JNANAVARDHANA 10.0

Jnanavardhana 10.0 program consisted of 26 participants from the pool of the heads of the departments and professors of BMSIT&M. Every Wednesday one of the participants has to give a talk on a chosen subject to the rest of the members. There is no restriction on the topic, however normally speakers choose subjects close to their area of expertise. Jnanavardhana promotes inter disciplinary thinking and stimulates the mind of the listener. There are discussions after the talk which brings out societal and technological issues to the forefront and helps in team building. This booklet is a collection of the abstracts of the talks conducted from April to December 2021.

Coordinator: Dr. Sanjay Lakshminarayanan, Professor, EEE, BMSIT&M.

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Optical Communication

Dr. Ambika R, Professor, ECE

Fiber optics, or optical fibers, are long, thin strands of carefully drawn glass about the diameter of a human hair. These strands are arranged in bundles called optical cables. We rely on them to transmit light signals over long distances.

At the transmitting source, the light signals are encoded with data… the same data you see on the screen of a computer. So, the optical fiber transmits "data" by light to a receiving end, where the light signal is decoded as data. Therefore, fiber optics is actually a transmission medium – a "pipe" to carry signals over long distances at very high speeds.

Fiber optic cables were originally developed in the 1950s for endoscopes. The purpose was to help doctors view the inside of a human patient without major surgery. In the 1960s, telephone engineers found a way to use the same technology to transmit and receive telephone calls at the "speed of light". That is about 186,000 miles per second in a vacuum, but slows to about two-thirds of this speed in a cable.

Single And Multimode Fiber

Fiber optic cables carry light signals in modes. A **mode** is a path that the light beam follows when traveling down the fiber. There are single mode and multimode fiber cables.

Single mode fiber is the simplest structure. It contains a very thin core, and all signals travel straight down the middle without bouncing off the edges. Single mode fiber optic cables are typically used for CATV, Internet, and telephone applications, where the signals are carried by single mode fibers wrapped into a bundle.

Multimode fiber is the other type of fiber optic cable. It is about 10 times larger than a single mode cable. The light beams can travel though the core by following a variety of different paths, or in multiple different modes. These cable types can only send data over short distances. Therefore, they are used, among other applications, for interconnecting computer networks.

How fiber optics works

Fiber optics transmit data in the form of light particles -- or photons -- that pulse through a fiber optic cable. The glass fiber core and the cladding each have a different refractive index that bends incoming light at a certain angle. When light signals are sent through the fiber optic cable, they reflect off the core and cladding in a series of zig-zag bounces, adhering to a process called total internal reflection. The light signals do not travel at the speed of light because of the denser glass layers, instead traveling about 30% slower than the speed of light. To renew, or boost, the signal throughout its journey, fiber optics transmission sometimes requires repeaters at distant intervals to regenerate the optical signal by converting it to an electrical signal, processing that electrical signal and retransmitting the optical signal.

Fiber optic cables are moving toward supporting up to 10-Gbps signals. Typically, as the bandwidth capacity of a fiber optic cable increases, the more expensive it becomes.

Optical sources, detectors, advantages, applications and recent trends in optical communication is the highlights of this topic.

Inclusive Focus of NEP in Autonomy

Dr. Anil G.N, Dean Academics, Professor CSE

Introduction to NEP

NEP aims to address the many growing developmental imperatives of this country. The rich heritage of ancient and eternal Indian knowledge and thought has been a guiding light for this Policy. The pursuit of knowledge (Jnan), wisdom (Pragyaa), and truth (Satya) was always considered in Indian thought and philosophy as the highest human goal. The aim of education in ancient India was not just the acquisition of knowledge as preparation for life in this world, or life beyond schooling, but for the complete realization and liberation of the self. World-class institutions of ancient India such as Takshashila, Nalanda,Vikramshila, Vallabhi, set the highest standards of multidisciplinary teaching and research and hosted scholars and students from across backgrounds and countries.

The Indian education system produced great scholars such as Charaka, Susruta, Aryabhata, Varahamihira, Bhaskaracharya, Brahmagupta, Chanakya, ChakrapaniDatta, Madhava, Panini, Patanjali, Nagarjuna, Gautama, Pingala, Sankardev, Maitreyi, Gargi and Thiruvalluvar, among numerous others, who made seminal contributions to world knowledge in diverse fields.The teacher must be at the centre of the fundamental reforms in the education system. The new education policy must help re-establish teachers, at all levels, as the most respected and essential members of our society, because they truly shape our next generation of citizens. Moving towards multidisciplinary universities and colleges, with more HEIs across India that offer medium of instruction in local/Indian languages;

- Moving towards faculty and institutional autonomy;
- Revamping curriculum, pedagogy, assessment, and student support
- Establishment of a national research foundation
- Governance of HEIs by independent boards having academic and administrative autonomy;
- Increased access, equity, and inclusion

The new education policy must help recruit the very best and brightest to enter the teaching profession at all levels, by ensuring livelihood, respect, dignity, and autonomy, while also instilling in the system basic methods of quality control and accountability.Policy has proposed for the revision and revamping of all aspects of the education structure, including its regulation and

governance. The principle of NEP is on enhancement of cognitive skills to achieve higher order cognitive skills like critical thinking, problem solving with emotional and social intelligence.

The new education policy must provide to all students, irrespective of their place of residence, a quality education system, with particular focus on historically marginalized, disadvantaged, and under-represented groups. Education is a great leveller and is the best tool for achieving economic and social mobility, inclusion and equality.Quality higher education must aim to develop good, thoughtful, well-rounded, and creative individuals. Initiatives must be in place to ensure that all students from such groups, despite inherent obstacles, are provided various targeted opportunities to enter and excel in the educational system.

- Recognizing, identifying, and fostering the unique capabilities of each student, by sensitizing teachers as well as parents to promote each student's holistic development in both academic and non-academic spheres;
- According the highest priority to achieving Foundational Literacy and Numeracy by all students by Grade 3;
- Flexibility, so that learners have the ability to choose their learning trajectories and programmes, and thereby choose their own paths in life according to their talents and interests;
- No hard separations between arts and sciences, between curricular and extra-curricular activities, between vocational and academic streams, etc. in order to eliminate harmful hierarchies among, and silos between different areas of learning;

Multidisciplinary and a holistic education across the sciences, social sciences, arts, humanities, and sports for a multidisciplinary world in order to ensure the unity and integrity of all knowledge. Emphasis on conceptual understanding rather than rote learning and learning-for-exams. Creativity and critical thinking to encourage logical decision-making and innovation. Ethics and human & Constitutional values like empathy, respect for others, cleanliness, courtesy, democratic spirit, spirit of service, respect for public property, scientific temper, liberty, responsibility, pluralism, equality, and justice

Landscape of Higher Education:

By 2040, all higher education institutions (HEIs) shall aim to become multidisciplinary institutions.Increase the Gross Enrolment Ratio in higher education including vocational education from 26.3% (2018) to 50% by 2035. Growth will be in both public and private institutions, with a strong emphasis on developing a large number of outstanding public institutions. A university can offer

- Undergraduate and graduate programmes
- Research-intensive Universities
- Teaching-intensive Universities.

Autonomous degree-granting College (AC) will refer to a large multidisciplinary that grants undergraduate degrees.A stage-wise mechanism for granting graded autonomy to colleges, through a transparent system of graded accreditation, will be established. HEIs will have the autonomy and freedom to move gradually from one category to another, based on their plans, actions, and effectiveness.These three broad types of institutions are not in any natural way a rigid, exclusionary categorization, but are along a continuum. The undergraduate degree will be of either 3 or 4-year duration, with multiple exit options within this period.

A certificate after completing 1 year in a discipline or field including vocational and professional areas, or a diploma after 2 years of study, or a Bachelor's degree after a 3-year program.Academic Bank of Credit (ABC) shall be established which would digitally store the academic credits earned from various recognized HEIs.All institutions and faculty will have the autonomy to innovate on matters of curriculum, pedagogy, and assessment within a broad framework of higher education qualifications. Integrated curriculum must be close consideration of the academic autonomy. Curriculum must be heterogeneity –centred fulfilling needs of the aplomb viewpoints projected by all stakeholders.Curriculum must concomitantly include institution's vision, research needs, industry requirement and other requirements. Pre-balanced autonomy structure to ensure learning at cognitive, affective and psychomotor levels.Key challenges that government-funded as well as private HEIs face are –

- Restriction of decision-making as per the University
- Operational dependency on the University
- Ankylosing curricula
- Lack of adequate infrastructure to scale up.

An institution can manage and achieve higher level of academic and research by effectively maintaining the norms laid out and integration of research at every level of the academic framework.Curriculum structure in autonomy shall effectively cover skill based holistic learning in higher education with multiple exit options. Institutions and faculty will have the autonomy to innovate on matters of curriculum, pedagogy, and assessment within a broad framework of higher education qualifications.

A National Curricular framework developed by the NCERT will be cater the needs of the early education for each learner.Autonomous degree granting College can focus on advance curriculum to bridge the gap between industry and academia. Under graded autonomy, academic, administrative and financial autonomy will be given to colleges on the basis of their accreditation status under the three categories, with top research universities having the highest levels of autonomy.It's a conceptual shift to reduce complexity of the system, as well as to ensure there is dedicated planning and funding for institutions who say they want to be research universities.This model has adverse ramifications for accessibility, equity and quality for the higher education sector.

The issue of autonomy is the key to unravelling the inherent problem with NEP 2020 in matters of higher education. By engaging with the multi-fold ramifications of this provision, a lot can be gleaned on the heavy cost that the common masses will pay in terms of growing inaccessibility of higher education.

EMERGENT PHENOMENA

Dr.Annamma Abraham, Professor,
Mathematics

Introduction

An ant is not very smart. It doesn't have much of a brain, no will, no plan, and yet, many ants together are smart. An ant colony can construct complex structures. Some ants gather food. They can wage war or defend themselves. How is this possible? How can a bunch of ants do smart things together? This phenomenon is called emergence, and it's one of the most fascinating and mysterious features of our universe. It describes small things forming bigger things that have different properties than the sum of their parts. Emergence is complexity arising from simplicity, and emergence is everywhere.

Water has vastly different properties to the molecules that make it up, like the concept of wetness. Zooming in far enough in a wet fabric we see that there is no wetness. There are just molecules sitting in the spaces between the atoms of the cloth. Wetness is an emerging property of water. Ice and snow are something new only created by a lot of individual interactions between water molecules. Many things interact under a certain set of rules, creating something above and beyond themselves. It turns out that more is different.

Illustrations of Emergence

Hundreds of millions of complicated molecules interact to maintain a robust and amazing structure, the human being. A being with vastly different properties than the sum of its dead parts emerges. The smallest unit of life: a cell, emerge from things that are not alive. Cells combine and cooperate. They specialize and respond to one another, and over time, develop into complex organisms with remarkable capacities There is no master mind giving commands**.** Just single units communicating with their neighbours, and acting according to the feedback they get.

Some things that emerge are hard to define. What actually is a nation, is it its population? Is it its institutions, its symbols like its flag, colours or anthems? The physical things it makes like cities, the territory it occupies? All of these things are fluid. Populations change and are replaced. Institutions come and go, cities can be constructed and abandoned. Borders have changed all the time for most of history, and symbols get replaced by new symbols. A nation has no face, no brain, no body. Are nations not real, then? Of course they are, nations interact with the world. They can change landscapes, wage wars, grow or decline, and they can stop existing. But they only exist because of a lot of humans interacting with each other.

Emergent properties are those that arise through interactions among smaller parts that alone do not exhibit such properties. For example a smaller part might be a cell the cell does not exhibit the same properties as when many cells are put together to form a multicellular organism. Single cells come together to form tissues, many different tissues come together to form an organ and if you put different organs together they'll form an organ system. Putting the small intestine together with the pancreas, the stomach and several other organs as well the digestive system is formed. What the digestive system can do is far greater than what any one of its singular cellular parts can do. Often emergent properties are explained by saying that the whole is greater than the sum of the parts.

Concepts related to Emergence

Emergence is conceived as a process where patterns and regularities arise through interactions among smaller or simpler entities that themselves do not exhibit such properties. The concept of emergence implies that what is created out of synergistic relations is not just quantitatively different it is in fact qualitatively different. In order to create some qualitatively different and new phenomena the system must go through what we call a phase transition a phase transition is an often rapid or accelerated period during the process of a systems development where the fundamental parameters with which we describe the system can change qualitatively. A good example is the metamorphosis of a butterfly from being a caterpillar to a mature adult. Not only does the system's morphology change but the whole set of parameters that we define it with are so drastically altered prior and post the phase transition that the creature is given a whole new name

There is also strong and weak emergence. Weak emergence describes how the emergent phenomena can be traced back to the individual elements meaning we can predict and observe higher-level emergent phenomena just by looking at individual components. In contrast strong emergence also known as irreducible emergence states that these phenomena cannot be reduced to the individual components, instead the emergent phenomena are traced back to the interactions between the multiple components and cannot be predicted in any sense by looking at the components on their own. This distinction between strong and weak emergence may also be formulated within the language of information theory where weakly emergent phenomena are essentially computable or we could simulate them in contrast with strongly emergent phenomena where no amount of information could predict or formulate the end result of the process prior to its completion.

Emergence leads us to another key theme in system theory that is hierarchy, the distinction between micro and macro and top-down versus bottom-up causality. Synergistic interactions give rise to new levels of organization that have their own internal properties, features and dynamics. These new emergent levels are called integrative levels. Although these new levels are not directly dependent upon the properties of their paths, the pattern of organization that is emerged is dependent upon the integrity of the synergies between their constituent parts. All systems are composed of a micro level set of building blocks that place an upward set of physical constraints on the system. The macro level defines a pattern of organization. It exerts a downward effect on the paths by creating the context for their operation. Societies and individuals create institutions, but then these institutions feedback to constrain the individuals towards the ends of the institution as a whole. The study of society, the micro and macro are divided into two different domains. Psychology for talking about the individual and sociology for talking about macro level patterns

within social systems, this is because phenomena like social movements only emerge out of the synchronized activities of many individuals and will not form part of the study of the individual.

Synergies may be both positive and negative. A negative synergy is a form of interference or a negative externality where two things are working in a counteractive fashion thus making the combined outcome less than the sum of its parts, noise pollution might be an example of this. Two people talking at the same time doesn't make the conversation twice as good as they are interacting in a destructive fashion. We get the emergence of an effective organization through positive synergies which involve people differentiating their activities while also coordinating them within some combined process. This results in powerful emergence that makes the whole truly different from its parts, like in the case of a swarm of bees or an ant colony.

Obliquity means not explicit or directly to the desired points. For example in trying to land a rocket on the moon, it is directed slightly off from the most direct line and the gravity of the moon catches it and brings it in to the desired final point. Because complex systems are nonlinear, meaning there is no direct cause-and-effect, the outcomes to the system are an emergent phenomena. We cannot directly affect them but instead we have to aim around the phenomena that we wish to effect. We have to instead focus on the components interactions that are giving rise to this imagined outcome. We have to take an oblique approach to solving the problem. In business the principle of obliquity becomes relevant where the oblique goals will often be more effective. For example the goal of delighting customers may make more money than an explicit direct goal of simply trying to make money.

Conclusion

Through the concept of emergence we understand how the synergistic interactions of the individuals within the organization result in the emergence of global behaviour and structure that is qualitatively different from that of the micro level. In emergence there are positive and negative synergies that can give rise to novel desirable outcomes or unintended consequences. Emergence also explains the need to not try to directly control and affect the macro level of the system but instead use an oblique approach by looking at the nonlinear local interactions that are creating that behaviour and try to alter the context within which those choices are made.

The problem of double spending in digital currency and other use cases.

Dr.Arunkumar B.R., Professor, CSE

Abstract

Double-spending is the risk that a digital currency can be spent twice. It is a potential problem *unique to digital currencies because digital information can be reproduced relatively easily by savvy* individuals who understand the blockchain network and the computing power necessary to manipulate it.Physical currencies do not have this issue because they cannot be easily replicated, and the parties involved in a transaction can immediately verify the authenticity and past ownership of the physical currency. That is of course excluding matters involving cash transactions.

With digital currency, there is a risk that the holder could make a copy of the digital token and send it to a merchant or another party while retaining the original.This was a concern initially with bitcoin, the most popular digital currency or "cryptocurrency," since it is a decentralized currency with no central agency to verify that it is spent only once. However, bitcoin has a mechanism based on transaction logs, known as the blockchain, to verify the authenticity of each transaction and prevent double-counting.Still there are some attacks in the blockchain which enables double spending as well as we can find several use cases which are affected by the problem of double spending.

This session of the series, "Jnanavardhana -10", focuses on double spending, attacks on blockchain and use-cases facing the problem of double spending .

Role of Digitization in Immunization Drive.

Dr. Bharathi M A, Professor & HOD, AIML

The COVID-19 pandemic has put an enormous burden on public health, healthcare agencies, and organizations across the world. Experts from the Department of Health and Human Services (HHS) are leading vaccine development, while experts from the Department of Defense (DoD) have partnered with the Centers for Disease Control and Prevention (CDC) and other parts of HHS to coordinate supply, production, and distribution of vaccines. However, successful rollout of the national vaccination program requires close collaboration among state, and local healthcare entities for information dissemination and scheduling to the public .

Big Data

DR.BHUVANESHWARI C MELINAMATH,
HOD, CSE

Big data, what is big data? Why big data?, Other characteristics of data but not definitional traits for big data, Challenges with big data, Big data stack, Exercises - Puzzle, fill in the blanks.

Defining Big Data term

Big data is a term that describes the large volume of data – both structured and unstructured – that effect a business on a day-to-day basis. But it's not the amount of data that's important. It's what organizations do with the data that matters. Big data can be analyzed for insights that lead to better decisions and strategic business moves.

Big data is a broad term for **data** sets so **large** or complex that traditional **data** processing applications are inadequate. Challenges include analysis, capture, **data** curation, search, sharing, storage, transfer, visualization, querying and information privacy.

Big Data technology

Big data is not a single technology but a combination of old and new technologiesthat helps companies gain actionable insight. Therefore, big data is the capability to manage a huge volume of disparate data, at the right speed, and within the right time frame to allow real-time analysis and reaction. As we note earlier in this chapter, big data is typically broken down by three

Characteristics:

✓ Volume: How much data
✓ Velocity: How fast that data is processed
✓ Variety: The various types of data
✓ Veracity: Unclear imprecise

Although it's convenient to simplify big data into the three Vs, it can be misleading and overly simplistic. For example, you may be managing a relatively small amount of very disparate, complex data or you may be processing a huge volume of very simple data. That simple data may be all structured or all unstructured. Even more important is the fourth V: veracity. How accurate is that data in predicting business value? Do the results of a big data analysis actually make sense?

Big data Challenges:

Big data technologies are maturing to a point in which more organizations are prepared to pilot and adopt big data as a core component of the information management and analytics infrastructure. Big data, as a compendium of emerging disruptive tools and technologies, is positioned as the next great step in enabling integrated analytics in many common business scenarios. As big data wends its inextricable way into the enterprise, information technology (IT)practitioners and business sponsors alike will bump up against a number of challenges that must be addressed before any big data program can be successful. Five of those challenges are:

1. Uncertainty of the Data Management Landscape
– There are many competing technologies, and within each technical area there are numerous rivals. Our first challenge is making thebest choices while not introducing additional unknowns and risk to big data adoption.

2.The Big Data Talent Gap
– The excitement around big data applications seems to imply that there is a broad community of experts available to help in implementation. However, this is not yet the case, and the talent gap poses our second challenge.

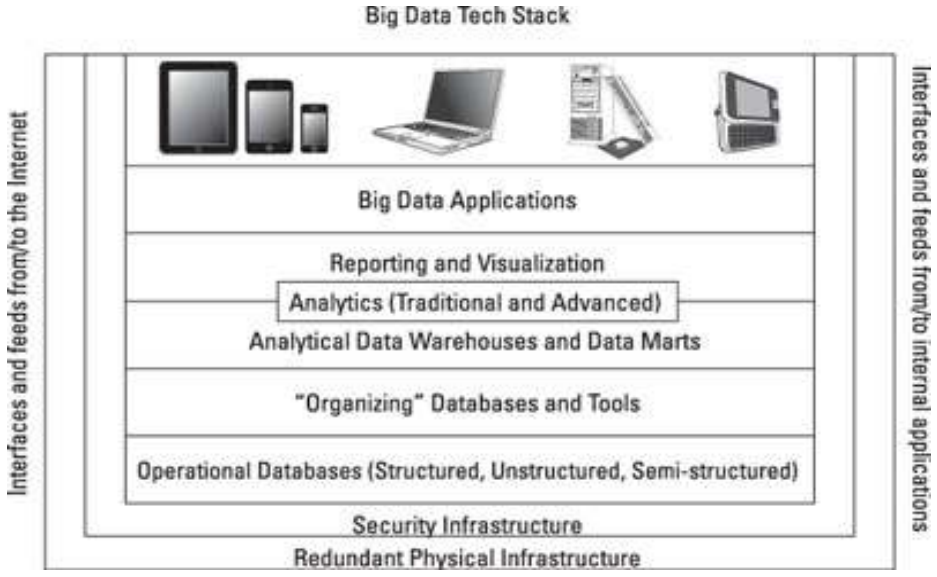
3.Getting Data into the Big Data Platform
– The scale and variety of data to be absorbedinto a big data environment can overwhelm the unprepared data practitioner, making dataaccessibility and integration our third challenge.

4.Synchronization Across the Data Sources
– As more data sets from diverse sources areincorporated into an analytical platform, the potential for time lags to impact data currencyand consistency becomes our fourth challenge.

5.Getting Useful Information out of the Big Data Platform
– Lastly, using big data for differentpurposes ranging from storage augmentation to enabling high-performance analytics is impeded if the information cannot be adequately provisioned back within the othercomponents of the enterprise information architecture, making big data syndication our fifthchallenge.

Big data stack (ref-dummies for more detail)

To understand big data, it helps to see how it stacks up — that is, to lay out the components of the architecture. A big data management architecture must include a variety of services that enable companies to make use of myriad data sources in a fast and effective manner.



Here's a closer look at what's in the image and the relationship between the components:

- **Interfaces and feeds:** On either side of the diagram are indications of interfaces and feeds into and out of both internally managed data and data feeds from external sources. To understand how big data works in the real world, start by understanding this necessity.
  What makes big data big is that it relies on picking up lots of data from lots of sources. Therefore, open application programming interfaces (APIs) will be core to any big data architecture. In addition, keep in mind that interfaces exist at every level and between every layer of the stack. Without integration services, big data can't happen.

- **Redundant physical infrastructure:** The supporting physical infrastructure is fundamental to the operation and scalability of big data architecture. Without the availability of robust physical infrastructures, big data would probably not have emerged as such an important trend. To support an unanticipated or unpredictable volume of data, a physical infrastructure for big data has to be different than that for traditional data. The physical infrastructure is based on a distributed computing model. This means that data may be physically stored in

many different locations and can be linked together through networks, the use of a distributed file system, and various big data analytic tools and applications.

- **Security infrastructure:** The more important big data analysis becomes to companies, the more important it will be to secure that data. For example, if you are a healthcare company, you will probably want to use big data applications to determine changes in demographics or shifts in patient needs. This data about your constituents needs to be protected both to meet compliance requirements and to protect the patients' privacy. You will need to take into account who is allowed to see the data and under what circumstances they are allowed to do so. You will need to be able to verify the identity of users as well as protect the identity of patients.

- **Operational data sources:** When you think about big data, understand that you have to incorporate all the data sources that will give you a complete picture of your business and see how the data impacts the way you operate your business. Traditionally, an operational data source consisted of highly structured data managed by the line of business in a relational database. But as the world changes, it is important to understand that operational data now has to encompass a broader set of data sources.

Applications of Mathematics in Machine Learning.

Dr. Chethan A.S, Professor, Mathematics

Mathematics has become part of our day-to-day life. Mathematics is the basic building block to solve data driven applications in real world scenario. Machine learning is all about dealing with data. We collect data from organisations or from any repositories like Kaggle, UCI etc., and perform various operations on the data set like cleaning and processing the data, visualizing and predicting the output of the data. Many algorithms in Machine learning are written using the four pillars of Mathematics namely Statistics, Probability, Calculus and Linear Algebra. The talk gives an insight on the importance of Mathematics in Machine learning and how it can be used to solve real world problems.

Blockchain for Education

Dr. P. Ganesh, HOD, MCA

Abstract:

Blockchain has been extensively discussed as the foundation technology behind cryptocurrencies. However, Blockchain also has multiple applications within the educational process — making teaching and learning more engaging and fun. The anticipated applications of Blockchain include Record keeping, Verification of certificates, Online Learning, Identity Management among others. Already, universities abroad are engaging themselves to utilise this for their academic and assessment activities and are able to reap its fruits. As we strive to plan for an autonomous process in academic activities, we can explore the Blockchain implementation at BMSIT.

Diesel injection and combustion in CI engines

Dr. H K Govindaraju, Vice Principal, Professor, Mechanical Engineering

Diesel combustion, which is in principle unsteady turbulent diffusion combustion, is fundamentally controlled by the mixing process of fuel with air in the combustion chamber.

The diesel engine is an intermittent-combustion piston-cylinder device. It operates on either a two-stroke or four-stroke cycle (*see* figure); however, unlike the spark-ignition gasoline engine, the diesel engine induces only air into the combustion chamber on its intake stroke. Diesel engines are typically constructed with compression ratios in the range 14:1 to 22:1.

The diesel engine gains its energy by burning fuel injected or sprayed into the compressed, hot air charge within the cylinder. The air must be heated to a temperature greater than the temperature at which the injected fuel can ignite. Fuel sprayed into air that has a temperature higher than the "auto-ignition" temperature of the fuel spontaneously reacts with the oxygen in the air and burns. Air temperatures are typically in excess of 526 °C (979 °F); however, at engine start-up, supplemental heating of the cylinders is sometimes employed, since the temperature of the air within the cylinders is determined by both the engine's compression ratio and its current operating temperature.

The combustion cycle of a diesel engine is simple. It consists of four phases, which have the task of transforming the thermal energy, supplied by diesel oil and air, into mechanical energy. It is worth pointing out that the diesel engine, like all internal combustion engines, is very inefficient, because in the four phases of its cycle, only one produces mechanical energy useful for moving, while the other three absorb the energy. However, let's see in detail the four parts.

Process of Combustion cycle:

1.Suction

Intake valves open to allow air to enter. The piston goes from the upper dead center (PMS) to the lower dead center (PMI), during this journey the connecting rod makes 1 stroke and the crank rotates 180°. As they descend, they create a strong depression in the combustion chamber; thanks to this depression and the insertion of fuel by an injector, the chamber fills up.

2. Compression

The valves close and the piston rises compressing the fuel inside the combustion chamber. In diesel engines the pressures reached at the end of this phase are higher than those of spark ignition engines to allow the self-ignition of the mixture.

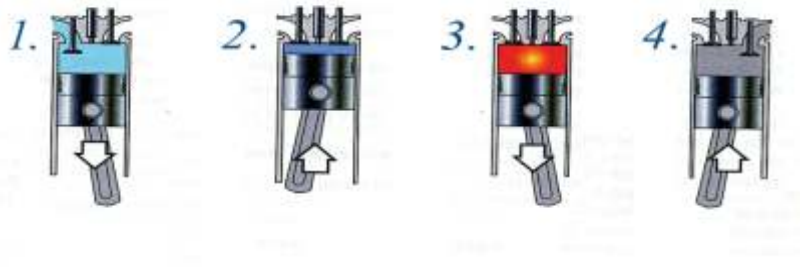
3. Expansion

In diesel engines, ignition occurs spontaneously due to the high temperature and pressure formed at the end of compression. After combustion, gases at very high pressure and temperature have formed inside

the chamber, pushing the piston down to the PMI. Since all the pistons are connected to each other through the crankshaft, while one goes up the other goes down, and the mechanism goes forward.

4. Unloading

The piston, which has fallen due to the combustion of the fuel, rises, expelling the gases through the opening of the exhaust valves, which evacuate the gas from the cylinder, preparing it for a new cycle. The combustion residues are introduced into the exhaust manifold, connected to the exhaust system: muffler and possibly the silencer.



Types of combustion chambers for CI Engines

There are two different types of combustion chambers for CI Engines.

Direct Injection type and Indirect Injection type

Direct Injection type combustion chambers:

Direct Injection type combustion chambers are also known as the open type combustion chambers. This open type combustion chambers, the combustion chamber volume will be located in the cylinder. The fuel will be injected directly into the combustion chamber with the help of the fuel injector.

There are four design variants available in Direct Injection type combustion chambers. those are

Shallow depth chamber,
Hemispherical chamber,
Cylindrical chamber,
Toroidal chamber

Shallow depth combustion chambers are mostly used in the heavy engines running with the low speeds. As you can see the shallow depth chamber diagram, the depth of the cavity provided in the piston is quite small and the diameter is large. Due to the large diameter, there will be almost negligible squish.

As you can see the hemispherical chamber, the depth to the diameter ratio can be varied. so that the squish can be controlled to attain better performance.

In a few modern diesel engines, this type of combustion chambers was implemented. As you can see the Cylindrical Chamber diagram, the shape of the combustion chamber is truncated cone with the base angle of 30°. The Squish can be varied by varying the depth. The swirl can be produced by masking the valve for nearly 180°of the circumference. Squash also can be controlled by varying the depth.

This Toroidal chamber design is mainly focused to provide the powerful Squish along with the air moment. As the more Squish, the mask needed on the inlet valve is small and there is better utilization of oxygen.

This is also known as the Ricardo swirl chamber. Swirl combustion chamber consists of the spherical-

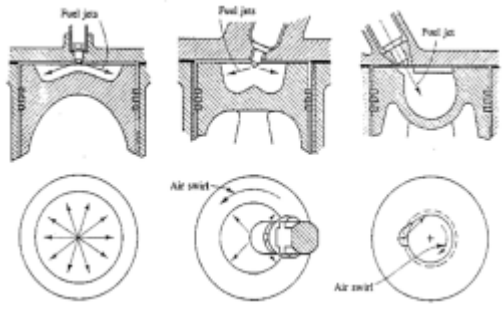
shaped chamber located in the cylinder head separated from the engine cylinder. During the compression stroke, 50% of the air will be transferred to this swirl chamber. In this spherical shaped swirl chamber, the fuel will be injected with the help of a nozzle and the combustion will be initiated.

The main drawback of this chamber is that the heat loss is greater compared to the open combustion chambers.

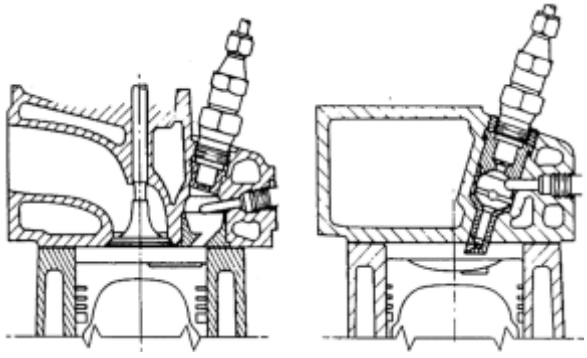
These chambers are used where the less quality of fuels are used. Where reliability is the main objective than the fuel economy. As you can see the above diagram of the Precombustion chamber. It consists of the Prechamber connected to the main chamber. This Prechamber located in the cylinder head. This Prechamber volume accounts for 40% of the total combustion space.

During the compression stroke, the air will be injected into the Prechamber the combustion will be initiated in it. But the bulk combustion will be taken place in the main chamber only. About 80% of the energy will be released in the main combustion chamber.

The rate of pressure rise and the maximum pressure attain during the combustion process is comparatively low than the open combustion chambers.



(a) Shallow depth, Hemispherical and Cylindrical combustion Chambers



(b) Swirlprechamber and direct combustion chamber

Bitcoin and Cryptocurrency Technologies

Dr. M. C. Hanumantharaju,
Professor, ECE and COE

There's a lot of excitement about Bitcoin and cryptocurrencies. Optimists claim that Bitcoin will undamentally alter payments, economics, and even politics around the world. Pessimists claimBitcoin is inherently broken and will suffer an inevitable and spectacular collapse. Underlying these differing views is significant confusion about what Bitcoin is and how it works. The Jnanavardhan presentation will hype and get to the core of what makes Bitcoin unique.To really understand what is special about Bitcoin, we need to understand how it works at a technical level. Bitcoin truly is a new technology and we can only get so far by explaining it through simple analogies to past technologies. We'll assume that you have a basic understanding of computer science - how computers work, datastructures and algorithms, and some programming experience.

In this presentation, we'll address the important questions about Bitcoin. How does Bitcoin work? Whatmakes it different? How secure are your bitcoins? How anonymous are Bitcoin users? Whatapplications can we build using Bitcoin as a platform? Can cryptocurrencies be regulated? If we weredesigning a new cryptocurrency today, what would we change? What might the future hold?

Presentation Flow

- Introduction to Cryptography and Cryptocurrencies
- Bitcoin Whitepaper and its Analysis
- How to store and use Bitcoin
- Cryptocurrency Mining
- Community, Politics and Regulation
- Altcoins and Cryptocurrency Ecosystem

Porous Silicon and its application for pressure sensor.

Dr. Jayadeva G.S, Professor, HOD, ECE

Abstract: Presently we are in the era of sensors. There are different types of sensors that we use everyday in our homes, office, cars etc. All these sensors are used to make our lives easier. Tremendous amount of research is going on to improve the sensor's parameters such as sensitivity, operating range, and other parameters. Porous Silicon is one such material which has better sensitivity than simple silicon. This presentation concentrates on formation of porous silicon, its simulation, and its application as a pressure sensor. It can also be used as a Humidity, Gas, and Vapour sensor.

Porous silicon was discovered by accident in 1956 by Arthur Uhlir Jr. and Ingeborg Uhlir at the Bell Labs in the U.S. At the time, the Ulhirs were in the process of developing a technique for polishing and shaping the surfaces of silicon and germanium. However, it was found that under several conditions a crude product in the form of thick black, red or brown film were formed on the surface of the material. At the time, the findings were not taken further and were only mentioned in Bell Lab's technical notes.

Despite the discovery of porous silicon in the 1950s, the scientific community was not interested in porous silicon until the late 1980s. At the time, Leigh Canham – while working at the Defence Research Agency in England – reasoned that the porous silicon may display quantum confinement effects.[2] The intuition was followed by successful experimental results published in 1990.

The published result stimulated the interest of the scientific community in its non-linear optical and electrical properties. The growing interest was evidenced in the number of published work concerning the properties and potential applications of porous silicon. In an article published in 2000, it was found that the number of published work grew exponentially in between 1991 and 1995.

TESTS OF SIGNIFICANCE

Dr. Jojy Joseph Idicula, Professor, Mathematics

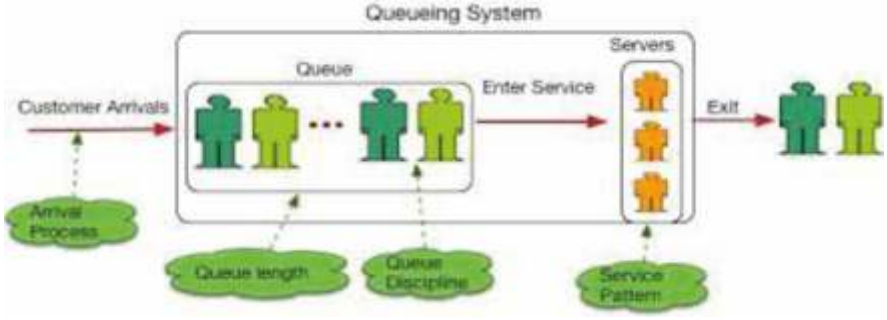
Tests of significance are statistical methods by which the probability or the relative frequency of an observed difference, occurring by chance is found. There are two kinds of Tests : parametric & non parametric tests. If the information about thepopulation is completely known by means of its parameters, then the statistical test is called parametric test. Examples of parametric tests are t-test, f-test, z-test,ANOVA, etc. On the other hand, if there is no knowledge about the population orparameters but still it is required to test the hypothesis of the population, then it iscalled non parametric test. Example of non-parametric test are Chi square test forgoodness of fit, Kruskal Wallis test, etc.Tests for statistical significance are used to estimate the probability that arelationship observed in the data occurred only by chance; the probability that thevariables are really unrelated in the population. They can be used to filter outunpromising hypotheses.Tests for statistical significance are used because they constitute a commonyardstick that can be understood by a great many people, and they communicateessential information about a research project that can be compared to the findingsof other projects.However, they do not assure that the research has been carefully designed andexecuted. In fact, tests for statistical significance may be misleading, because theyare precise numbers. But they have no relationship to the practical significance ofthe findings of the research.

Finally, one must always use measures of association along with tests forstatistical significance. The latter estimate the probability that the relationship exists;while the former estimate the strength (and sometimes the direction) of therelationship. Each has its use, and they are best when used together.

Fundamentals of Queueing Theory and its Applications.

Karabi Sikdar, Professor& HOD,
Department of Mathematics

Queueing theory is a powerful tool in the analysis of waiting line models arising in real life situations such as railway reservation counters, banks, hospitals, telephone traffic etc. Its application is not only restricted to the traditional areas, but has also been extensively used in manufacturing, production-assembly and inspection operation, maintenance, construction and mining, computer and communication systems etc. In recent years, its importance has further increased in the area of telecommunications due to the developments taking place in the Broadband Integrated Services Digital Network (B-ISDN), which is intended for the transfer of voice, video, data and high-resolution images, through high-speed local as well as wide area network. For the analysis and design of these systems one needs to know about various performance measures such as mean queue length, mean waiting time, blocking probability, server utilization, system capacity etc. These and other related information can be obtained by developing an appropriate queueing model and then solving it analytically as well as numerically using efficient mathematical techniques. Though mathematical techniques are a prerequisite for developing a queueing model, the veracity of the algorithms can be best tested by subjecting it to computational analysis. The increased use of queueing models in modern technology warrants such a treatment. Lately, the research in queueing theory has turned more application oriented, taking computational aspects of queueing models in its folds.



Queueing theory originated with the pioneering work reported by Erlang (1909) on the application of probability theory to telephone traffic problems. Kendall (1951) introduced a convenient representation of a queueing system in the abbreviated form A/B/C/X/Y where 'A' stands for inter-arrival time distribution of a customer, 'B' for service time distribution of a customer, 'C' designates number of servers, 'X' for the system capacity (it may be finite or infinite) and 'Y' specifies the queue discipline (First Come First Served (FCFS), Last Come First Served (LCFS) or Service in Random Order (SIRO), etc.). The development of queueing theory centred around telephone problems before 1940. The scientific research after the Second World War found applications of queueing theory in Operations Research, especially in management of inventory, production and maintenance. For the fundamentals of queueing theory and its applications, one may refer the books by Kleinrock (1975), Gross and Harris (1985), Medhi (1991).

Applications of Queueing theory

- Commercial Queuing Systems
  - Ex. Bank, ATM, gas stations, plumber, garage . .
- Transportation service systems
  - Ex. Vehicles waiting at toll stations and traffic lights, trucks or ships waiting to be loaded, elevators, buses . . .
- Business-internal service systems
  - Ex. Inspection stations, conveyor belts, computer support . . .
- Social service systems
  - Ex. Judicial process, the ER (Emergency Room) at a hospital, waiting lists for organ transplants or student dorm rooms

SHOCK WAVES AND THEIR APPLICATIONS

DR. R. LOKESH, Associate Professor, HOD Physics

Shock waves are wave instances or pulses and is a kind of disturbance produced in the medium due to sudden burst of energy in the medium. Example: Burst of cracker bomb, bursting of vehicle tyres, explosion of gas cylinders, explosion of bombs, burst in air due to striking of lightning and objects moving with supersonic speed.

- ✓ Shock waves are a kind of nonlinear wave which manifests as a discontinuity in a medium in which they travel and exhibits a sudden increase in the properties such as temperature, pressure, density, enthalpy etc. in the medium with in in a small volume of the medium known as shock front.
- ✓ Shock waves are characterized by abrupt, nearly discontinuous changes in the values of pressure, temperature, density of the medium through which they are travelling.
- ✓ Shock waves carries a large amount of energy with it and energy of shock waves dissipates relatively quickly with distance.
- ✓ Shock waves travels in the form of shock fronts and general wave properties cannot be applied.
- ✓ Shock waves finds applications in many fields of science and technology such as Safe drug delivery, Kidney stone treatment, bone& muscle healing, heat treatment, Juice extraction, Wood treatment, Watertreatment, Seed treatment etc.

  In my talk I will be introducing about basics of shock waves, properties, production of shock waves and discussing about few application of shock waves.

The New World Order

Dr. Mala C.S, Dean Student Welfare, Professor ECE

People of goodwill throughout the centuries have inclined their hearts, Seers and poets for countless generations have expressed their vision, The sacred scriptures of mankind have constantly held the promise of

- **Vasudaivakutaumbam**
- **Paradise on Earth**
- **The Golden Age**
- **The New World Order**

The most essential requisite for the New World Order is PEACE, Peace is the choice before all who inhabit the earth.

The Favourable Signs Promoting Peace are as follows:

- The League of Nations,
- The United Nations Organization;
- The achievement since the Second World War of independence by the majority of all the nations on earth, indicating the completion of the process of nation building, and the involvement of these fledgling nations with older ones in matters of mutual concern;
- Advancement in Scientific, educational, legal, economic and cultural fields;
- Rise in number of international humanitarian organizations;
- The spread of women's and youth movements calling for an end to war;
- The spontaneous spawning of widening networks of ordinary people seeking understanding through personal communication.
- Scientific and technological advances portend(signify) a great surge forward in the social evolution of the planet;

Yet barriers persist in the fulfilment of Peace which are:

Doubts, misconceptions, prejudices, suspicions and narrow self-interest which has harassed nations and peoples in their relations with one another.

The United nations has failed to remove the threats of war. The spread of anarchy and terrorism, aggression and conflict has come to characterize our social, economic and religious systems. Many have succumbed to the view that such behaviour is intrinsic to human nature and therefore ineradicable.

We Should regard the current world confusion and calamitous condition in human affairs as a natural phase, An organic process leading ultimately and irresistibly to the unification of the human race ,A single social order whose boundaries are those of the planet. The human race: A distinct organic unit evolutionary stages analogous to the stages of infancy and childhood. Now in the culminating period of its turbulent adolescence approaching its long-awaited coming of age.

The ROLE OF RELIGION : WORLD PEACE

Man's perception and practice of it are largely the stuff of history. An eminent historian described Religion as a "**faculty of human nature**." The **perversion of this faculty(sense)** has contributed to the **confusion in society and the conflicts in and between individuals.** The influence exerted by religion is seen on the vital expressions of civilization: No one can deny indispensability of Religion to social order and is demonstrated by its direct effect on laws and morality.

TREAT OTHERS AS WE OURSELVES WOULD WISH TO BE TREATED

An ethic repeated in all the great religions, lends force to this latter observation in two particular respects: it sums up the moral attitude, the peace-inducing aspect, extending through these religions irrespective of their place or time of origin; It also signifies an aspect of unity which is their essential virtue, A virtue which mankind has failed to appreciate.

A genuine universal framework must be adopted.

RACISM

Racism, one of the most baneful and persistent evils, is a major barrier to peace. Its practice perpetrates too outrageous a violation of the dignity of human beings to be countenanced under any pretext. Racism retards the unfoldment of the boundless potentialities of its victims, Corrupts its perpetrators, blights human progress

Recognition of the oneness of mankind, implemented by appropriate legal measures, must be universally upheld if this problem is to be overcome.

RICH AND POOR

The inordinate disparity between rich and poor, a source of acute suffering, keeps the world in a state of instability, virtually on the brink of war. (Civil Wars in various countries). The solution calls for the combined application of spiritual, moral and practical approaches. A fresh look at the problem is required, entailing consultation with experts for eliminating extremes of wealth and poverty, Spiritual verities, the understanding of which can produce a new universal attitude. Fostering such an attitude is itself a major part of the solution.

UNIVERSAL EDUCATION

The cause of universal education, which has already enlisted in its service an army of dedicated people from every faith and nation, deserves the utmost support that the governments of the world can lend it. For ignorance is indisputably the principal reason for the decline and fall of peoples and the perpetuation of prejudice. No nation can achieve success unless education is accorded all its citizens. Lack of resources limits the ability of many nations to fulfill this necessity .First priority to the education of women and girls In keeping with the requirements of the times, consideration should also be given to teaching the concept of world citizenship as part of the standard education of every child.

UNIVERSAL HUMAN VALUES :

Human values, can give solutions for every social problem. Governments and all in authority would be well served in their efforts to solve problems if they would first seek to identify the principles involved and then be guided by them. Good intentions and practical knowledge are not enough A dynamic attitude, a will, an aspiration, which facilitate the discovery and implementation of practical measures is required.

THE NEW WORLD ORDER IN A NUT SHELL

- **An Auxiliary Universal Language**
- **Abandonment of all forms of prejudices**
- **Equality between men and women in all spheres of life**
- **Harmonious balance between Religion and Science**
- **A common curriculum of study for all**
- **A single currency for all**
- **A World Government**
- **A World Tribunal**
- **Universal Human Values to be ingrained in all the peoples of the world**
- **If there has to be an advancement in all spheres of human learning and living then an International Standard has to be set in all affairs**

THE EMPHATIC PROMISE

In the earnestness to impart the fervour of hope and the depth of confidence in humanity, is the emphatic promise of Bahá'u'lláh, the founder of the Baha'I Faith who says:

"These fruitless strives, these ruinous wars shall pass away, and the 'Most Great Peace' shall come."

Indeed, let it be this Generation that inaugurates this glorious stage in the evolution of social life on the planet.

The Future of IT Revolution Through Quantum Computers

Dr. Manjunath T.N, Professor, ISE

Quantum computing is the exploitation of collective properties of quantum states, such as superposition and entanglement, to perform computation. The devices that perform quantum computations are known as quantum computers. They are believed to be able to solve certain computational problems, such as integer factorization (which underlies RSA encryption), substantially faster than classical computers. The study of quantum computing is a subfield of quantum information science. Expansion is expected in the next few years as the field shifts toward real-world use in pharmaceutical, data security and other applications. Quantum computing began in 1980 when physicist Paul Benioff proposed a quantum mechanical model of the Turing machine. Richard Feynman and Yuri Manin later suggested that a quantum computer had the potential to simulate things a classical computer could not feasibly do. In 1994, Peter Shor developed a quantum algorithm for factoring integers with the potential to decrypt RSA-encrypted communications. Despite ongoing experimental progress since the late 1990s, most researchers believe that "fault-tolerant quantum computing [is] still a rather distant dream." In recent years, investment in quantum computing research has increased in the public and private sectors. On 23 October 2019, Google AI, in partnership with the U.S. National Aeronautics and Space Administration (NASA), claimed to have performed a quantum computation that was infeasible on any classical computer. There are several types of quantum computers (also known as quantum computing systems), including the quantum circuit model, quantum Turing machine, adiabatic quantum computer, one-way quantum computer, and various quantum cellular automata. The most widely used model is the quantum circuit, based on the quantum bit, or "qubit", which is somewhat analogous to the bit in classical computation. A qubit can be in a 1or 0 quantum state, or in a superposition of the 1 and 0 states. When it is measured, however, it is always 0 or 1; the probability of either outcome depends on the qubit's quantum state immediately prior to measurement.

AUTHORITY, RESPONSIBILITY AND ACCOUNTABILITY IN ORGANIZATIONS

Dr. Mohan Babu, Principal, BMSIT&M

The Context:

Management of any business or project essentially involves the basic functions namely, Planning (long and short-term) the activities, Organizing (Divide the work and integrate the effort) for executing them, Staffing (Empowering HR), Leading every effort towards the set objectives (Motivate and Direct) and Coordinate and Control (to be effective and efficient) the activities being done.

Of these functions, the process of organizing the resources for achieving organizational objectives focuses on determining: (i) Which all activities help us attain the objectives? (ii) How to group/department them to best utilize the resources? (iii)Which organizational structure best achieves objectives? (iv) How to divide the work and assign to various positions? (v) Who should be responsible to get the dept's work done? (vi) How to relate various positions with the flow of Authority, Responsibility and Accountability? (vii) How to integrate their efforts with communication network and (viii) What infrastructure and resources are to be provided, among others. A typical example of an organizational structure is shown in the figure below.

Thus, an organization can be understood as a formalized intentional structure of positions/roles designed to achieve its objectives. Every position in the hierarchy is vested with authority, responsibility, and accountability. However, the extent varies. Some of the key aspects that we should know while preparing an organizational chart are formal and informal structures, appropriate departmentation, chain of command, line and staff functions, span of management and its impact on the levels of management. Mostly we see that an organization/department/unit chooses to be centralized/decentralized based on the strategy it pursues, for

instance, VTU has adopted more of a centralized whereas the Indian railways has adopted a decentralized organizational structure.

Authority, Responsibility and Accountability, and their Mutual Relationships:

Authority: The legitimate power vested in a position to make decisions, give orders to and enforce obedience on subordinates. Examples: Power to Hire/promote an employee, start a new department/business unit, and spend on an event/activity.

Responsibility: The obligation of an individual to carry out assigned activities to the best of his or her ability. Examples: Obligation to adhere to Covid SOPs, constrain prisoners in jailor secure ads to fill reserved spaces in newspaper.

Accountability: Answerability for something that we have done or are supposed to do. Examples: NSA was accountable for bombing Balakot Terrorists camp, GOI was accountable for demonetization, and High court is accountable to supreme court for its decisions.

Relationship b/w Authority, Responsibility and Accountability: Authority flows from top to bottom, bu the opposite is not True. Authority not vested in a position can't be delegated. A superior can't delegate all the authority vested in him. Authority delegated can be withdrawn/limited, if required. Delegation does not diminish the authority of the manager and Authority delegated should be commensurate with the responsibility. Responsibility assumes two forms as follows.

Forms of Responsibility:

Continuing responsibility through Employment Contracts: An employee must keep performing his task or responsibility so long as he is in the employment of the company. Employment contract requires them to do so to become entitled to monetary and other benefits and privileges provided by the organization. For example: Relationship b/w a CEO and his production manager. Similarly, persons occupying various positions in the hierarchy will automatically assume the corresponding responsibilities and enjoy the authority vested therein by virtue of their service agreements.

Specific responsibility through Delegation of Authority: Continuing responsibilities of a position increase with organizational activities. No superior can meet these ever-increasing responsibilities. Hence, a superior can assign specific works (a part of his continuing responsibility) to his subordinate (latter's noncontinuing responsibility) and delegate commensurate authority to execute it. Once accepted, the subordinate also becomes responsible its completion. This is only an *ad hoc* delegation of authority and an important way to improve the subordinates' capacity. It is not a continual assignment of obligation, but only a specific one. Its scope is limited and occasional and may be withdrawn too. Example: Asst Labor Commissioner might ask his Labor officer to conduct arbitration of gratuity benefits or a Principal may assign his/her CS duty to a Sr. Professor. Major advantages of this are that (i) the superior is relieved of less significant works and can now focus on key issues and be quite efficient in handling them. (ii) it enhances the pool of competent managers, thus increasing flexibility in job assignment in organization. (iii) subordinates develop desire and ability to make decisions and commit to them. This enhances their job satisfaction.

Delegation of Authority:

The process of Delegation can be effective when the superior determines the results expected from a subordinate, assigns tasks to a subordinate, and lets him know the expectations, delegates clearly the

authority to accomplish these tasks and holds the subordinate responsible for the task and accountable for the outcome. Often, delegation is not easy and managers fail due to poor delegation of authority.

Can a superior delegate his work and free himself from the responsibility and accountability? No! as the work is a continuing responsibility of the superior, and the original authority for discharging it is vested in his position, he continues to be responsible for performance of the assigned task by him and/or his subordinate(s).

Centralized and Decentralized Structures of Organization:

We call a structure 'Centralized' when the authority to make and enforce decisions is retained at the top of the hierarchy, the extent to which subordinates look towards their superiors to make their decision is higher and subordinates have greater dependence on higher levels. The company with well-balanced organization structure probably centralizes the decisions at the top on key concerns such as finance, major capital expenditure, new product introduction, major marketing strategies, basic HR policies, executive development, and compensation, etc. and leaves the rest to lower levels.

Advantages of Centralization include: (i) strict enforcement of uniformity in policies and procedures,(ii) consistent/uniform decisions are possible, (iii) better coordination among depts/divisions and better control over their/organizational activities, (iv) helps eliminating duplication of activities and saves costs, (v) services of outstanding employees available in some depts can be utilized wherever required in the entire organization, and (vi) control over HR costs as people employed at lower levels need not be very competent.

We call a structure 'Decentralized' when there is a systematic distribution of authority to all levels of management/in the whole of the organization. But for only key decisions, authority may be distributed to the middle level and lower level of management. Here, authority spreads across lower levels in an organization and is closer to the point/place of action. Decentralization is not just about handing over a part of the authority to a subordinate (as in delegation) but a principle guiding the decision-making process in an organization. Decentralization is a choice, while delegation is a must.

Advantages of decentralization are (i) lesser burden on the top Management (ii) takes advantage of the talent spread across organization (iii) huge/widely spread organizations benefit from this structure (VTU, ESCOMs, Panchayats), (iv) subordinates get a chance to decide and act independently and develop managerial competencies (v) a pool of competent managers is available for succession, and continuity of organization. Since managers can see the results of their own actions, they become more responsible and accountable. We can see fewer levels in hierarchy and hence efficient communication, faster decision-making, and quality (closer to point of action) decisions. This also facilitates better customer support and offers a democratic environment where employees have a say in the governance. Their participation enhances their self-esteem and motivation.

Although decentralization has certain advantages it cannot be carried to the extent where the top would lose control and organization's existence itself is threatened.

Thus, a proper understanding of authority, responsibility and accountability is very important for everyone in order to make sure that the organizational objectives are achieved effectively and efficiently with minimum conflicts.

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HIGH VOLTAGE INSULATION SYSTEMS

Dr Narapreddy Ramarao, Associate Professor & HOD, EEE

High voltages are used in the electrical equipment related to laboratories of nuclear research, particle accelerators and Van de Graff generators, electrostatic precipitators, X-Ray equipment for medical and industrial applications, Electrical Power Transmission over long distances, testing of electrical insulation systems and electrical equipment. Three types of insulating materials are used in the electrical engineering applications and they are 1. Gaseous Insulating Materials(Air, N2, CO2, C Cl2 F2, SF6 etc.,.), Liquid Insulating Materials(Petroleum oils(Transformer oils), Tetrachloroethlene(C_2Cl_4), high temperature hydrocarbon oil, tertachloroethylene and perfluoropolyether) and Solid Insulating Materials (Glass, Porcelain, Polyethylene, cross linked polyethylene-XLPE, polyvinyl chloride(PVC), Teflon, silicone, composite polymer materials).

The failure of electrical system mostly depends on the breakdown of electrical insulation. Different types of electrical insulation systems are having different breakdown mechanisms and depend on physical conditions, chemical, mechanical and electrical properties. Gases are most commonly used dielectrics. Ex: Air, N2, CO2, C Cl2 F2, SF6 etc.,. At low voltages small currents flow through insulating material and electrical properties will be retained by insulating media. At high voltages current flowing through the insulating media increases very sharply and electrical breakdown occurs. Huge spark is formed between electrodes during breakdown and causes short circuit between them. The maximum voltage applied to the insulating media at the moment of breakdown is called the breakdown voltage. To understand breakdown phenomenon in gases knowledge of Electrical properties of gases, Processes which produces high currents in gases are required. A gas in its normal state is a perfect insulator. When high voltage is applied to electrodes which are immersed in a gaseous medium, the gas becomes a conductor and an electrical breakdown occurs. The processes that are primarily responsible for the electrical breakdown are ionization by i. collision ii. photo-ionization and iii. the secondary ionization processes.

Electrical discharges in insulating gases are two types. i. Non-sustaining discharges ii. Self sustaining discharges. The buildup of high currents in a breakdown is due to the process of ionization, in which electrons and ions are created from neutral atoms or molecules and their migration to the anode and cathode respectively leads to high currents. Two types of theories explain breakdown phenomena in gases i.e., Townsend's theory and Streamer theory. These theories explain breakdown phenomena in gases under different physical conditions like pressure, temperature, electrode field configuration, nature of electrode surface and availability of initial conducting particles. Breakdown in insulating gases having non-uniform fields can be observed as a bluish luminance and this phenomenon always accompanied by a hissing noise and the air surrounding the corona region becomes converted into ozone and this phenomenon is called as corona discharge. Corona causes power loss in High Voltage transmission lines and it leads to deterioration of insulation due to the combined action of the bombardment of ions and of chemical compounds formed during discharges. It also gives rise to radio interference.

Liquid dielectrics are mainly used as impregnants in high voltage cables, capacitors and for filling up of transformers, circuit breakers etc.,. Liquid dielectrics also act as heat transfer agents in transformers and arc quenching media in circuit breakers. Liquid dielectric can withstand voltage stresses up to 10MV/cm, but in practice order of 100kV/cm are possible. Liquid dielectric heat transfer capability is 10 times more efficient than air or nitrogen. Liquid dielectrics used as insulation, should be free from moisture, products of oxidation and other contaminants. It also must be free from water content which reduces dielectric strength by 20% for 0.01% of water. The dielectric strength of liquid insulating material further reduces sharply, if it contains fibrous impurities in addition to water. In practice, the choice of liquid dielectric depends on type of application and mainly based on chemical stability. Other factors such as cost, space, previous usage and susceptibility to environmental influences are considered. The breakdown in commercial liquids depend on several factors such as nature and surface condition of electrodes, physical properties of liquid, impurities and gases present in liquid.

Solid dielectrics have higher breakdown strength when compared to liquids and gases. Solid insulting materials used in practice are generally classified as organic and inorganic. Organic: 1. Paper 2. Wood 3. Rubber. Inorganic: 1. Mica 2. Glass 3. Porcelain 4. Synthetic polymers like Perspex, PVC and epoxy resins. A good solid dielectric should have low dielectric loss, high mechanical strength, should be free from gaseous inclusions and moisture, resistant to thermal and chemical deterioration. If breakdown occurs in solid dielectrics, it will be permanently damaged while gases fully and liquids partially recover their dielectric strength after the applied electric field is removed.

Based on thermal withstanding capacity, Insulating materials are classified as follows:

	Class	**Temperature**	**Insulating Materials**
01	Class A	105°C	Impregnated paper, silk, cotton, coated or immersed in a dielectric liquid such as oil.
02	Class B	130°C	Mica, Fibre, Glass, Asbestos (Inorganic material) with suitable bonding, impregnating, or coating substances.
03	Class C	Above 180°C	Mica, Porcelain, Ceramics, Glass, Quartz, etc. with or without bonding, impregnating, or coating substances.
04	Class E	120°C	Synthetic Resins, Enamel wires, Cellulose, etc.
05	Class F	155°C	Mica, Glass, Fibre, Asbestos, etc., with a suitable coating, bonding, impregnating as well as combinations of materials.
06	Class H	180°C	Combinations of materials of mica, fiber, glass, asbestos, etc with suitable bonding or impregnating or coating and Silicone Elastomer.
07	Class Y	90°C	Cotton, silk, wood, paper, cellulose, and similar organic materials without impregnation.

Hypothesis Test

Dr. Pushpa S.K, Professor, HOD ISE

Hypothesis is a claim about something around us. That claim has to be tested through some experimental means or through observation. First hypothesis statement has to be written based on the available information, this statement tells about the relationship between the independent and dependent variable. If any changes in the independent variable then, this effect can be noticed on the dependent variable. For example smoking leads to lung cancer. Here smoking is an independent variable and lung cancer is a dependent variable. Based on the claim NULL and Alternate hypothesis to be identified. Since testing is made on samples of the entire population, while making decision there is a possibility of making mistakes. These errors are called as Type-I and Type-II error. The probability of committing a Type –I error is called as level of significance (α) of a test. It is also called the size of the test or critical region. Generally it is prefixed as 5% or 1% level ($\alpha = 0.05$ or 0.01). The rejection region lies in one tail or two tails on the probability curve of sampling distribution of the test statistics. There are various tests like Z, T, Chi-Square test, F test and P- test.

IMPACT OF AIR POLLUTION ON ENVIRONMENT

Dr. RAJAKUMARA H. N. , Professor , HOD, Civil Engineering

Air pollution can cause various environmental effects such as,

Acid rain whichis precipitation containing harmful amounts of nitric and sulfuric acids. These acids are formed primarily by nitrogen oxides and sulphur oxides released into the atmosphere when fossil fuels are burned. These acids fall to the Earth either as wet precipitation (rain, snow, or fog) or dry precipitation (gas and particulates). Some are carried by the wind, sometimes hundreds of miles. In the environment, acid rain damages trees and causes soils and water bodies to acidify, making the water unsuitable for some fish and other wildlife. It also speeds the decay of buildings, statues, and sculptures that are part of our national heritage. Acid rain has damaged Massachusetts lakes, ponds, rivers, and soils, leading to damaged wildlife and forests.

Eutrophicationwhichis a condition in a water body where high concentrations of nutrients (such as nitrogen) stimulate blooms of algae, which in turn can cause fish kills and loss of plant and animal diversity. Although eutrophication is a natural process in the aging of lakes and some estuaries, human activities can greatly accelerate eutrophication by increasing the rate at which nutrients enter aquatic ecosystems. Air emissions of nitrogen oxides from power plants, cars, trucks, and other sources contribute to the amount of nitrogen entering aquatic ecosystems.

Haze is caused when sunlight encounters tiny pollution particles in the air. Haze obscures the clarity, colour, texture, and form of what we see. Some haze-causing pollutants (mostly fine particles) are directly emitted to the atmosphere by sources such as power plants, industrial facilities, trucks and automobiles, and construction activities. Others are formed when gases emitted to the air (such as sulphur dioxide and nitrogen oxides) form particles as they are carried downwind.

Effects on wildlife in a number of ways such as like humans, animals can experience health problems if they are exposed to sufficient concentrations of air toxics over time. Studies show that air toxics are contributing to birth defects, reproductive failure, and disease in animals. Persistent toxic air pollutants (those that break down slowly in the environment) are of particular concern in aquatic ecosystems. These pollutants accumulate in sediments and may bio-magnify in tissues of animals at the top of the food chain to concentrations many times higher than in the water or air.

Ozone Depletion can occur due to man-made chemicals referred to as ozone-depleting substances, including chlorofluorocarbons, hydrochlorofluorocarbons, and halons. These substances were formerly used and sometimes still are used incoolants, foaming agents, fire extinguishers, solvents, pesticides, and aerosol propellants. Thinning of the protective ozone layer can cause increased amounts of UV radiation to reach the Earth, which can lead to more cases of skin cancer, cataracts, and impaired immune systems. UV can also damage sensitive crops, such as soybeans, and reduce crop yields.

Crop and forest damage can lead to reduced growth and survivability of tree seedlings and increased plant susceptibility to disease, pests, and other environmental stresses (such as harsh weather). As described above, crop and forest damage can also result from acid rain and increased UV radiation caused by ozone depletion.

Global climate changes are due to the production of large quantity of greenhouse gases including carbon dioxide and methane. As a result, the Earth's atmosphere appears to be trapping more of the sun's heat, causing the Earth's average temperature to increase - a phenomenon known as global warming. Many scientists believe that global warming could have significant impacts on human health, agriculture, water resources, forests, wildlife, and coastal areas.

Health Effects

Air pollution can harm us when it accumulates in the air in high enough concentrations. Millions of Americans live in areas where urban smog, particle pollution, and toxic pollutants pose serious health concerns. People exposed to high enough levels of certain air pollutants may experience irritation of the eyes, nose, and throat; wheezing, coughing, chest tightness, and breathing difficulties; worsening of existing lung and heart problems, such as asthma; increased risk of heart attack. In addition, long-term exposure to air pollution can cause cancer and damage to the immune, neurological, reproductive, and respiratory systems. In extreme cases, it can even cause death.

Road Traffic accounts for a significant portion of air pollution in cities and towns, causing serious pollution problems like carbon monoxide and smog. Due to the increase in the use of private cars, road traffic pollution is considered a major threat to clean air in industrialised countries. Traffic fumes contain harmful chemicals that pollute the atmosphere. Road traffic emissions produce greenhouse gases that contribute to global warming.

Indoor Air Pollution is the degradation of indoor air quality by harmful chemicals and other materials; it can be up to 10 times worse than outdoor air pollution. This is because contained areas enable potential pollutants to build up more than open spaces. Statistics suggest that in developing countries, health impacts of indoor air pollution far outweigh those of outdoor air pollution. Indoor air pollution from solid fuels accounted for 3.5 million deaths and 4.5% of global daily-adjusted life year (DALY) in 2010; it also accounted for 16% of particulate matter pollution. Though there

is a decrease in household air pollution from solid fuels in Southeast Asia, still it ranked third among risk factors in the report of the Global Burden of Disease.

Air pollution control

The primary focus of air pollution regulation in industrialized countries has been on protecting ambient, or outdoor, air quality. This involves the control of a smallnumber of specific "criteria" pollutants known to contribute to urban smog and chronic public health problems. The criteria pollutants include fine particulates, carbon monoxide, sulphur dioxide, nitrogen dioxide, ozone, and lead.

Since the end of the 20th century, there also has been recognition of the hazardous effects of trace amounts of many other air pollutants called "air toxics." Most air toxics are organic chemicals, comprising molecules that contain carbon, hydrogen, and other atoms. Specific emission regulations have been implemented against those pollutants. In addition, the long-term and far-reaching effects of the "greenhouse gases" on atmospheric chemistry and climate have been observed, and cooperative international efforts have been undertaken to control those pollutants. The greenhouse gases include carbon dioxide, chlorofluorocarbons (CFCs), methane, nitrous oxide, and ozone.

Control of particulates is achieved by a variety of physical processes. Common types of equipment for collecting fine particulates include cyclones, scrubbers, electrostatic precipitators, and bag-house filters. Once collected, particulates adhere to each other, forming agglomerates that can readily be removed from the equipment and disposed of, usually in a landfill.

Control of gases forming gaseous pollutants, as well as volatile organic compounds (VOCs) and other gaseous air toxics, are controlled by means of three basic techniques: absorption, adsorption, and incineration (or combustion). These techniques can be employed singly or in combination. They are effective against the major greenhouse gases as well. In addition, a fourth technique, known as carbon sequestration, is in development as a means of controlling carbon dioxide levels.

Control of Vehicle Emission by the authorities can reduce pollution using their traffic control powers. For example, they have a duty to monitor the level of traffic on their roads and set traffic reduction targets. They can make Traffic Regulation Orders (TROs) to reduce traffic congestion and improve air quality. Other traffic calming measures, such as the creation of traffic gateways into busy urban areas, can reduce traffic-related air pollution.

In areas where air pollution is high, known as Air Quality Management Areas (AQMA), local authorities can carry out random roadside tests on vehicles. It is necessary to form Vehicle and Operator Services Agency (VOSA) to closely monitor smoky vehicles on the road.

Traffic pollution can also be reduced by implementing EV technology for various types of vehicles instead of conventional petrol or diesel engines. In the present scenario, researchers are working-on

to use hydrogen gas and ethanol as fuel for vehicles, this may reduce air pollution to a great extent and can help in improving the Air Quality Index (AQI) especially in metropolitan cities.

Control of Indoor Air Pollution

Public awareness: One of the most important steps in the prevention of indoor air pollution is education, viz., spreading awareness among people about the issue and the serious threat it poses to their health and wellbeing. The education should help people in finding different ways of reducing exposures with better kitchen management and protection of children at home. People should also be educatedabout the use of alternative cleaner sources of energy to replace direct combustion of biomass fuel. The stakeholders must include not only public but also politicians and administrators to ensure their commitment and increase their awareness about health effects of indoor air pollution.

Change in pattern of fuel use: Fuel use depends on ones' habit, its availability, and most importantly, its affordability. At present, majority of low-income families rely solely on direct combustion of biomass fuels for their cooking needs as this is the cheapest and easiest option available to them; however, this could be rectified by promoting the use of cleaner energy sources such as gobar gas which utilizes cow dung to produce gas for cooking.

Modification of design of cooking stove: The stoves should be modified from traditional smoky and leaky cooking stoves to the ones which are fuel-efficient, smokeless, and have an exit (e.g., chimney) for indoor pollutants. A good example is the one designed by the National Biomass Cookstoves Initiative, of the Ministry of New and Renewable Energy under a Special Project on Cookstove during 2009-2010, with the primary aim of enhancing the availability of clean and efficient energy for the energy deficient and poorer sections of the country

.

Improvement in ventilation: During construction of a house, importance should be given to adequate ventilation; for poorly ventilated houses, measures such as a window above the cooking stove and cross ventilation through doors should be instituted.

Intersectoral coordination and global initiative: Indoor air pollution can only be controlled with coordinated and committed efforts between different sectors concerned with health, energy, environment, housing, and rural development.

VLSI Technology Trends and Its Ecosystem in India

Dr. Raju Hajare,
Associate Prof and HoD-Electronics and Telecommunication Engineering

VLSI Technology Trends:

Very large Scale Integration(VLSI) is a process of integrating or embedding hundreds of thousands of transistors on to a single silicon wafer. VLSI refers to an IC technology with numerous devices on a single chip. Two of the most common VLSI technology devices are the microprocessors and microcontrollers.

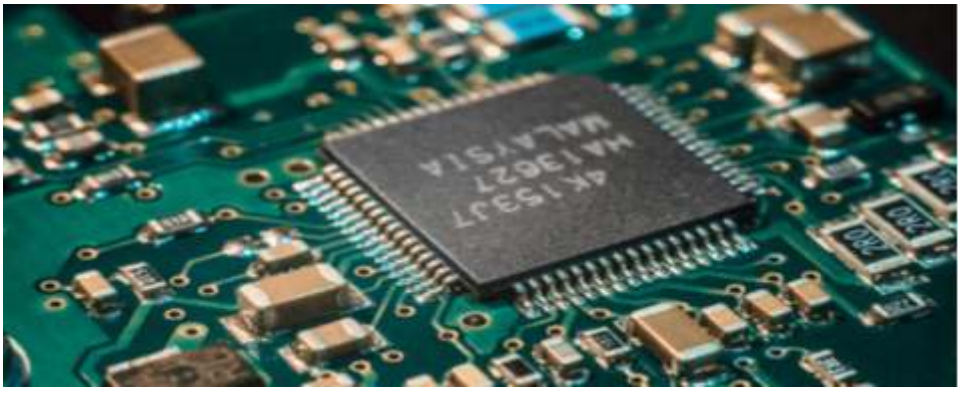


Fig1.PCB with semiconductors would not be possible without VLSI technology.

There is big scope for designing an accurate and computationally efficient ***compact transistor*** *modelsand* ***faster memories*** *for future smart systems based digital India and the world. Following are the some of the novel transistor structures that have shown promise for the semiconductor industry.*

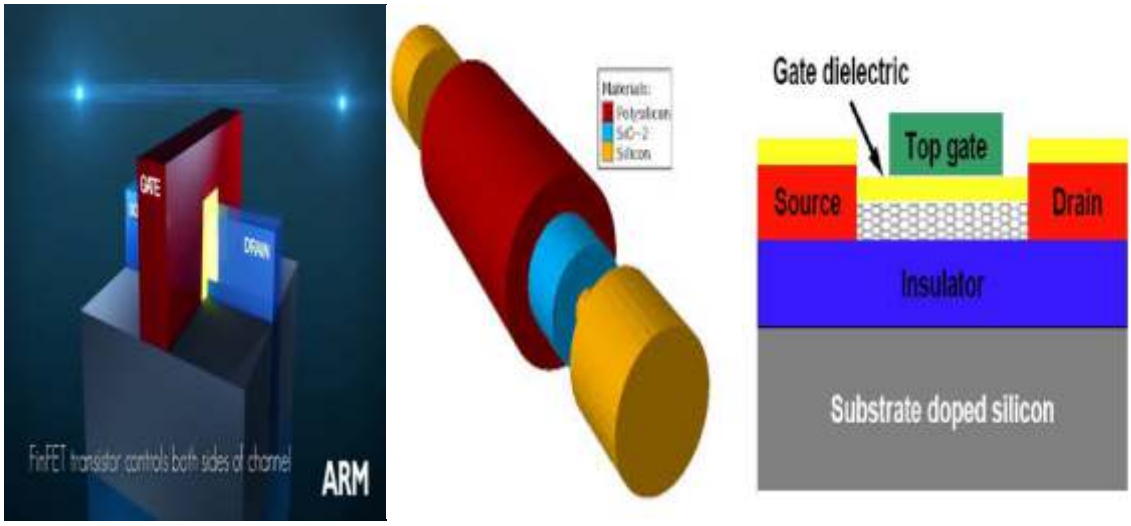
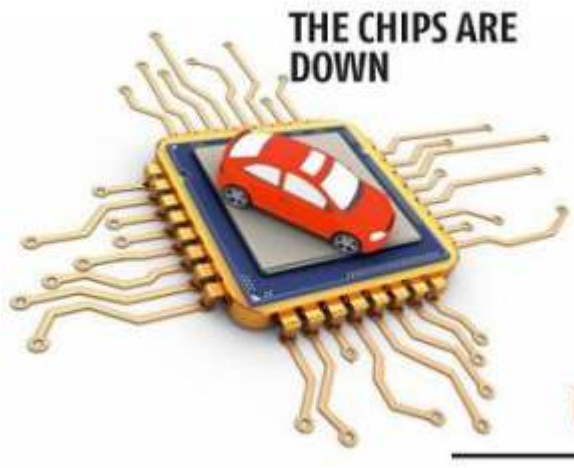


Fig 2. Nano transistor structures for future high speed ICs

Present scenario and Way forward for India

At present, the world is witnessing an alarming trend A **huge shortage of semiconductor chips** worldwide. As a result, there is a shortage of products from laptops and mobile phones to cars and gaming consoles. The automotive industry remains one of the most hard-hit sectors during this pandemic, and it is **altering the contours of global trade and policymaking as per the emerging threats, opportunities**, and public sentiment.



Company	Jul '21	Aug '21	Change (in %)
Maruti Suzuki	162,462	130,699	-19.55
Hyundai	60,249	59,068	-1.96
Tata Motors	51,981	54,190	4.25
Honda Cars	6,055	11,177	84.59
Toyota	13,105	12,772	-2.54
M&M	20,797	15,973	-23.20
Hero MotoCorp	429,138	453,879	5.77
Honda 2-wheelers	385,533	430,683	11.71
Bajaj Auto	369,116	338,310	-8.35
Aggregate	**1,498,436**	**1,506,751**	**0.55**

Source: Companies

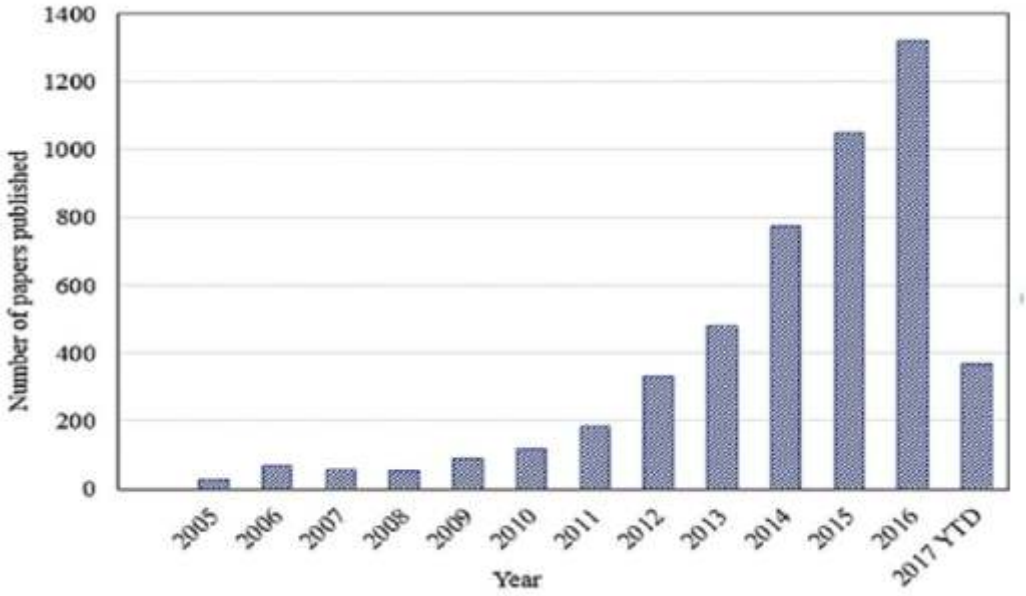
The global realization of **a self-reliant economy** is a consequence of Covid-induced lockdowns, restricted mobility, low production, and supply chain irregularities, which impelled the governments to look for domestic alternatives.

India should Support IoT-based Startups and provide them adequate infrastructure, funding, and a world-class environment essential to promote R&D. This will help local companies in manufacturing components.

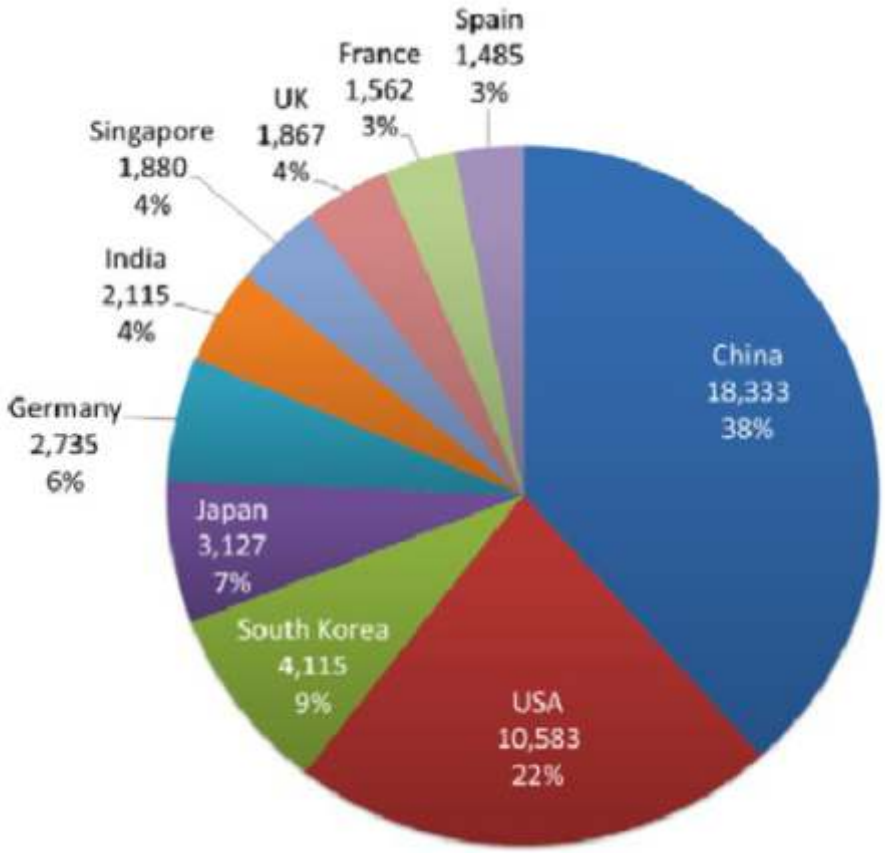
Graphene: The wonder material of the 21st century

Dr.Ramakrishnappa T, Associate Professor and Head, Department of Chemistry

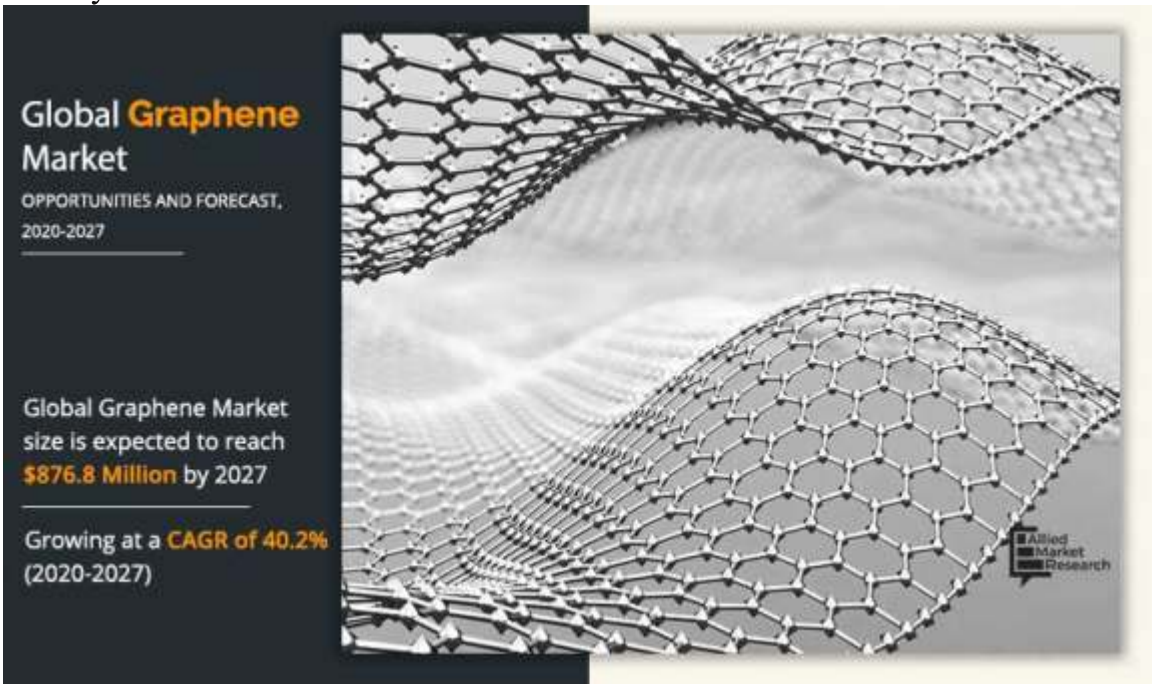
Today, R&D plays important roles in enhancing national competitiveness and sustainability. Many traditionally scientifically under-developed countries are now catching up and the global R&D landscape has seen dramatic changes. Facing the continuing competition, researchers, technology innovators, and policy makers all need to grasp the structure and developments of global research and innovation, so dynamical monitoring and diagnosing of research fields become a strategic endeavour at higher levels of research planning and policy making. Materials science is the foundation for many emerging industries. Graphene, due to its outstanding electrical, thermal, and optical properties, has great potential for applications in energy, environment, electronics, biology and other fields. As a result, graphene research is gaining intensive attention world-wide. Many countries have embarked on R&D programs on graphene to position themselves among the leaders. Scientometric analysis has recently been applied to map global trends of graphene research using publications or patent data. Evidence from such analysis shows that graphene research increased over past two decades and saw an up-ward burst in recent 5 years. Some attributed recent rising number of publications on graphene to the fact that researchers working in carbon nanotubes gradually move towards study of graphene. The growth complexity may also be due to graphene's growing applications in non-electronics areas, such as health, environment, and energy. Still, a detailed and large scale analysis of graphene R&D is needed to fully reveal the landscape. This presentationfocuses on the aspects of the global graphene R&Dgrowth, evolution of substance properties and applications.



Number of graphene publications related to the field of energy research from the Energy journal, Elsevier, **source: Web of Science.**



The distribution of articles related to graphene and its composites published in each country.



CCDs and Digital Cameras

Dr. Sanjay Lakshminarayanan,
Professor, EEE

CCD stands for "Charge Coupled Device", it consists of a semiconductor material in which electrical charges are induced when struck by photons or electromagnetic radiation. The charges are moved by gating signals into a capacitive element where a voltage proportional to the charge develops. This voltage is converted into a digital value and this digitized value is recorded, for later development of the image on some other device or photo. In other words it is like a retina of the eye.

In later designs a "Pinned Photo Diode" was used to detect photons. The CCD evolved into a "CMOS Sensor" which has now almost replaced the CCD as the primary photo sensor in almost all cameras. In CMOS sensors, the charge is not moved. The CCD has a higher quantum efficiency which is used in astronomical applications to capture infrared, ultraviolet to x-ray images. The Hubble space telescope is built with a CCD camera.

Most present day cameras in Mobiles are built with CMOS sensors. Each pixel consists of a pinned diode, and few other MOS transistors to read the magnitude of the light induced charge. The rows and columns of the sensors are multiplexed and digitized using a analogto digital converter and stored in memory to form a complete picture. Where high sensitivity is required such as in microscopes or telescopes/astronomy, CCDs are still preferred. The modern DSLR cameras are built using CMOS sensors.

In CCDs there is photon noise, dark noise and read noise. Dark noise is due to thermal processes and has a Poissons distribution. Read noise is created within the camera electronics during the readout process as the electrons are subjected to the analog to digital conversion, amplification and processing steps that enable an image to be produced.

A CCD dynamic range of 60 dB requires an analog-to-digital converter of at least 10 bits while a CCD dynamic range of 73 dB requires an analog-to-digital converter of at least 13 bits. To convert the analog signal at a video rate (typically 7–20 MHz), a flash type analog-to-digital converter must be employed. ADCs have a comparator which is essentially a differential amplifier and implemented using MOSFETs.

Dynamic range is measured in "stops". An increase of one stop equals a doubling of the brightness level. The human eye can perceive about 20 stops of dynamic range in ideal circumstances. This means that the darkest tones we can perceive at anyone time are about 1,000,000 times darker than the brightest ones in the same scene. This is how you can still see details in dark shadows on a bright, sunny day.

Cameras have a narrower dynamic range than the human eye, although the gap is closing. The best modern cameras like the Nikon D810 can achieve just under 15 stops of dynamic range in any one photo. Most digital cameras get somewhere between 12 and 14 while film negatives can get up to about 13. This is why when you take photos on a sunny day you often have to choose whether you "blow out your highlights", making them pure white, or "crush your shadows", making them pure black in the final image.

Diagnostic Maintenance

Dr. K. M. Sathish Kumar
Professor and Head, Mechanical Engineering

Maintenance, although requiring the expenditure of significant amounts of energy, is usually required in orderto keep (or restore) facilities at an acceptable operationalstandard. For most plants, maintenance practice ispredominantly based on routine-scheduled prevention aswell as previously unanticipated reactions to overcomefaults. Predictive maintenance procedures, such asthat devised in this project, are evolving and results inless wasted effort.Diagnostic maintenance is a maintenance strategy that monitors the actual condition of an asset to decide what maintenance needs to be done. Process of measuring the specific equipment parameters, noting signs of any significant changes that could be indicative of an impending failure.

Direct on-line real-time continual monitoring and analysis of machinery behaviour is the most reliable way toachieve a high productivity. If an abnormal situationcan be detected early, when defects are minor and havenot affected machine output, with the cause of the faultdiagnosed while the machine is still running, then thedowntime for associated repairs can be reduced and otherattendant advantages achieved.

Diagnostic maintenance has long been practiced by maintenance personnelwho relied on their innate senses of hearing, touch andsight, but the judgment and conclusions were often notreliable. All physical structures and machinery, that areassociated with rotating components, give rise to vibration. The vibrations so generated by machinery have become a well-utilized parameter for assessment. Itis one of the most versatile techniques, which is capableof detecting about 70% of common mechanical faultsassociated with rotating machinery.

The desire and need for accurate diagnostic and realpredictive prognostic capabilities have been around for aslong as human beings have operated complex and expensivemachinery.The area of intelligent maintenance and diagnostic andprognostic–enabled condition-based maintenance of machinery, is a vital one for today’s complex systems inindustry, aerospace vehicles, military and merchant ships, theautomotive industry, and elsewhere.

Goal of Diagnostic maintenance:

- ✓ The goal is to monitor and spot upcoming equipment failure so that maintenance can be proactively scheduled when it is needed – and not before.
- ✓ Improve equipment's Engineering and Environmental performance.
- ✓ Ensure operational longevity of equipment.
- ✓ Monitoring allows diagnostics and performance analysis.
- ✓ Prediction of failure allows planning of maintenance or repair.

Diagnostic and Prognostic Techniques:

It is essential to have diagnostic and prognostic techniques for the development of a well-designed maintenanceprogram which can help in decision making by understanding the degradation process of any machinecomponent by collecting and analysing data to understand its condition.

Diagnostics: The condition monitoring system delivers the data relating the functioning of a machine. Theinformation gained from these data can be used to determine the status of machine health and itsdeterioration. This process of determining the health is referred as diagnostics. It is basically a patternrecognition from the measurement of the faults in the system. It is an important part of predictivemaintenance programs for checking the machine health.

Prognostics: It is an emerging discipline to scientifically detect and identify a failure mode within a system. It deals with predicting thedevelopment of defects of any machine component. The first crucial part of a successful prognostic system involves an early diagnostic of a defect with a sufficient lead time for enabling monitoring and actions.

Diagnostics Maintenance Techniques:

- ✓ Visual inspection
- ✓ Vibration Monitoring
- ✓ Acoustic Emissions Monitoring
- ✓ Oil analysis
- ✓ Infrared Thermography
- ✓ Ultrasound Testing
- ✓ Remote Visual Inspection

Advances in Diagnostic maintenance:

- ✓ Impact of Industry 4.0
- ✓ Real-time condition monitoring
- ✓ Flexible evaluation and analysis options
- ✓ Targeted notification of experts
- ✓ Smart sensors
- ✓ Monitoring and industrial analytics tools

The application of Diagnostic maintenance appears more realistic compared to other maintenance techniques.This is based on the fact that 99% of equipment failures are preceded by certain signs, conditions, or indications that such a failure was going to occur.Diagnostic maintenance techniques were discussed with emphasis on how these techniques work toward maintenance decision making.In general, it can be concluded that each of the techniques has its own unique concept/principle, processes, and challenges toward real industrial practise.

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Secure Communication with Cryptography

Dr. Seema Singh, Dean External Relations, Professor, ETE

Today's pervasive computing and communications networks have created an intense need for secure and reliable cryptographic systems.Cryptography is the study of secure communications techniques that allow only the sender and intended recipient of a message to view its contents. The term is derived from the Greek word kryptos, which means hidden. It is closely associated to encryption, which is the act of scrambling ordinary text into what's known as ciphertext and then back again upon arrival.

The Basic Principles of Cryptography includes Encryption, Authentication, Integrity and Non-Repudiation. The main three types of cryptography techniques are Secret key Cryptography, Public key cryptography and Hash Functions. Various algorithms under symmetric and asymmetric encryption are discussed.The major difference between the two types of encryption is, symmetric encryption uses 1 key, whereas asymmetric encryption uses 2 keys.

Symmetric encryption **uses a single key to encrypt and decrypt**. If the data is encrypted using a key, then decryption to get the hidden data need to be carried out using the same key. Symmetric encryption is also called “secret key” encryption because the key must be kept secret from third parties.

Unlike symmetric encryption, which uses the same secret key to encrypt and decrypt sensitive information, asymmetric encryption, also known as public-key cryptography or public-key encryption, uses **mathematically linked public and private key pairs to encrypt and decrypt** senders and recipients’ sensitive data. Examples and interactive application showing various algorithms were demonstrated.

Cyber Crime and Cyber Laws

Dr. Thippeswamy, Professor, CSE

Introduction : Cybercrime, also called **computer crime**, the use of a computer as an instrument to further illegal ends, such as committing fraud, trafficking in child pornography and intellectual property, stealing identities, or violating privacy. Cybercrime, especially through the Internet, hasgrown in importance as the computer has become central to commerce, entertainment, and government.

Because of the early and widespread adoption of computers and the Internet in the United States, most of the earliest victims and villains of cybercrime were Americans. By the 21st century, though, hardly a hamlet remained anywhere in the world that had not been touched by cybercrime of one sort or another.

Defining cybercrime: New technologies create new criminal opportunities but few new types of crime. What distinguishes cybercrime from traditional criminal activity? Obviously, one difference is the use of the digital computer, but technology alone is insufficient for any distinction that might exist between different realms of criminal activity. Criminals do not need a computer to commit fraud, traffic in child pornography and intellectual property, steal an identity, or violate someone's privacy. All those activities existed before the "cyber" prefix became ubiquitous. Cybercrime, especially involving the Internet, represents an extension of existing criminal behaviour alongside some novel illegal activities.

Most cybercrime is an attack on information about individuals, corporations, or governments. Although the attacks do not take place on a physical body, they do take place on the personal or corporate virtual body, which is the set of informational attributes that define people and institutions on the Internet. In other words, in the digital age our virtual identities are essential elements of everyday life: we are a bundle of numbers and identifiers in multiple computer databases owned by governments and corporations. Cybercrime highlights the centrality of networked computers in our lives, as well as the fragility of such seemingly solid facts as individual identity.

Types of cybercrimes: Cybercrime ranges across a spectrum of activities. At one end are crimes that involve fundamental breaches of personal or corporate privacy, such as assaults on the integrity of information held in digital depositories and the use of illegally obtained digital information to blackmail a firm or individual. Also at this end of the spectrum is the growing crime of identity theft. Midway along the spectrum lie transaction-based crimes such as fraud, trafficking in child pornography, digital piracy, money laundering, and counterfeiting. These are specific crimes with specific victims, but the criminal hides in the relative anonymity provided by

the Internet. Another part of this type of crime involves individuals within corporations or government bureaucracies deliberately altering data for either profit or political objectives.

At the other end of the spectrum are those crimes that involve attempts to disrupt the actual workings of the Internet. These range from spam, hacking, and denial of service attacks against specific sites to acts of cyberterrorism—that is, the use of the Internet to cause public disturbances and even death. Cyberterrorism focuses upon the use of the Internet by nonstate actors to affect a nation's economic and technological infrastructure. Since the September 11 attacks of 2001, public awareness of the threat of cyberterrorism has grown dramatically.

Cyber laws to handle Cybercrimes: In Simple words, cybercrimes are unlawful acts wherein the computer is either a tool or a target or both. Cybercrimes can involve criminal activities that are traditional in nature, such as theft, fraud, forgery, defamation, and mischief, all of which are subject to the Indian Penal Code. The abuse of computers has also given birth to a range of new age crimes that are addressed by the Information Technology Act, 2000.

Cyber law (also referred to as cyberlaw) is a term used to describe the legal issues related to use of communications technology, particularly "cyberspace", i.e., the Internet. It is less a distinct field of law in the way that property or contract are as it is an intersection of many legal fields, including intellectual property, privacy, freedom of expression, and jurisdiction. In essence, cyber law is an attempt to integrate the challenges presented by human activity on the Internet with legacy system of laws applicable to the physical world.

Why Cyberlaw in India? :When Internet was developed, the founding fathers of Internet hardly had any inclination that Internet could transform itself into an all pervading revolution which could be misused for criminal activities and which required regulation. Today, there are many disturbing things happening in cyberspace. Due to the anonymous nature of the Internet, it is possible to engage into a variety of criminal activities with impunity and people with intelligence, have been grossly misusing this aspect of the Internet to perpetuate criminal activities in cyberspace. Hence the need for Cyberlaws in India.

What is the importance of Cyberlaw?: Cyberlaw is important because it touches almost all aspects of transactions and activities on and concerning the Internet, the World Wide Web and Cyberspace. Initially it may seem that Cyberlaws is a very technical field and that it does not have any bearing to most activities in Cyberspace. But the actual truth is that nothing could be further than the truth. Whether we realize it or not, every action and every reaction in Cyberspace has some legal and Cyber legal perspectives.

Introduction of Information Technology Act, Objectives and Features: The Information Technology Act, 2000 was notified on Oct 17, 2000. It was the law that deals with law-breaking and electronic commerce in India and during this article, we are going to verify the objectives and options of the knowledge Technology act 2000. In 1996, the international organization Commission on International Trade Law (UNCITRAL) adopted the model law on electronic commerce (e-commerce) to bring uniformity within the law in several countries. Further, the overall Assembly of the international organization counselled that each one country should think about this model law before creating changes to its laws. India became the 12th country to alter

cyber law once it passed the knowledge Technology Act, 2000. While the primary draft was created by the Ministry of Commerce, Government of India because of the E-Commerce Act, 1998, it was redrafted because of the 'Information Technology Bill, 1999', and passed in could 2000.

Objectives of the Act: Let us know about the objectives of the Act. The Information Technology Act, 2000 provides legal recognition to the group action done via electronic exchange of information and alternative electronic suggests that of communication or electronic commerce transactions. This also involves the utilization of alternatives to a paper-based technique of communication and knowledge storage to facilitate the electronic filing of documents with government agencies. Further, this act amended the Indian legal code 1860, the Indian proof Act 1872, the Bankers' Books proof Act 1891, and also the bank of India Act 1934.

The objectives of the Act are as follows:

- Grant legal recognition to any or all transactions are done via electronic exchange of information or alternative electronic suggests that of communication or e-commerce, intact of the sooner paper-based technique of communication.
- Offer legal recognition to digital signatures for the authentication of any data or matters requiring legal authentication.
- Facilitate the electronic filing of documents with Government agencies and conjointly departments.
- Facilitate the electronic storage of information.
- Offer legal sanction and conjointly facilitate the electronic transfer of funds between banks and money establishments.
- Grant legal recognition to bankers underneath the proof Act, 1891, and also the bank of India Act, 1934, for keeping the books of accounts in electronic kind.

Conclusion: Though not all people are victims to cybercrimes, they are still at risk. Crimes by computer vary, and they don't always occur behind the computer, but they executed by computer. With the technology increasing, criminals don't have to rob banks, nor do they have to be outside to commit any crime. They have everything they need on their lap. Hence, everyone must be aware of Cybercrimes and the Cyber Laws (IT Act 2000/08).

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