BLAZE

technical magazine

Sri Venkateswara Engineering College

Blaze bags.....

Department of Electrical and Electronics Engineering

Seven Steps to Success

1) Make a commitment to grow daily.

2) Value the process more than events.

3) Don't wait for inspiration.

4) Be willing to sacrifice pleasure for opportunity.

5) Dream big.

6) Plan your priorities.

7) Give up to go up.

— John C Maxwell

March 2020

We light-up the world

Vision of the Department

To produce graduates in Electrical and Electronics Engineering with quality education by creating Center of Excellence in various domains, equip them in technical aspects to meet the industrial standards and provide an environment for quality research and continual learning in a professional way to serve the society with ethical mean for the development of the nation.

Mission of the Department

- Enriching the students in technical concepts through innovative teaching methods by qualified teachers.
- Introducing Industrial based education in correlation with the regular curriculum by establishing Centre of Excellence in various domains to meet the industrial standards.
- Inculcating the thoughts of innovation, research and continual learning to excel the students in their field of interest.
- Facilitating the students by creating awareness on leadership quality, professional ethics and human values in delivering their responsibilities to the society for the development of nation.

About the Department

The Electrical & Electronics Engineering department was started with UG programme in 2008 with an intake of 60. The department has well talented, qualified, experienced & dynamic faculty along with skilled technical supporting staff who spearhead the process of achieving the vision of the department. The department has well equipped labs & infrastructure. It is continuously striving to impart quality education and competitive spirit among students for academic excellence.

Strengths of the Department

1. In every semester Department of EEE conducts minimum of two workshops and there guest lecturers in the recent trends in Electrical Engineering to bridge the gap between Academics & Industries, and the students will be guided to do their Major & Minor projects on the same topics.

2. Every faculty member of the department attends a minimum of one faculty development program in every academic year. And most of the faculty members register for NPTEL online courses.

3. Department publishes a bi-monthly newsletter in every academic year, which includes the activities that were done in the past two months; fortnight wall magazines based on recent advancements in the field of electrical engineering prepared by students.

Editorial Board

Message from Principal

"The mind is not a vessel to be filled, but a fire to be kindled." Said Plutarch.

I congratulate the staff and students of all faculties who used various mediums of expression to present their ideas. As long as our ideas are expressed and thoughts kindled we can be sure of learning, as everything begins with an idea. I appreciate every student who shared the joy of participation in co-curricular and extracurricular activities along with their commitment to curriculum. That little extra we do, is the icing on the cake.

Do more than care – help
Do more than dream – work.'
Do more than forgive – forget
Do more than be fair – be kind
Do more than believe – practice
'Do more than belong – participate

Just as our mother earth gives us more and more, BLAZE will enable our learners to give and get a little more of learning.

Happy Reading!

~ Dr. T Kalpalatha Reddy, Principal

Message from HOD

It gives me immense pleasure to pen a few words as prologue to the technical magazine BLAZE of the EEE department. This issue is designed to present the write-ups regarding topics related to electrical engineering, self development and the scientists introduction etc which makes the issue resourceful and informative. I congratulate all the contributors all the contributors and also the editorials board for bringing out such a nice issue.

Happy Reading.

~ Dr. Shaik Rafi Kiran, HoD, Dept. of EEE

Message from Faculty Advisor

It gives us great pleasure to bring the technical magazine Blaze, the department magazine of EEE. The name and fame of an institute depends on the caliber and achievements of the students and teachers. The role of a teacher is to be a facilitator in nurturing the skills and talents of students. This magazine is a platform to exhibit the literary skills and innovative ideas of teachers and students. We would like to place on record our gratitude and heartfelt thanks to all those who have contributed to make this effort a success. Last but not the least we are thankful to all the authors who have sent their articles. We truly hope that the pages that follow will make an interesting read.

~ Gowtham Chendra, Assistant Professor, Dept. of EEE

Editorial

A famous philosopher once said, "Inside all of us is a hidden dream."

BLAZE, our department magazine, is a platform for our students to showcase their creative abilities hidden dreams and aspirations for writing. Our magazine aims towards bringing out the latent talent in our students through articles, poems, quizzes. We at BLAZE encourage our students to put on their thinking caps and create ...

Nora Roberts has rightly said, "If you don't go after what you want, you will never have it. If you don't step forward, you are always in the same place."

This technical magazine is just that step to make them move forward towards their dreams. Like every year, Blaze has articles. Success of this effort to bring out 'BLAZE' is the result of dedicated teamwork put in by all concerned. Enjoy the Gems of BLAZE!

~ P Sowmya, IV EEE, Chief Editor

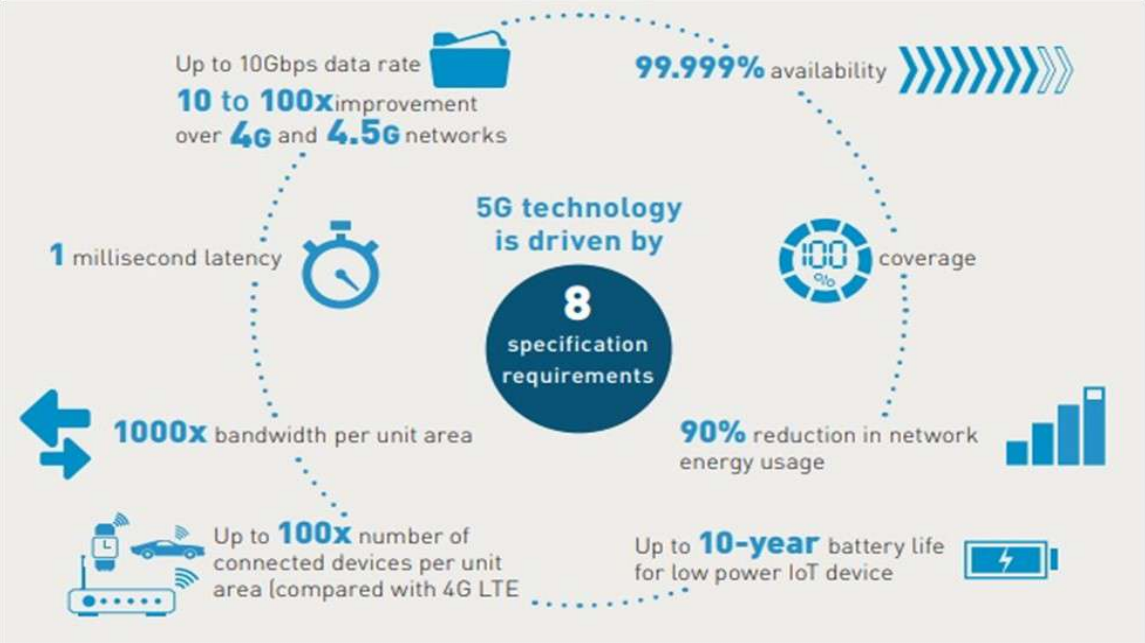
What is 5G?

5G technology is a breakthrough.

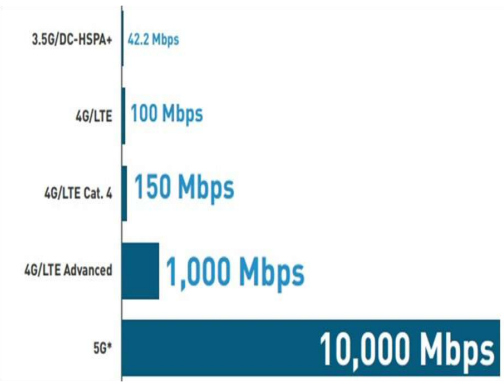
The next-generation of telecom networks (fifth generation or 5G) have started hitting the market end of 2018 and will continue to expand worldwide.

Beyond speed improvement, 5G is expected to unleash a **massive IoT (Internet of Things) ecosystem** where networks can serve communication needs for billions of connected devices, with the right trade-offs between speed, latency, and cost.

5G technology is driven by 8 specification requirements:



1. Up to 10Gbps data rate - > 10 to 100x improvement over 4G and 4.5G networks
2. 1-millisecond latency
3. 1000x bandwidth per unit area
4. Up to 100x number of connected devices per unit area (compared with 4G LTE)
5. 99.999% availability
6. 100% coverage
7. 90% reduction in network energy usage
8. Up to 10-year battery life for low power IoT device



How fast is 5G?

5G tops out at 10 gigabits per second (Gbps). 5G is **10 to x100 faster than** what you can get with **4G**.

What makes 5G faster?

According to communication principles, the shorter the frequency, the larger the bandwidth.

The use of **shorter frequencies** (millimeter waves between 30GHz and 300GHz) for 5G networks is the reason why 5G can be faster. In fact, this high-band 5G spectrum provides the expected boost not only in speed but also in capacity, low latency, and quality.

However, **5G download speed** may differ widely by area.

According to the February 2020 issue of Fortune Magazine, average 5G speed measures done in Q3/Q4 2019 range from: 220 megabytes per second (Mbps) in Las Vegas, 350 in New York, 380 in Los Angeles, 450 in Dallas, 550 Chicago, and over 950 in Minneapolis and Providence approximatively.
That's 10 to 50 times more than 4G LTE.

What is 5G low latency?
5G technology offers an extremely **low latency rate,** the delay between the sending and receiving of information. From 200 milliseconds for 4G, we go down to **1 millisecond** (1ms) with 5G.

Just think about it.
A millisecond is 1/1000 of a second.
The average reaction time for humans to a visual stimulus is 250 ms or 1/4 of a second. People are capped at around 190-200 ms with proper training.
Imagine now that your car could **react 250 times faster than you**. Imagine it could also respond to hundreds of incoming information and can also communicate its reactions back to other vehicles and road signals all within milliseconds.
At 60 mph (100km/h), the reaction distance is about 33 yards (30 meters) before you pull on the brakes. With a 1ms reaction time, the car would only have rolled a bit more than one inch (less than 3 centimeters).

Use cases associated with low latency are:
- V2X (Vehicle-to-Everything) communication: V2V: (Vehicle-to-Vehicle), V2I (Vehicle-to-Infrastructure), autonomous, connected cars
- Immersive Virtual Reality Gaming (5G will bring VR to the masses)
- Remote surgical operations (aka telesurgery)
- Simultaneous translating.

5G vs. 4G - What is the difference?
- The 5th generation of wireless networks addresses the evolution **beyond mobile internet** to massive IoT (Internet of Things) from 2019/2020 onwards. The main evolution compared with today's 4G and 4.5G (LTE advanced) is that, **beyond data speed** improvements, new IoT and critical communication use cases will require a new level of improved performance.
- For example, **low latency** is what provides real-time interactivity for services using the cloud: this is key to the success of self-driving cars, for example.
- 5G vs. 4G also means at least x100 devices connected. 5G must be able to **support 1 million devices** for 0.386 square miles or 1 Km^2.

- Also, **low power consumption** is what will allow connected objects to operate for months or years without the need for human assistance.
- Unlike current IoT services that make performance trade-offs to get the best from current wireless technologies (3G, 4G, WiFi, Bluetooth, Zigbee, etc…), 5G networks will be designed to bring the level of performance needed for massive IoT.

It will enable a perceived, entirely ubiquitous connected world.
In short, that's what makes it **transformational**.

5G and the previous mobile generations at a glance
In the last four decades, mobile phones, more than any other technology, have quietly changed our lives forever.
Do you remember how much you loved your 2G Nokia 3310?
1G, the first generation of telecom networks (1979), let us talk to each other and be mobile
2G digital networks (1991) let us send messages and travel (with roaming services)
2.5G and **2.75G** brought some improvement to data services (GPRS and EDGE)
3G (1998) brought a better mobile internet experience (with limited success)
3.5G brought a truly mobile internet experience, unleashing the mobile apps eco-system
4G (2008) networks brought all-IP services (Voice and Data), a fast broadband internet experience, with unified networks architectures and protocols
4 G LTE (for Long Term Evolution), starting in 2009, doubled data speeds
5G networks expand broadband wireless services beyond mobile internet to IoT and critical communications segments

How fast will 5G take-up be?
The projected adoption rate for 5G differs drastically from all previous generation networks (3G, 4G).
While previous technology was driven by mobile internet usage and the availability of "killer apps," 5G is expected to be mainly **driven by new IoT usages**, such as connected and self-driving cars, for example.
According to a June 2019 report from Ericsson, 5G will reach 45% population coverage and 1.9 billion subscriptions by 2024, making it the fastest generation ever to be rolled out on a global scale.

What are the implications of 5G for mobile operators?
5G is still a cellular broadband technology and is a network of networks. MNOs' **expertise and knowledge** in building and operating networks will be crucial to the success of 5G. Beyond providing network services, MNOs will be able to develop and operate new IoT services.
The implementation of 5G networks while keeping 3G and 4G networks operational will likely trigger a new challenge for MNOs regarding the ability of frequencies in the spectrum (mainly if the forecasted massive volume on IoT occurs).
MNOs will need to operate a new spectrum in the 6 to 300 GHz range (typical **5G bandwidth**), which means massive investments in the network infrastructure.
To reach the 1ms latency goal, 5G networks imply connectivity for the base station using **optical fibers.**
On the cost savings side, 5G networks are planned to be capable of supporting virtual networks such as low power low throughput (LPLT) networks for low-cost IoT. 5G for consumers means not just faster mobile internet, but mainly internet connectivity in many more objects than what you see today.
The car and the house are two examples of the big IoT revolution coming ahead, supported by 5G networks.
Samsung and other Android OEMs plan to introduce the first 5G smartphones in 2019. 54 5G phones are already commercially available.

- Mr. VGT Rakesh, Assistant Professor, Dept. of EEE

Introduction:

Marissa Mayer is Google's first female engineer, having joined the company at a startup stage in 1999. At just 36 years old, she was the youngest member of Google's executive operating committee. Mayer led product management for a variety of search products, such as Google Earth, Google Maps, Local Search, Street View and Gmail. In July, 2012, Mayer was appointed President and CEO of Yahoo!.

Early life and education:

Mayer was born in Wausau, Wisconsin, the daughter of Margaret Mayer, an art teacher of Finnish descent, and Michael Mayer, an environmental engineer who worked for water companies. Her grandfather, Clem Mayer, had polio when he was 7 and served as mayor of Jackson, Wisconsin for 32 years. As a child, Mayer was "painfully shy" and was a Brownie. During middle school and high school, she took piano and ballet lessons, the latter which taught her "criticism and discipline, poise and confidence." When she was attending Wausau West High School, Mayer was on the curling team and the precision dance team. She excelled in chemistry, calculus, biology, and physics. She took part in extracurricular activities, becoming president of her high school's Spanish club, treasurer of Key Club, captain of the debate team, and captain of the pom-pom squad. Her high school debate team won the Wisconsin state championship and the pom-pom squad was the state runner-up. During high school, she worked as a grocery clerk. After graduating from high school in 1993, Mayer was selected by Tommy Thompson, then the Governor of Wisconsin, as one of the state's two delegates to attend the National Youth Science Camp in West Virginia.

Marissa's aggressive speech:

For the 20th anniversary of Yahoo, Marissa Mayer discusses how she's trying to reinvent the company. In a wideranging interview, Mayer shares her vision for fixing the company's past mistakes, including a major investment in mobile and a new ad platform. Yet she's been dogged by critics who see her as an imperious micromanager, who criticize her $1.1 billion purchase of Tumblr, and who fault her for moving too slowly. The company's executives explain that the business could only return to health after she first halted Yahoo's brain drain and went big on mobile. As one Yahoo employee summarized Mayer's thinking: "First people, then apps." "In technology we live at a rare, fast moving pace," Mayer said, "There are probably industries where gender is more of an issue, but our industry is not one where I think that's relevant." The obsession with product, user experience, and her strong point of view is a strength, she argues. For example, her insistence that her team find a way to use the time users spend thumbing their email app to refresh it led to a news and search integration that created millions of extra minutes of user engagement, according to Yahoo mobile head Adam Cahan.

- Nadar Jayasudha
III EEE

Introduction:

A humanoid robot is a robot with its body shape built to resemble that of the human body. A humanoid design might be for functional purposes, such as interacting with human tools and environments, for experimental purposes, such as the study of bipedal locomotion, or for other purposes. In general, humanoid robots have a torso, a head, two arms, and two legs, though some forms of humanoid robots may model only part of the body, for example, from the waist up. Some humanoid robots may also have heads designed to replicate human facial features such as eyes and mouths. Now this Humanoid Robot Technique has been used for Navy.

About:

The birth of SAFFiR (Shipboard Autonomous Firefighting Robot) - US Navy's latest recruit was at The Naval Future Forces Science and Technology Expo . Scientists unveiled a Fire Fighting Robot Prototype that was able to successfully complete it's demonstration. This stands 5Feet10 and weighs 143 pounds . He would be soon fighting fire in the US Navy . This was tested under simulated fire where it walked across uneven floors , used thermal imaging to identify overheated equipments and used hose to extinguish a small fire . Dr. Thomas McKenna, ONR program manager for human-robot interaction and cognitive neuroscience said that they had set out to build and demonstrate a humanoid capable of mobility aboard a ship, manipulating doors and fire hoses, and equipped with sensors to see and navigate through smoke . The main theme of this or as a long-term goal is to keep Sailors from the danger of direct exposure to fire.

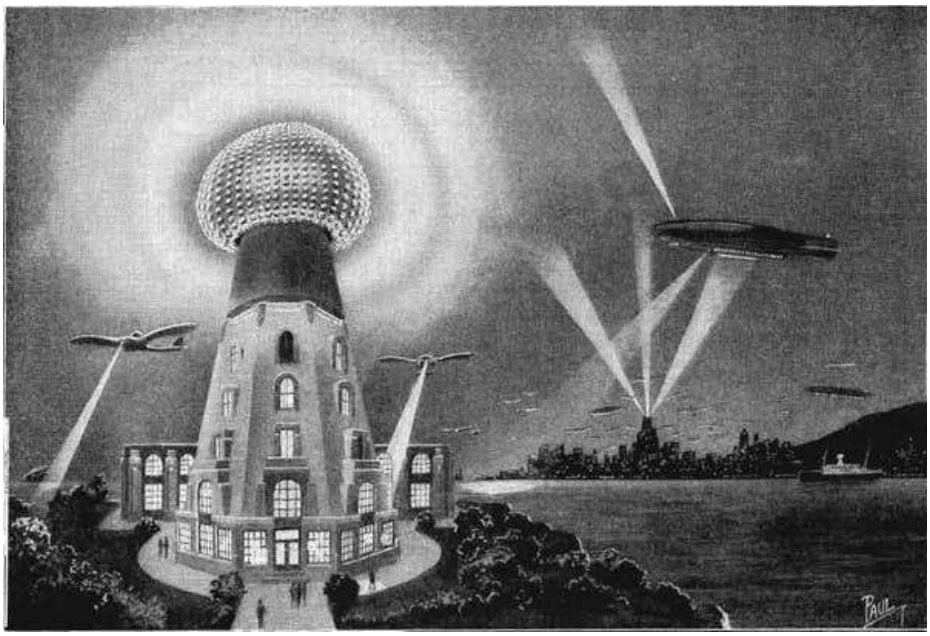
The Making:

The Humanoid Robot SAFFiR has been loaded with a lot of latest technologies. Sensors including infrared stereovision and a rotating laser for Light Detection and Ranging (LIDAR), that enables the Humanoid to see through Dense Smoke. It also has hands that can manipulate objects, open doors and handle a hose. But seeing through smoke and handling hose is just a part of the equation. According to the team who built the Bot, the hardest part of the process was designing the robotic equivalent of ‘‘sea legs’’ that allow SAFFiR the Humanoid Robot to stay upright aboard a rollicking ship. Whole-body momentum control allows for the robot to optimize the locations of all of its joints so that it maintains its center of mass on uncertain and unstable surfaces.

- Nasappagari Bhavana Reddy
II EEE

It was Tesla Motors, more than any other company, that triggered the current interest in electric cars. The firm's namesake, Nikola Tesla, a genius inventor and Thomas Edison's arch rival, would no doubt be pleased. Yet Tesla would be even more thrilled to realize the next step for electric vehicles involves turning his biggest vision into reality: the wireless transmission of power.

Due to their low local emissions, battery-powered electric cars are more in demand than ever, but they still have a reputation for being too expensive and having too short a driving range. So how about recharging them without having to plug in a cable, while parking or even driving on the road?
This isn't science fiction: we know from our electric tooth brushes that batteries can be recharged without plugging in a wire, and even smart phones can be charged just by being placed on top of a pad.



Nikola Tesla planned – but never completed – a wireless power transmitter in New York.

Here's how it works: an alternating current (AC) flows through a wire coil (the transmitter), which causes a magnetic field to switch between two directions at a high frequency. A second coil (the receiver) exposed to that magnetic fields picks up those oscillations, inducing an AC current in its own circuit, which is then used to power the car (or charges the battery in your toothbrush).

Electronic systems able to handle higher frequencies, which allow more power to be transmitted, are becoming more affordable. Energy can now be transferred between coils that are increasingly further apart or aren't aligned accurately.

Thanks to this technology, some electric cars can already be charged by parking them on top of charging pads, which can be as much as 20cm away from the receiving coil at the bottom of the vehicle. The next step is to wire-up the roads themselves with coils so that cars, buses, and even trucks could be charged while they move.

For peace of mind, wireless charging systems are properly shielded so that no animals or humans will be harmed. A coil in the road will only emit power when it is in wireless communication with a receiver coil above it, and the latter will absorb nearly all of it. The bit that is lost is mostly absorbed by the metal body of the car itself.

The path to wired-up roads

Retrofitting roads with wireless charging coils sounds expensive. But recent studies show that the biggest part of the cost comes from the construction work itself – on a new or renovated road, the extra costs are not that high.

An early Tesla demo of wireless charging

Charging on the move isn't just a convenient time-saver – it will also bring down the cost of electric vehicles themselves. Batteries that get recharged more frequently during usage will last longer and can be made smaller while retaining the same driving range.

As with all new technologies that rely on not-yet existing infrastructure, wireless vehicle charging will start in a niche market (remember the early and expensive days of mobile phones?). In this case, the niche is electric buses that re-charge at bus stops and on certain segments of their fixed driving route.

The global pioneer is the Online Electric Vehicle (OLEV), a bus developed a few years ago by South Korea's Advanced Institute of Science and Technology (KAIST). Continuous charging means OLEV buses cover their routes using small batteries just a third the size of those found in a regular electric car. More recently, Swedish truck and bus-maker Scania trialled a similar system of recharging stations for buses to demonstrate such technology could still work in harsh Nordic winters.

For passenger cars, wireless charging will first come as a convenience feature. People will be able to park in their driveway or garage without having to plug in a cable, and will still have a recharged battery next time they need the car.

We will have to wait longer for a dense network of highways that can charge vehicles on the move. This would be a major infrastructure investment and would involve a substantial quest for more copper wires and semiconductor components.

Experience with the technology and agreement on international compatibility standards will be prerequisites of such investments. Safety must not be ignored: the transmitter coils emit substantial power, which is only considered safe if it is in proper communication with a receiver coil. Communication between transmitter and receiver must also be secured against accidental or even intentional interference – an aspect that even touches on cyber security.

So when and where will we see electrified roads being rolled out on larger scale? Korea will try and maintain its leadership in this technology. Places like Singapore, wealthy and with strong ambitions in clean and efficient transport, may follow soon. Standardised electrified roads could become what the railways were to the 19th century: not only a leap in transport efficiency, but the core of a new industry.

- MV Bramhananda Reddy, Assistant Professor, Dept. of EEE

There was a man who worked for the railroad.

One day, he went into the freezer compartment to do his routine work. The door accidentally closed and he found himself trapped in the compartment. He shouted for help but no one heard him since it was midnight.

He tried to break down the door but he could not. As he lay in the freezer compartment, he began to feel colder and colder. Then he began to feel weaker and weaker, and he wrote on the wall of the compartment, "I am feeling colder and colder; and I am getting weaker and weaker. I am dying, and this may be my last words".

In the morning when the other workers opened up the compartment they found him dead. The sad twist to the above story is that the freezing apparatus there had broken down a few days ago. The poor worker did not know about it and in his mind the freezing apparatus was working perfectly. He felt cold, got weaker and literally willed himself to die.

Moral

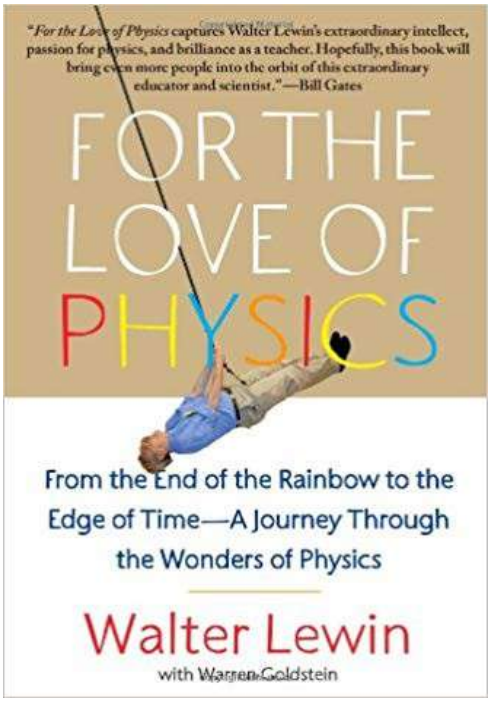
Our sub-conscious mind can be cheated. The sub-conscious mind can only accept and act on information passed to it by the conscious mind. It has no capacity to reject or decline any instruction or information passed to it by the conscious mind. In the case of the poor worker, he consciously thought that he was getting colder, weaker and dying and the sub-conscious mind accepted the above instructions and affected his physical body. That was how he willed himself to die.

- Dr. Shaik Rafi Kiran, Professor & HOD, Dept. of EEE

Book Intro: For the love of Physics

'For the Love of Physics: From the End of the Rainbow to the Edge of Time - A Journey Through the Wonders of Physics'

- Walter Lewin



An engaging book for the Physics aficionado

'For the Love of Physics: From the End of the Rainbow to the Edge of Time - A Journey Through the Wonders of Physics' by Walter Lewin is an engaging book which tries to explain the concepts of the subject in a unique and interactive manner. We all go through physics exams and study its concepts, but have you ever wondered what these concepts actually mean to our race, to our planet and their importance for our existence? This takes you on a journey and explains you the physics behind every natural concept from Rainbows to the concept of time. This book is an engaging and entertaining attempt at explaining the different and difficult concepts of physics to a layman.

About the Author

Walter Lewin is a renowned Physicist of Dutch origin and taught Physics at MIT where he spent 45 years. He completed his doctorate in nuclear physics from Delft University of Technology in 1965. He is famous for his online lectures published on edX and MIT Open Courseware, with some of them being watched over 2 million times.

First, let us evaluate your self-desire of how you want to represent yourselves to this world. Remember, this is a game and the individual with the highest score wins! So, here goes the question – Is the figure below concave or convex?

Examine the figure carefully… Be patient, pause your reading and come up with the most appropriate answer that you are satisfied with. So, now let us see how you want to represent yourselves to this world. Please, allot a mark of 1 to your score card if you have diagnosed this figure as either a concave or convex. If you are in a confusion as you have diagnosed the figure as either of them, then, feel free to assign yourselves a highest mark of 2.

Finally, the results have been declared that the individual with the score of zero wins the game. So, the highest appraisals and the prestigious title of "Winner" goes to that person who have showed up suddenly from nowhere. End of competition.

From this competition, I have showed you how this world has changed drastically from a truthful vintage to a corrupted young age. As a citizen of this once beautiful economy, we never have tried to face our day to day chances with utmost courage and determination. We know our strength but fail to be confident about it. We dream of a safe future and live for someone else's life. We see an act of arrogance and marvel at ourselves about our escape from them. We have a passion but we hide it with our dull looking resume. Finally, we get a job and lead a mechanical life.

Just ask yourselves, "Is this the life which you are destined to live?" If your answer is yes, then, you can surely win with almost nil passion and nil interest. If you say no, then, you surely are a 'LEGEND'! The above game might have come up with two end points. One is acceptance and the other is back talks.

Let us first analyze the scene in terms of back talks. Just consider a competition is being held like this and you are one of the competitors. If you have entered this competition with the main motto of winning, then, you would have started to doubt your skills after the announcement of the results. Fear would have enveloped your mind and you would be subjected to constant disappointment. This might lead you to hide your identity in that competition and would also have made you have back talks about the conspiracy that happened during the finals. Now, what might have been the state of your mind if you had accepted the result of the competition? Just one thing, your inner voice would never have got down, no matter what happens. The factor that made your mind to accept or deny the result was the belief which you had on yourselves. In turn, this whole thought would have been from the source so-called FEAR. Fear was the outcome of that competition but your belief has changed the state of your mind. It is all again your choice.

If you face constant failures in your life, just learn the mistakes from them and wait for the even more beautiful future you are destined to live in. A person who wants to be a winner, learns less and wins his/ her life in the first attempt. But a person who is LEGENDARY tries with many attempts to succeed while learning many valuable things and finally wins in his last attempt. A winner is just a HISTORY who wins his life; while a LEGEND is beyond history who wins the world. FEAR has two meanings. The choice is yours…

Choice 1 – Forget Everything And Run forward to be a winner.
Choice 2 – Face Everything And Rise, accepting all your defeats, to be a legend.

- Mrs. N Pushpa, Assistant Professor, Dept. of EEE

Electric Shock:

An electric shock can occur upon contact of a human or animal body with any source of voltage high enough to cause sufficient current flow through the muscles or nerves. The minimum detectable current in humans is thought to be about 1 mA. The current may cause tissue damage or heart fibrillation if it is sufficiently high.

Description:

The level of voltage is not a direct guide to the level of injury or danger of death, despite the common misconception that it is.

A small shock from static electricity may contain thousands of volts but has very little current behind it due to high internal resistance.

Physiological effects and damage are generally determined by current and duration. Even a low voltage causing a current of extended duration can be fatal.

It should be noted, however, that Ohm's Law directly correlates voltage and current for a given resistance; thus, for a particular path through the body under a particular set of conditions, a higher voltage will produce a higher current flow.

Causes of electric shock:

Electric shock is caused by a difference in conduction of electricity across different surfaces. Electricity will always find the path to ground (or the completion of a circuit) that offers the least amount of resistance. When any object providing less resistance than the normal circuit enters the path of the electrons, the current will leave the circuit and travel through the new path to ground. This principle is why birds can stand on electrical wires and be safe, yet a downed electrical wire can be deadly for several hundred feet in all directions. Electricity dissipates in various and unpredictable ways. If you have a difference in voltage from one place to another, and there is a circuit completion (a wire, a finger) in between, current will jump across. Electric shock is not the state of being electrically energized that can be totally harmless if controlled; it is the state of completing a circuit, or bridging the gap between conductors.

'Let go' current:

With sufficiently high current there can be a muscular spasm which causes the affected person to grip and be unable to release from the current source. The maximum current that can cause the flexors of the arm to contract but that allows a person to release his hand from the current's source is termed the let-go current. For DC, the let-go current is about 75 mA for a 70-kg man. For alternating current, the let go current is about 15 mA, dependent on muscle mass.

Shock effects:

Psychological:

The perception of electric shock can be different depending on the voltage, duration, current, path taken, etc.

Current entering the hand has a threshold of perception of about 5 to 10 milliamperes (mA) for DC and about 1 to 10 mA for AC at 60 Hz.

Burns:

Tissue heating due to resistance can cause extensive and deep burns.

High-voltage (> 500 to 1000 V) shocks tend to cause internal burns due to the large energy (which is proportional to the square of the voltage) available from the source.

Damage due to current is through tissue heating.

Ventricular fibrillation:

A low-voltage (110 to 220 V), 60-Hz AC current traveling through the chest for a fraction of a second may induce ventricular fibrillation at currents as low as 60mA. With DC, 300 to 500 mA is required. If the current has a direct pathway to the heart (eg, via a cardiac catheter or other electrodes), a much lower current of less than 1 mA, (AC or DC) can cause fibrillation. Fibrillations are usually lethal because all the heart muscle cells move independently. Above 200mA, muscle contractions are so strong that the heart muscles cannot move at all.

Neurological effects:

Current can cause interference with nervous control, especially over the heart and lungs.

Uses of Electric Shock:

Medical uses:

- Electric shock is also used as a medical therapy, under carefully controlled conditions:
- Electroconvulsive therapy or ECT is a psychiatric therapy for mental illness. The objective of the therapy is to induce a seizure for therapeutic effect. There is no sensation of shock because the patient is anesthetized.
- The therapy was originally conceived of after it was observed that depressed patients who also suffered from epilepsy experienced some remission after a spontaneous seizure.
- The first attempts at deliberately inducing seizure as therapy used not electricity but chemicals; however electricity provided finer control for delivering the minimum stimulus needed.
- Ideally some other method of inducing seizure would be used, as the electricity may be associated with some of the negative side effects of ECT including amnesia.
- ECT is generally administered three times a week for about 8-12 treatments.
- As a surgical tool for cutting or coagulation. An "Electrosurgical Unit" (or ESU) uses high currents (e.g. 10 amperes) at high frequency (e.g. 500 kHz) with various schemes of amplitude modulation to achieve the desired result - cut or coagulate - or both. These devices are safe when used correctly.
- As a treatment for fibrillation or irregular heart rhythms: see defibrillator and cardio version.As a method of pain relief: see Transcutaneous Electrical Nerve Stimulator (more commonly referred to as a TENS unit).As an aversive punishment for conditioning of mentally handicapped patients with severe behavioral problems.
- This method is highly controversial and is employed at only one institution in the United States, the Judge Rotenberg Educational Center; the institute also uses electric shock punishments on non-handicapped children with behavioral problems, and whether this constitutes legitimate medical treatment or abusive discipline is currently the subject of litigation.

How to Avoiding danger of shock:

- Current electrical codes in many parts of the world call for installing a residual-current device (RCD or GFCI, ground fault circuit interrupter) on electrical circuits thought to pose a particular hazard to reduce the risk of electrocution.
- It is strongly recommended that people should not work on exposed live conductors if at all possible.
- If this is not possible then insulated gloves and tools should be used. Also, remember there can be a voltage potential between "neutral" wires and ground.
- The neutral wire from a high-wattage appliance will have nearly as much voltage potential to ground as its hot wire. However, even a low-wattage appliance isn't safe against electrocution from its neutral wire.

First aid:

The recommended first aid for someone who had received a severe electrical shock has three major components.

Call for help.

Make sure the victim is no longer in contact with the electrical current source. Turn off all power if this can be done quickly.

Check for breathing and heart beat and apply cardiopulmonary resuscitation, if necessary.

Point of entry:

Macro shock:

- Current across intact skin and through the body.
- Current from arm to arm, or between an arm and a foot, is likely to traverse the heart, therefore it is much more dangerous than current between a leg and the ground.
- This type of shock by definition must pass into the body through the skin.

Micro shock:

- Very small current source with a pathway directly connected to the heart tissue.
- The shock is required to be administered from inside the skin, directly to the heart i.e. a pacemaker lead, or a guide wire, conductive catheter etc. connected to a source of current.
- This is a largely theoretical hazard as modern devices used in these situations include protections against such currents.

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Hyper loop

A Hyper loop is a proposed mode of passenger and freight transportation, first used to describe an open-source vactrain design released by a joint team from Tesla and SpaceX. Hyperloop is a sealed tube or system of tubes through which a pod may travel free of air resistance or friction conveying people or objects at high speed while being very efficient, thereby drastically reducing travel times over medium-range distances.

Elon Musk's version of the concept, first publicly mentioned in 2012, incorporates reduced-pressure tubes in which pressurized capsules ride on air bearings driven by linear induction motors and axial compressors.

The Hyperloop Alpha concept was first published in August 2013, proposing and examining a route running from the Los Angeles region to the San Francisco Bay Area, roughly following the Interstate 5 corridor. The Hyperloop Genesis paper conceived of a hyperloop system that would propel passengers along the 350-mile (560 km) route at a speed of 760 mph (1,200 km/h), allowing for a travel time of 35 minutes, which is considerably faster than current rail or air travel times. Preliminary cost estimates for this LA–SF suggested route were included in the white paper—US$6 billion for a passenger-only version, and US$7.5 billion for a somewhat larger-diameter version transporting passengers and vehicles—although transportation analysts had doubts that the system could be constructed on that budget; some analysts claimed that the Hyperloop would be several billion dollars overbudget, taking into consideration construction, development, and operation costs.

The Hyperloop concept has been explicitly "open-sourced" by Musk and SpaceX, and others have been encouraged to take the ideas and further develop them. To that end, a few companies have been formed, and several interdisciplinary student-led teams are working to advance the technology. SpaceX built an approximately 1-mile-long (1.6 km) subscale track for its pod design competition at its headquarters in Hawthorne, California.

Theory and operation:

Developments in high-speed rail have historically been impeded by the difficulties in managing friction and air resistance,both of which become substantial when vehicles approach high speeds. The vactrain concept theoretically eliminates these obstacles by employing magnetically levitating trains in evacuated (airless) or partly evacuated tubes, allowing for speeds of thousands of miles per hour. However, the high cost of maglev and the difficulty of maintaining a vacuum over large distances has prevented this type of system from ever being built. The Hyperloop resembles a vactrain system but operates at approximately one millibar (100 Pa) of pressure.

Initial design concept

The Hyperloop concept operates by sending specially designed "capsules" or "pods" through a steel tube maintained at a partial vacuum. In Musk's original concept, each capsule floats on a 0.02–0.05 in (0.5–1.3 mm) layer of air provided under pressure to air-caster "skis", similar to how pucks are levitated above an air hockey table, while still allowing faster speeds than wheels can sustain. Hyperloop One's technology uses passive maglev for the same purpose. Linear induction motors located along the tube would accelerate and decelerate the capsule to the appropriate speed for each section of the tube route. With rolling resistance eliminated and air resistance greatly reduced, the capsules can glide for the bulk of the journey. In Musk's original Hyperloop concept, an electrically driven inlet fan and axial compressor would be placed at the nose of the capsule to "actively transfer high-pressure air from the front to the rear of the vessel", resolving the problem of air pressure building in front of the vehicle, slowing it down. A fraction of the air is shunted to the skis for additional pressure, augmenting that gain passively from lift due to their shape. Hyperloop One's system does away with the compressor.

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