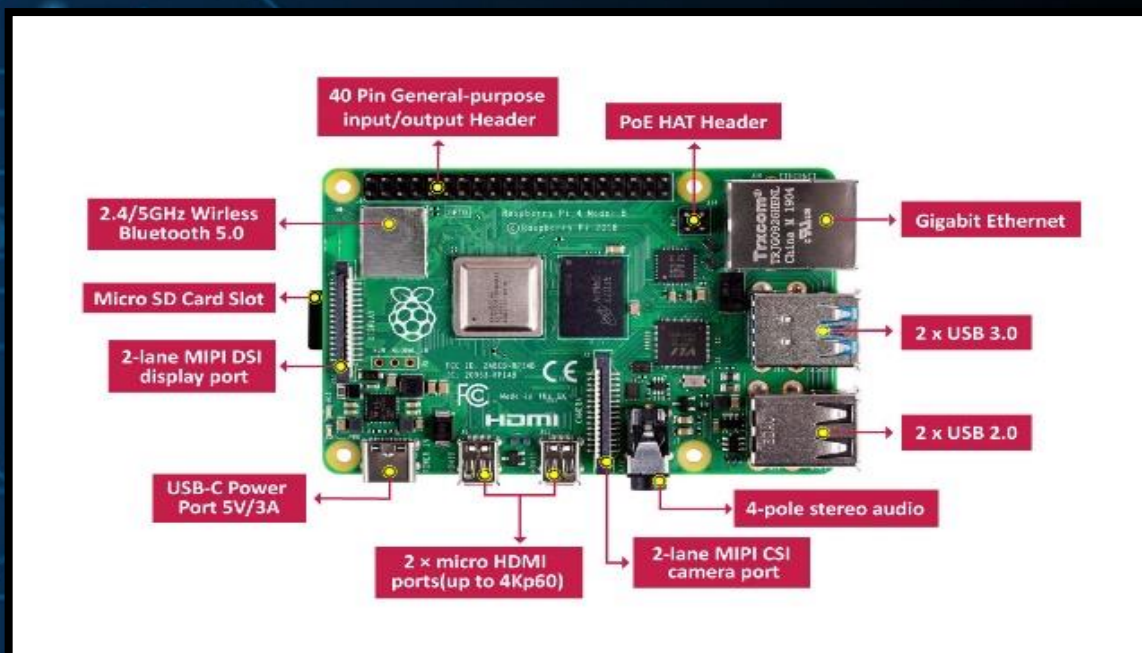
# Pocket Size Computer – Myth or Reality

---Rajatabha Chakraborty

ECE 2<sup>nd</sup> Year


Well, pocket size computer is no more a myth now, the wings of technology have made it possible through the marvel of invention, what is called a **RASPBERRY PI**.

The small single board computer (SBC) developed first in the UK has created a deep turnover in the field of computer architecture.



The board which comes with quite impressive specifications of 1.5 GHz 64 core, Micro SDHC slot and even with a graphics of Broadcom Video core VI 500 MHz. It also has Linux OS, Windows IOT core OS inbuilt in it.

The marvel which has both wireless (from raspberry 0 onwards) and wired connections is highly efficient and ready to use like a computer with USB ports, 4k monitor support (in raspberry pi 4) and can be used for solving the basic requirements of a computer like coding, paint playing Mario like low graphic games. Web surfing is also



possible in this device through the help of Ethernet cables or Wi-Fi connectivity. Technology is never satisfied, so it again came up with a better version of raspberry pi coined as **ATOMIC PI**. The atomic pi also serves as a mini sized computer but with better computing features including Intel graphics, higher ram and storage space with DDR3 ram features. It comes up with Intel Atom x5-Z3850 quad core with 2M cache. Along with all these it also provides with real time clock and battery features. Want to boast of a computer in pocket? Spend 4k bucks and it is all yours ...**build your own laptop.**

# Sound – a friend in disguise

---Kinkini Deb

ECE, 2015


Inside the womb, a baby starts getting acquainted with hearing sounds. Unconsciously the baby learns to react to the sounds related to different events happening in the outside world. After the birth, the baby starts seeing things around him/her. Slowly he/she starts to understand how the events connect both hearing and seeing ability together.

In the initial days, the films used to be silent. Sound production (mainly music and theatre) was mostly live ones, very much dependent on acoustical structures, being produced with the help of combination of mechanical and electrical machines. Slowly people got the idea of using audio with the visuals to evoke the emotion of the film audience. This idea introduced both music and sound designing for the medium of film-making. Live theatre/musical performances also got influenced and intrigued the researchers to find out way to let the performers put less effort for their vocal projection and produce better quality sound of proper level to be audible to the person sitting at the back.

Audio recording and mixing devices was being developed gradually by the physicists and the engineers with invention of better electrical electronic circuitry, merging mechanical mechanisms, incorporating appropriate signal transmission methods, using the algorithms of signal processing, so on. With the introduction to the digital world, audio engineering spread its wings wide and the creative world got benefitted more, than in the analogue reign.

Besides the technical aspects, the discipline has majorly contributed to the world of animation and games. With the introduction of auto-tuner, non-singers has got highly benefitted.





Nowadays, many audio engineers have engaged themselves for the research and development in the field of medical science to cure many disease using tone generators, frequency based music production etc.

Hopefully, this continuously budding discipline will contribute to many other fields in recent time.



Water Drop

By Supriya Maji  
ECE 3<sup>rd</sup> Year



Light Effect

By Ankit Kumar  
ECE 3<sup>rd</sup> Year



By Shilpa Das  
ECE 3<sup>rd</sup> Year



By Ritika Bharti  
ECE 3<sup>rd</sup> Year



DISCOVERING THE WRITER IN YOU



# POETRY

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# **SILENCE SPEAKS**

---Gaurav Kumar

ECE-B 2<sup>nd</sup> Year

***Silence has no tongue but it speaks much more,  
It is the voice of the deep heart's core.  
It screams, it shouts, it makes us fear,  
It speaks to us what ears fail to hear.***

***Silence is a weapon sharper than a sword,  
It comes down hard without a word.  
Noble minds are with silence fed,  
Solemn prayers are in silence said.***

***Many a wars are with silence won,  
Things undone are with silence done.  
Sages often rejoice in silence,  
It puts an end to violence.***

***Silence and a smile are two powerful tools,  
They solve our problems and keep us cool.  
Silence gently drops as manna and dew,  
It is a jewel that adorns a few.***

# **FOOD**

*---Bhumika Tewary*

*ECE-C 1<sup>st</sup> Year*

*Janari, Matur, Comida, Mat  
Didn't know food can also be spelt like that!  
What's your favourite? I would love to know...  
There's a restaurant nearby; whatsay let's go?!*

*Chinese or Italian what would you like?  
Oh! There's nothing that I dislike  
What's there for dinner and what's for lunch?  
Focus on the diet plan or just let that scrunch!!*

*Bad carb, Good carb, omega3  
Well yes, that's gluten free  
One life, One love and say that's food  
Can smell the Chola Bhaturs that's being cooked in the  
neighborhood!*

*Have to stop lest I'll go on and on  
Goodbye people... I've to clean the lawn.  
Doing it only because I'll get a treat  
Which is the saucy, sizzled barbeque meat!*

**Note:**

***matur* - means food in Icelandic language(N. Germanic language used in Iceland)**

***janari*-means food in Basques(language used by the group of people who live in both Spain and France in areas bordering the Bay of Biscay and encompassing the western foothills of the Pyrenees Mountains)**

***comida*-means food in Spanish and Portuguese.**

***mat*-means food in Swedish and Norwegian language.**




# THE VOICE

---Poulami Bera

ECE-C 1<sup>st</sup> Year

*Again I found myself in the middle of somewhere,  
Heading to nowhere,  
And in the distant a silhouette caught my eyes  
Waving its hand towards me,  
For a moment I was taken aback because I know,  
This path of the wood no one follows.  
I stand there still,  
Fighting all against my will,  
As the silhouette came running,  
I felt two world merging.  
I looked into the eyes,  
The last thing I wished to say was a bye.  
The eyes, the nose, even the curve of lip was all so familiar,  
And when the voice said 'Hey, remember me?',  
A gush of thoughts crossed my mind.  
The bruises, the cuts,  
Was way beyond its guts.  
The pain behind the smile,  
As if shouting for a touch of care,  
As if longed for a loud cry,  
As if all it want a hint of warmth that would soothe the  
fragile.  
The voice within me uttered,  
' Yes, I know you'.  
Then slowly the frame started to fade,  
As if all it came for was a body to recognise.*



*And then again I found myself in the middle of somewhere,  
Heading to nowhere.  
I know the flash of that smile,  
Will soothe me for a while.*

## **SITUATION**

---Ankit Kumar

ECE-A 3<sup>rd</sup> Year

*Never been in a situation before,  
where it seems to be all alone.*

*Never been a guy,  
who knows how to disrespect.*

*Been a person,  
who is so hard to love.*

*But never been the man,  
who received anything in return.*

*Never been the warmth,  
that cools down everything.*

*Never been the pleasure,  
that feels comfortable in love.*

*I have received nothing,  
loosing every bit of myself,  
and yet not ready to give up those good deeds*

*But one thing I can't bear is  
to see her in somebody's else arm...*

*But all I can do is nothing...*

*Nothing means nothing...*





# ***PROSE***

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# **THE BEST MEDICINE**

*---Saheli Mukherjee  
ECE-A 4<sup>th</sup> Year*

**Music. What an absurdly relaxing feeling brushes your mind when this word is mentioned! It's like the saviour who would rescue you from all woes, all frustrations, the enormous pressure of your day to day activities that has been crushing you for a very long time; or simply it's your favourite companion on a long journey, the one who sets the mood when open fields, grazing cows or even hard concrete laid roads pass by. Undoubtedly, music has been a best friend to one and all.**

**The most interesting thing about music is that it will never bore you! The different genres, styles, artists, beats, riffs, rhythmic flows - all constitute this wonderful sensation that flows through your ears and tingles all the senses of your body. Hitting the road? Go for contemporary or smooth jazz. At a party? Ah, pop and hip hop will be the very soul of the party. Stressed out? Go for religious or classical. These are just a few mentions. The variety and number is so high that one could never finish listening to nearly every style of music in their entire lifetime.**

**When I talk about exploring different styles of music, I definitely do not mean me. I am someone who gets addicted to one song at a time and keeps on playing the same song over and over again, till the song rings in my ears even when I am half asleep.**



**For me, music has always been a fascination, a form of art, a deity to me. Worshiping music has cured depression and even provided comfort in times of physical pain. So, crush all your worries by being a part of this beautiful therapeutic procedure!**

# **AN APPOINTMENT WITH DOCTOR**

*---Ranit Nandy*

*ECE-A 4<sup>th</sup> Year.*

"It's your turn now Mr. Mark",the man said.After waiting over an hour and a half finally Mark got an opportunity to meet the doctor,the psychiatrist."Thank God",said Mark after blowing air out of his mouth and looking at his watch.

"May I come in doctor?",Mark asked."Yes,come in",said the doctor.

"What's your problem ?"asked the doctor.Mark sat down and looked at the doctor with gloomy eyes and said,"People basically say that I am mad,they say I sometimes speak alone.My friends want to prove me as mad,they laugh at me,they call me crazy"."But what is your problem?",the doctor asked worriedly.Mark said,"I came here to you because you are a doctor,you can say whether I am mad or a normal human being".The doctor smiled and said,"You are unique",but Mark was serious.The doctor asked,"You came here alone?".He replied,"Yes,I came here alone,and my guardians also doubt that I am suffering from mental illness"."Do your friends bully you?",doctor asked after a pause of few minutes."Yes,they call me crazy,they say I once played cricket without a bat and ball".Mark replied angrily."What?How did it happen?",doctor asked,staring at him with his eyes full of questions and without winking."They said that I hallucinated",Mark replied depressingly.

"Are you a drug addict?alcoholic person?",doctor asked.No sir,it's a lie that even my parents believe,that's why you are the only person who is my last hope.You do my check up and give me report so that I can prove that I am neither mad,crazy person nor do I hallucinate."Mr.Mark I don't want

to hurt your feelings, but believe me, I cannot give you report right now, it may take few weeks to several months. Many tests and check-ups are needed before that", doctor said calmly. No doctor I need it now, otherwise they won't stop bullying me, my parents will also believe me after that. Please doctor try to understand. "Mr. Mark you are really good, but you have to co-operate with me for that, assurance can be given only after tests and check-ups", doctor said. Without finding a way, Mark finally grabbed a scalpel and pointed to the doctor, and ordered to give him positive reports. Doctor denied to change his decision, and finally Mark tried to attack the doctor with one blow, but he slipped and fell down, and suddenly it was the end of his hallucination, he came back to his present situation mentally with a jerk, to see himself sitting on the bed in his room, his parents were next to him, and his right hand was grabbing a pen. He looked at them, and they finally asked, "Who were you talking to?".



# **IN CASE OF EMERGENCY, BREAK GLASS**

*---Megha Chakravorty  
ECE-A 3<sup>rd</sup> Year*

Welcome to the safety and survival drill. Curious are the little red boxes placed in passages or stairways, encasing in glass, an ingenuous red button or small lever. Not to worry, the rules to operating them are very simple – on the occasion of fire in the building, devise any possible means to shatter the glass, and without a second thought, press the button or pull the lever. This action grants you immediate access to fire alarm activation mechanism. Do it in time, and you will end up saving, not only yours but many other lives.

What, however, constitutes an emergency? Be brave and walk through this imagination with me. You are trapped in a building, a certain part of which has caught fire. As the fire spreads rapidly, engulfing objects in its path, the agony and panic in you is spreading too. Blinded by the smoke and clouded by thoughts of the worst possible outcome, you just want to end the pain. All you can think of is - You need to escape; you need to escape right now! You are groping ahead in search of anything of aid, but only end up hurting others close to you.

May be very few have been unfortunate enough to experience this, but I know for a fact that many of us have gone through similar feelings –rooting not from a fire but a mental emergency. Anxiety, depression, stress and so much more, ends up clogging rational thinking.

***The more you try to put a lid on it, the more it suffocates you. All you want is relief from the pain burning inside you, but only end up hurting your dear ones. Follow the drill. Break the glass! Reach out to anyone you hold dear - friends, family, or even a mere acquaintance. They will be your breath of fresh air, the warm blanket wrapped around your shoulders and the sip of cold water that calms your soul. Its fascinating how easily you can get help by simply gathering the courage to ask for it.***

# THE LIGHT

---Pramita Banerjee

ECE-A 3<sup>rd</sup> Year

Sammy retired to his bed at the end of a tiring day. He was all alone in his room. His roommate had gone home. Sammy wondered "Should I sleep with lights on today?". His head buzzed with the project presentation yet to be completed. He turned off the lights and scrawled into his comfy bed. Through the window he could see the tall trees, the dark green leaves waving with the wind. The white light from the lamp post reflected on the glass panes. The room was dark except some parts being lit up by the light. He sat up on his bed and looked out of the window straining his eyes. He was wonder-struck. One year had passed but this had completely escaped his attention. A white light shone from a window at a distance away. "Maybe there is a school student studying for exam". As he listened to his clock slowly ticking, he decided to give himself another chance of trying to fall asleep. He closed his eyes and started counting 1 2 3....

Not being able to sleep, he again opened his eyes and stared blankly around the room. Twinkling green dots. "Isn't something glowing? Oh! Its fire fly", a stunned Sammy exclaimed. A childlike amazement had come all over him. "I never expected to see fire fly here in the least. I thought they were rare.", Sammy said. The room was illuminated with the tiny green lights, again plunging into darkness. The faint eerie glimmering dot looked magical. Glowing, Glowing, gone...

**Sammy smiled to himself."One more time let's see.I can fall asleep now".He muttered to himself. Light is beauty. Light is optimism.Light is hope.**

# **RELIEF ON A HOT SUMMER DAY**

*---Sankalpa Mukherjee  
ECE-A 3<sup>rd</sup> Year*

It was in the month of June. Bored,I decided to try something new. It was fifteen minutes to three. I opened the fridge to check what was inside (It is my customary habit though).I found the chocolate syrup (one of my favourite). A new inspiration! I immediately sprang into action.

I took one cup of milk in a mixer blender and I added chocolate syrup, a little cocoa powder, sugar & 1 tea spoon of coffee powder.The mixer blended and whined with loud noise straight for less than half a minute. I again added 2 scoops of vanilla ice-cream along with 3 ice cubes. Mixing all of them together in the mixer this time for around 20 to 30 seconds, my new inspiration was successfully implemented. The chilled coffee was ready to be served- **COLD COFFEE**  
There is nothing better than a cold coffee that sets up the mood on a hot summer afternoon.

I had the most refreshing yummy glass of cold coffee at home in just a few minutes. A glimpse of my preparation:

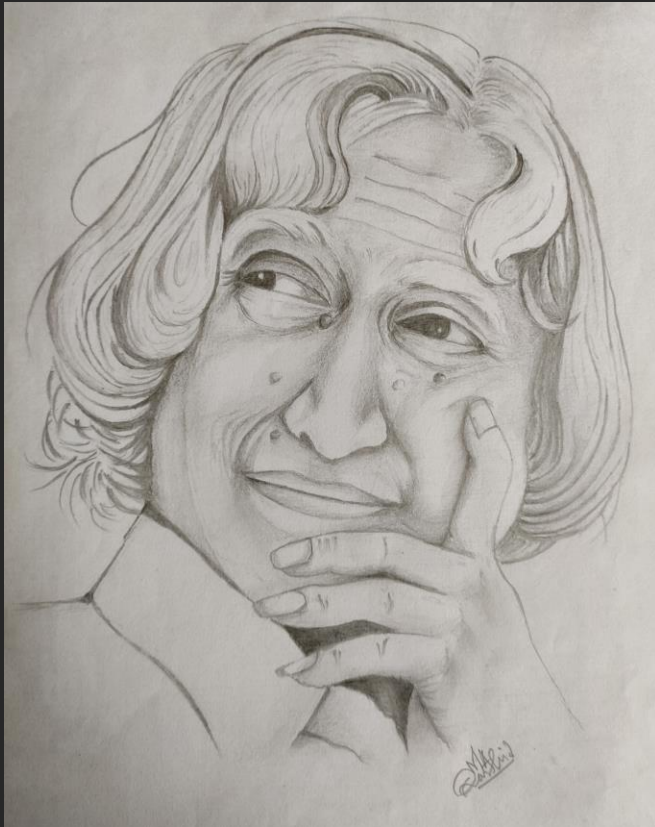




By Akash Roy  
ECE



By Moupriya Sarkar  
ECE 3<sup>rd</sup> year



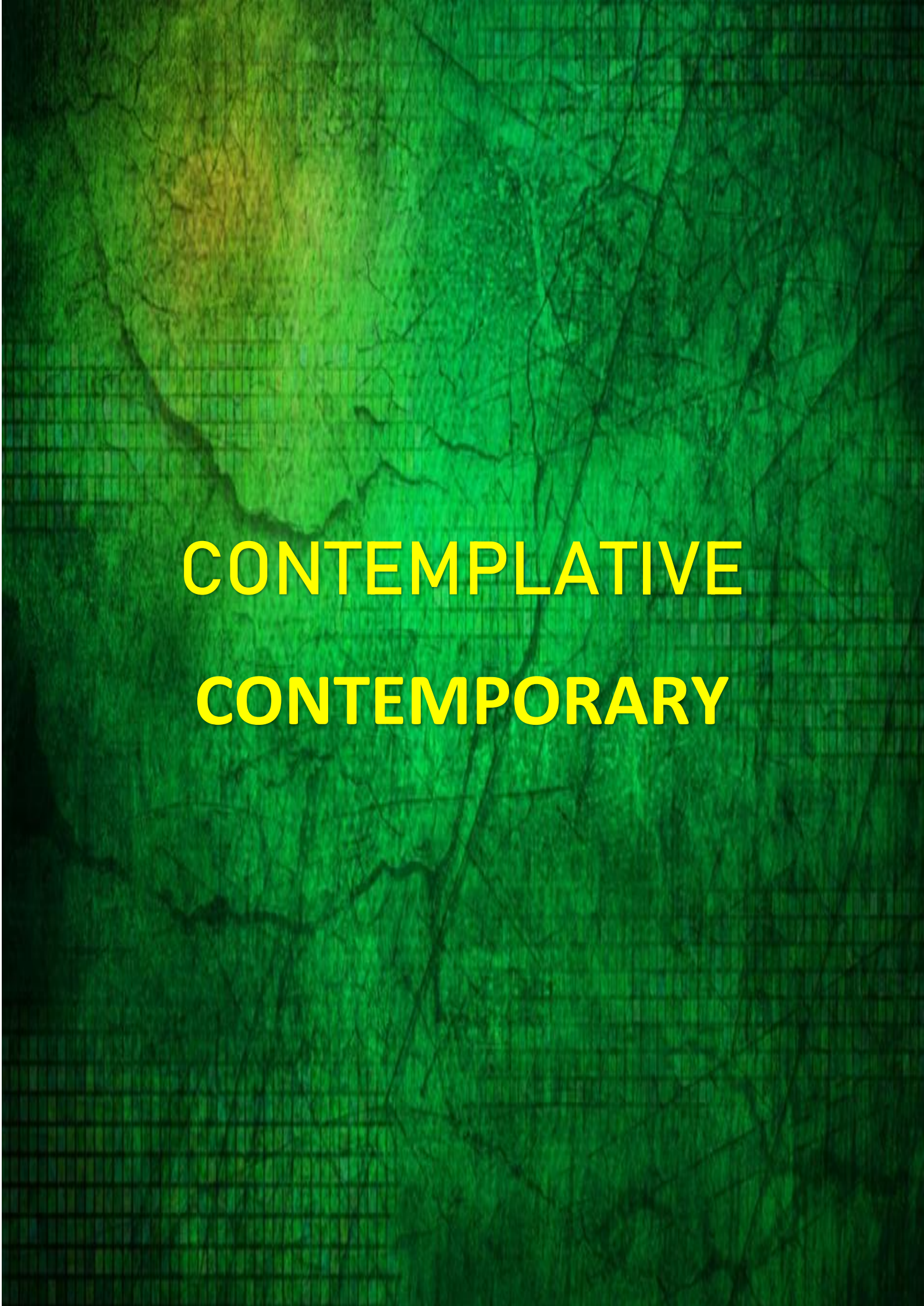
By Mamun Al Rashid

ECE-A 1<sup>st</sup> Year



By Upasana Roy

ECE



**CONTEMPLATIVE  
CONTEMPORARY**



# PENTAQUARK

---Pradepto Addya

*ECE-C 3rd Year*

In July 2015, researchers at CERN's Large Hadron Collider (LHC) in Geneva, Switzerland announced that they have found evidence of a new type of particle, called 'Pentaquark'.

Quarks are the tiny particles that bind together to form larger particles like Baryons(Protons, Neutrons) or mesons. They have mass, electric charge, colour charge and an additional property called 'Flavour', which describes its type(Quarks are of 6 types: Up, Down, Top, Bottom, Strange, Charm). Quarks form composite particle called 'Hadrons'. Quarks also have their counterpart, Anti-quarks. Proton is a hadron made up of 2 Up quarks and 1 Down quark while Neutron has 2 Down quarks and 1 Up quark. These Hadrons consisting of 3 quarks are called 'Baryons'. 2 quark-hadrons (1 Quark and 1 Anti-quark) form less stable 'Mesons'.

A Pentaquark seemed to consist of 2 Up quarks, 1 Down quark, 1 Charm quark and 1 anti-Charm quark. This discovery could help scientist assure their suspicions for the existence of more exotic particles.

Scientists after studying about Pentaquark speculate that instead of made of up 5 quarks independently, a pentaquark might be made up of 1 Baryon and 1 Meson fused together.

Whatever be the case of composition of a pentaquark, one thing that is clear is that we still are unaware of so many things present around us and there is lot more to discover.

On a lighter note, don't feel low if the above things went right above your head because even RICHARD FEYNMAN once quoted-

*"If you think you understand Quantum mechanics, you don't understand Quantum mechanics."*

# Into The Unknown

---Soumalya Bose

ECE-A 4<sup>th</sup> Year

Space has always been a subject of fascinating theories.

## **1. Mayan Civilization:**

In Teotihuacan, pyramids were built up according to our Solar system. Asteroid belt is represented in form of river Rio San Juan. Channels of liquid mercury, golden balls, mica chamber, extra-terrestrial materials have been discovered. Scientists say huge spacecrafts could be landed using mercury. People don't know how Mayans acquired vast knowledge of space without advanced technologies. People believe aliens delivered the knowledge.

## **2. Tutankhamun's Dagger:** The dagger dates back to 1350 BC. The major composition of the dagger is a meteoritic material. Even today's advanced technology finds it difficult to make material out of meteorites. How such an old civilization made it possible?

### ***3. Wedge of Aiud:***

A wedge found at Aiud, Romania in 1974, made of aluminium around 11000 years old. Surprisingly, Aluminium was discovered in 1808. Many believe this wedge is a broken part of lander of an ancient spacecraft that visited earth!!

### ***4. Betz Sphere:***

On 1974, Betz family was inspecting damage caused by bush fire. They found a polished metal orb. Few weeks later, they observed orb generates mysterious sounds in response to guitar. Orb being pushed on floor, stopped, vibrated, changed direction, returned to the person who rolled it and became active on bright days. They used to hear strange organic music. Scientists believe sphere had inbuilt UFO technology.

### ***5. Majestic-12:***

MJ-12 comprised of 12 prominent men with military, intelligence, scientific backgrounds. The documents classified as "MAJIC EYES ONLY", two level higher than "TOP SECRET". It's said that committee was formed for recovery, examination of alien spacecrafts at "Roswell UFO Incident". In 1984 UFOlogist J. Shandera received

envelope containing film showing images of 8 paged document describing MJ-12. Later, FBI debunked this theory abruptly!

#### *6. Konstantin Tsiolkovsky:*

Konstantin was born in Kaluga, USSR. He believed cosmism and acknowledged talks with aliens. He lacked conventional knowledge about space but developed basics of modern rocket science. No one knows how he developed it. His notes contain cigar-shaped spaceships.

*Does alien exist? Are they our ancestors? Have they ever visited earth?*

# WATER CRISIS IN CHENNAI

*---Soumi Banerjee*

*ECE-B 2<sup>nd</sup> Year*



The 2019 Chennai water crisis is just a trailer of what we are going to experience in near future. The main reason of water shortage is that all the four main reservoirs supplying water to the city had run dry. The monsoon failed for three years from (2016 to 2018) leading to this crisis. Global warming and changing climate have led to irregular and decreased rainfall leading to shortage of water at a time when the world population is increasing at an exponential rate leading to increase in overall demand.

On a positive note, some areas of India have a relatively wet climate. However, with no rain catchment programs in place, most of the water is displaced. In these areas, rain harvesting could be one solution for water collection.

Rainwater collected from rivers and roofs can be stored and utilised efficiently. Solar panels can also be used for harvesting most of the rainwater. Rainwater harvesting is a onetime investment with optimum cost. we can develop harvesting setups so that the harvested water can be used for various purposes. Collected water can be immediately used for agriculture, and with improved filtration practices to reduce water-borne pathogens, also quickly available for human consumption. The Solar Panel setup for rainwater harvesting in long run it can be used for ground water recharging. What we require now is efficient water management plans. We are heading towards a future were ocean water will b the only source of water and scarcity of water can bring about world war III.

# CHANDRAYAAN 2: ISRO'S SECOND MISSION TO THE MOON

---Sagnik Mukherjee

**ECE**

Since the very birth of civilization, man has always been fascinated by the mysteries of the universe. Of all the other things, the Moon has always been the most curious object in the upper heavens. So much so, that after Neil Armstrong set his foot on the lunar surface, for the first time, in 1969, we have always returned to the moon, only to find something new and interesting, each and every time.



ISRO's second lunar mission was launched on 14th July 2019 from Satish Dhawan Space Centre, Sriharikota. For



the initial lift off, we used the GSLV-Mk3. Dubbed as 'Baahubali'; this is, in fact, the most powerful Satellite Launch Vehicle we have ever made. The main lunar module consisted of three main parts, an Orbiter, a Lunar Lander (named 'Vikram', after Prof. Vikram Sarabhai), and a Rover (named 'Pragyan'). Along with the main interest of investigating the lunar surface, ISRO also tested a new type of cryogenic stage for placing the lunar module in its intended Earth Orbit.

The module was given its necessary speed, by raising orbits around the Earth and the module slowly gained the required speed, and thrust for Trans-lunar injection. The module was then catapulted on a trajectory to the moon.

Once the module approached the moon, it got into the moon's sphere of influence, and started orbiting the moon. Finally, 'Vikram' was separated from the orbiter and it was supposed to land on the lunar surface, with 'Pragyan'.

It's hard to believe that we lost contact at the last moment, when our destination was a mere 2.1 kilometres from us. But still the orbiter is intact, making the mission a 95% success. We shall try again. And perhaps someday we, Indians, would be able to walk on the moon. It shall be the proudest moment for us.

# Amazon: What it means to us

---Sagnik Mukherjee

ECE-A



Our society claims that 'A tree is man's best friend'. In fact they are Nature's best friend as well. If plants didn't evolve on this planet, some 300 million years ago, then Earth would have looked a lot different. Trees provide oxygen, take part in the food chain, and are an important part of the ecosystem.

It might sound baffling but about 1/3rd of our dry-lands are covered by deserts. Other 2/3rd part consist of mountains, swamps and plains. Forested lands occupy only about 30% of the land, and the most important of them is our 5.5 million square km Amazon Rainforest.

Home to several thousands of animal species, and many more plant species, the rainforest serves as 'The Lungs of our Planet' rectifying most of the harm we do to nature. It releases up to 20% of the world's oxygen, keeping us alive. A lot of endangered species and many more undiscovered species can be found in the heart of the forest. Scientists actually claim that the rainforest could be hiding more than a thousand species of insects, and a huge diversity of algae. These algae could actually be holding the solutions to some of our life-threatening diseases. Discovery of new plant species can boost up the research in the field of food production.

And, this forest is on fire. It's burning down, turning our hopes of surviving into ashes. For every tree that is catching fire, we are slowly heading for the worst. The people are trying their best; forest departments, fire fighting teams, the military, everyone is trying their best, but still the fire is raging through the trees.

We have to stop this hellfire as soon as possible. Considering the damage already done, the Amazon will take decades to recover from this loss. Our planet would face low oxygen levels. Our planet would never be the same if we lose the Amazon.



By Syrah O Keiv

ECE



By Akash Roy

ECE



# SPORTI-FY

# **Hardwork and Luck: This is Cricket**

---Reebhu Goswami  
ECE-A 3<sup>rd</sup> Year

It was a cold morning at Headingley, with the English sun sailing its rays across the blue skies. The gentle morning breeze kissed the grass on the field, making it ready for another day's action.

But the Englishmen could not enjoy a single bit of the weather. Instead, that day gave them chills in their body. They had something to prove which they failed to do in the last few Ashes series. The two pairs, Joe Root and Ben Stokes started to cover the distance from the dressing room to the pitch, knowing that a challenge awaits for them. It was that time when they needed 203 runs having 7 wickets in their hand.

They opened the day with 25 dot balls, until Warner took a brilliant catch of Root behind Paine off Lyon's ball. Still there was a bit of hope as Bairstow and Stokes punched the score to 238/4 at the lunch. After the play resumed, Hazlewood bowled an irresistible short ball to Bairstow, which made him chip it into the hands of Labuschagne in the slips. After this incident, Buttler – Stokes pair was the last hope. Buttler was run out by Head after he got trapped in confusion. Spectators started to leave as the wickets fell in quick succession. It was all rounded to 73 runs needed off the last wicket.

Now the final chapter of the story begins. I saw the eyes of Stokes which conveyed nothing more than fire! It was raw and one of it's kind. Leach kept Stokes alive. He formed the rope for Stokes to hold upon the cliff. Stokes started to crash 4's and 6's with all the power he had. It was that over when Lyon's appeal for LBW of Ben stokes was turned down by Chris Gaffaney. No reviews were left for the kangaroos! That was the moment when hardwork beared the sweetest fruit: *luck*, and it was:



BEN STOKES becomes the Hercules as he thrashes FOUR in the mid-off!! *"How the hell has he done that??"*- cries out the commentator! The crowds jumped off from their seats and cheered loudly as Stokes create a history in world cricket.



***Surely, that was one heck of a match!!***

# Sports And Women: Nation's Pride

**---Ritika Bharti  
ECE-C 3<sup>rd</sup> Year**

2019 has definitely been the year for Indian women athletes. Whether it is Hima das bagging 5 gold medals in 20 days or P.V Sindhu becoming the first Indian to win the World Badminton Championship , Nation had a glimpse of rejoice in their victories. Besides them , Dutee Chand became the first Indian to win a gold in a global event. “Pull me down, I will come back stronger”,she said after the historic win. No, the list does not end here. Manasi Joshi also created history by securing gold at the BWF Para-Badminton World Championship and PU Chitra clinched gold in Women's 1500m race at the Asian Athletics Championship 2019. And how can we forget Mary Kom bagging gold in the President's cup ahead of the World Championship.

Apart from gender inequality being a serious issue in Sports in our country and the dominance of Cricket all over the Country , these women athletes have found a way to get the recognition and now everyone is keeping a eye on their win or defeat. With their epic wins, India is certainly on the rise and the nation is extremely proud of these inspirational souls.



# It's That Time of the year, Again!!

---Uditanshu Bhattacharjee  
ECE-C 3<sup>rd</sup> Year

It's September. The best of the world are getting ready to compete against each other, in the most prestigious club competition of the World, The UEFA Champions League. Despite this being the 65<sup>th</sup> edition of the competition, contrary to expectations, the enthusiasm seems to increase every year.

The qualifiers for the group stages began on 25<sup>th</sup> June and concluded on 28<sup>th</sup> August. Six teams entered the competition through this route namely: Ajax, Olympiacos, Dinamo Zagreb, Sparta Prague, Red Star Belgrade, and Club Brugge. The rest 26 teams entered through their league rankings: 4 each from Spain, Italy, England, Germany, 3 from France and the rest from the other countries. Winners of Europa League 2018, Chelsea, also join the bandwagon this year. The Draw for the Group stages took place on 29<sup>th</sup> August 2019 at Monaco where the UEFA Men's Best Player Award was presented to Virgil Van Dijk, who incidentally



became the first defender to win this award. The Groups were divided and Barcelona, Dortmund and Inter fell in the same group which was now the **Group of Death**. As predicted by bet365, the

leading betting site predicts that Manchester City lead the race for winning the Champions League.



The image shows the group stage draw for the UEFA Champions League. It features a central soccer ball icon and eight groups (A through H) arranged in two columns. Each group lists the participating teams with their respective club crests. The teams are: Group A: Atlético, Dortmund, Monaco, Club Brugge; Group B: Barcelona, Tottenham, PSV, Internazionale; Group C: Paris, Napoli, Liverpool, Crvena Zvezda; Group D: Lokomotiv Moskva, Porto, Schalke, Galatasaray; Group E: Bayern, Benfica, Ajax, AEK; Group F: Man. City, Shakhtar Donetsk, Lyon, Hoffenheim; Group G: Real Madrid, Roma, CSKA Moskva, Plzeň; Group H: Juventus, Man. United, Valencia, Young Boys.

| GROUP A     | GROUP B        |
|-------------|----------------|
| ATLÉTICO    | BARCELONA      |
| DORTMUND    | TOTTENHAM      |
| MONACO      | PSV            |
| CLUB BRUGGE | INTERNAZIONALE |

| GROUP C       | GROUP D          |
|---------------|------------------|
| PARIS         | LOKOMOTIV MOSKVA |
| NAPOLI        | PORTO            |
| LIVERPOOL     | SCHALKE          |
| CRVENA ZVEZDA | GALATASARAY      |

| GROUP E | GROUP F          |
|---------|------------------|
| BAYERN  | MAN. CITY        |
| BENFICA | SHAKHTAR DONETSK |
| AJAX    | LYON             |
| AEK     | HOFFENHEIM       |

| GROUP G     | GROUP H     |
|-------------|-------------|
| REAL MADRID | JUVENTUS    |
| ROMA        | MAN. UNITED |
| CSKA MOSKVA | VALENCIA    |
| PLZEŇ       | YOUNG BOYS  |

The final of the event is scheduled at Istanbul's Ataturk Stadium where the grand event takes place on 30<sup>th</sup> May. So, get set for many upcoming sleepless nights and cheer your team with loud voice. It's a matter of pride, the stage where Greats fall and new faces emerge. After all, The **UEFA Champions League** is here.