Digital fluency

module -1

Emerging technologies

Artificial intelligence:(AI)

Introduction: AI is touching us in all aspects of our daily lives, most of the times unknowingly. Whenever we shop online, use our mobiles, drive to work daily, check our mail box or exercise, AI is coming into play and helping us, prodding us or controlling us. Since AI is already such an integral part of our lives, it makes sense to get more knowledge of this emerging technology.

From chess-playing computers to self-driving vehicles, Artificial Intelligence (AI) is progressing rapidly and touching every aspect of our lives. In this module, you will learn how machines can be made to learn from data and carry out human tasks.

Meaning:

AI is techniques that help machines and computers mimic human behaviour. Or in simple words, **AI is** intelligence demonstrated by machines, as opposed to the **natural intelligence** displayed by humans or animals.

Examples of AI:
1. Typing using software *:* While typing reports using any word-processor, wrong spellings or incorrect grammar is highlighted. We also are exposed to auto-complete options of previously used words, or auto-suggest of commonly used words while typing an e-mail, a SMS message or a social-media post.

2. Shopping online: All of us are now used to shopping online. We are either ordering clothes or gadgets online, or using a streaming service (watching movies/shows online). Depending on the user profile, the system shows ads, products or suggests programs to watch. So, what a 65 year old male is shown is different from what a 16 year old girl will be shown, even though they may be using the same service/portal.

Here too, AI is in play. The software is constantly monitoring what we are watching or searching online. Previous history of browsing is also looked at. Shopping preferences are noted. Then, appropriate suggestions are displayed. All this is happening invisibly or unknown to us.

3. Chat bots : Chat bots are used universally today on many websites to interact with the human users that arrive on the specific sites. They try to provide them effective communication and explain to the users how the company or industry works while providing detailed instructions and guides with spontaneous replies.

Chat bots are usually used for quick responses to most commonly asked questions on a particular website. They save time as well as reduce human labor and expenditure.

Machine Learning
Machine learning is simply a way of achieving AI. Machine learning is a way of "training" an algorithm so that it can learn how. "Training" involves feeding huge amounts of data to the algorithm and allowing the algorithm to adjust itself and improve.

To understand this, let's look at the ability of a machine to recognize an object in an image or video). You gather hundreds of thousands or even millions of pictures and then have humans tag them.

For example, the humans might tag pictures that have a cat in them versus those that do not. Then, the algorithm tries to build a model that can accurately tag a picture as containing a cat or not as well as a human. Once the accuracy level is high enough, the machine has now "learned" what a cat looks like.

Machine Learning Methods:

Supervised Learning:
Supervised learning is commonly used in applications where historical data predicts likely future events. For example, it can anticipate when credit card transactions are likely to be fraudulent or which insurance customer is likely to file a claim.
The most common fields of use for supervised learning are price prediction and trend forecasting in sales, retail commerce, and stock trading. In both cases, an algorithm uses incoming data to assess the possibility and calculate possible outcomes.

Unsupervised Learning:
Unsupervised learning works well on transactional data. For example, it can identify segments of customers with similar attributes who can then be treated similarly in marketing campaigns. Or it can find the main attributes that separate customer segments from each other.
Digital marketing and ad tech are the fields where unsupervised learning is used to its maximum effect. In addition to that, this algorithm is often applied to explore customer information and adjust the service accordingly.

Semi-supervised Learning:
Semi-supervised learning is useful when the cost is too high to allow for a fully supervised process. Examples of this include identifying a person's face on a web cam.
Legal and Healthcare industries, among others, manage web content classification, image, and speech analysis with the help of semi-supervised learning.

Reinforcement Learning:
This is often used for robotics, gaming and navigation. With reinforcement learning, the system discovers through trial and error which actions yield the greatest rewards.
Modern NPCs (non-playing characters) and other video games use this type of machine learning model a lot. Reinforcement Learning provides flexibility to the AI reactions to the player's action

Who uses Machine Learning?

Financial Services:
Banks and other businesses in the financial industry use machine learning technology for two key purposes: to identify important insights in data, and prevent fraud. The insights can identify investment opportunities, or help investors know when to trade. Data mining can also identify clients with high-risk profiles, or use cyber-surveillance to pinpoint warning signs of fraud.

Government Agencies:
Government agencies such as public safety and utilities have a particular need for machine learning since they have multiple sources of data that can be mined for insights. Analyzing sensor data, for example, identifies ways to increase efficiency and save money. Machine learning can also help detect fraud and minimize identity theft.

Healthcare:
Machine learning is a fast-growing trend in the health care industry, thanks to the advent of wearable devices and sensors that can use data to assess a patient's health in real time. The technology can also help medical experts analyze data to identify trends or red flags that may lead to improved diagnoses and treatment.

Retail:
Websites recommending items you might like based on previous purchases are using machine learning to analyze your buying history. Retailers rely on machine learning to capture data, analyze it and use it to personalize a shopping experience, implement a marketing campaign, price optimization, merchandise supply planning, and for customer insights.

Oil and Gas:
Finding new energy sources. Analyzing minerals in the ground. Predicting refinery sensor failure. Streamlining oil distribution to make it more efficient and cost-effective. The number of machine learning use cases for this industry is vast – and still expanding.

Deep Learning:
Deep learning is one of the approaches to Machine Learning.
Deep learning was inspired by the structure and function of the brain, namely the interconnecting of many neurons. Artificial Neural Networks (ANNs) are algorithms that mimic the biological structure of the brain.
In ANNs, there are "neurons" which have discrete layers and connections to other "neurons". Each layer picks out a specific feature to learn, such as curves/edges in image recognition. It's
This layering that gives deep learning its name, depth is created by using multiple layers as opposed to a single layer.

What are neural networks?
Neural Networks is the old name for Deep Learning.
Neural networks are a means of doing machine learning, in which a computer learns to perform some task by analyzing training examples. Usually, the examples have been hand-labeled in advance. An object recognition system, for instance, might be fed thousands of labeled images of cars, houses, coffee cups, and so on, and it would find visual patterns in the images that consistently correlate with particular labels.
Modelled loosely on the human brain, a neural net consists of thousands of simple processing nodes that are densely interconnected. Most of today's neural nets are organized into layers of nodes, and they're "feed-forward," meaning that data moves through them in only one direction. An individual node might be connected to several nodes in the layer beneath it, from which it receives data, and several nodes in the layer above it, to which it sends data.

Artificial Intelligence – The Technology Landscape
This part helps us to understand the various application areas that come under AI.

Robotics: Today, most of the industrial world is using robots to automate repetitive tasks. We see robots used to assemble cars, pack food items, paint vehicles and to even serve as your personal assistants/servants in homes. Robots are being used to clean homes, perform day to day tasks like controlling ACs, microwave ovens, washing machines.
Artificial Intelligence or AI **gives robots a computer vision to navigate, sense and calculate their reaction accordingly**. Robots learn to perform their tasks from humans through machine learning which again is a part of computer programming and AI.

Real Time Translation: Most of us use Google translate to get text translated from one language to another. It is a boon in a country like India, where we have a number of local languages. It makes understanding each other a lot easier.
Machine translation is the process of using artificial intelligence (AI) **to automatically translate content from one language** (the source) to another (the target) without any human input.

Digital Assistants (Virtual Companions) like Alexa and Siri are being used in homes to converse and perform simple tasks. In certain countries, virtual pets and companions are becoming popular.
Digital assistants use **advanced artificial intelligence** (AI), natural language processing, natural language understanding, and machine learning to learn as they go and provide a personalized, conversational experience.

Autonomous vehicles, autonomous robots, autonomous warehouse and factory systems and autonomous drones are some examples of autonomous systems. We use autonomous systems for commuting and navigation every day by using Google Maps. Commercial pilots use AI autopilot. On farms, Smart water pump-sets can be switched on/off using sensing or monitoring devices.

Autonomous systems are defined as systems that **are able to accomplish a task**, achieve a goal, or interact with its surroundings with minimal to no human involvement. It is also essential that these systems be able to predict, plan, and be aware of the world around them.

Gaming and Simulation is fast changing the ways in which we have been traditionally doing things. Especially in the fields of training, marketing and entertainment, Augmented Reality (AR) and Virtual Reality (VR) are two technologies that are forging a revolution. Driving lessons, flight training, shopping without actually visiting a physical store, special effects in movies & shows, architectural walkthroughs, prototyping and school classes are some of the areas of application of this technology.

AI in Business how is AI being used by businesses?

Today, businesses are using AI in various ways to help in decision making, across all levels of management. The following are the key areas –

For reasoning: Reasoning is the ability to solve problems through logical deduction. For eg., AI is used to financial asset management, legal assessment, financial application processing, autonomous weapons systems and games.

To present knowledge: AI can help in presenting knowledge about the world. For eg., financial market trading, purchase prediction, fraud prevention, drug creation, medical diagnosis and media recommendation.

In planning: AI helps in helping to set and achieve goals. For eg., inventory management, demand forecasting, predictive maintenance, physical and digital network optimization, navigation, scheduling and logistics.

To facilitate communication: AI uses translation to make business processes easier to conduct, regardless of the geographical location. AI uses its ability to understand spoken and written languages to do this. Some applications of this aspect of AI is being used to facilitate real-time

Here are the top 10 technology trends that will transform Healthcare in the future: AI and Machine Learning Offer Better way to Spot Diseases

With the growing population, AI and ML are also growing to offer new and innovative ways to identify disease, diagnose conditions, crowd-source and develop treatment plans, monitor health epidemics, create efficiencies in medical research and clinical trials, and make operations more efficient to handle increasing demand. Artificial intelligence along with machine learning can help solve many clinical problems.

Robots in Healthcare can Conduct More Varied Tasks

The potential for robots in healthcare has reached beyond surgical uses. They will be able to help doctors examine and treat patients in rural areas through telepresence, transporting medical supplies, disinfecting hospital rooms, helping patients with rehabilitation or with prosthetics, and automating labs and packaging medical devices.

Computer and Machine Vision Can Help Give Appropriate Care

There are various ways computers and machine vision are being used in medicine for diagnostics, viewing scans and medical images, surgery, and more. It is helping doctors to know exactly how much blood a woman loses while delivering in order to provide immediate care to reduce the mortality of mothers from post-partum haemorrhaging. The technology provides accurate intelligence eliminating the guessing game in the healthcare sector.

Wearable Tech has More to Offer than Just Counting Steps
Wearable fitness technology is not only limited to tell people how many steps they walk each day. It possesses rather more opportunities for healthcare by monitoring heart rhythms, detecting atrial fibrillation and send reports to doctor, monitoring blood pressure and many more. Wearable devices will further help consumers proactively get health support if there are irregularities in their trackers.

AI-Enabled Genomic can Determine Personalised Treatments
Artificial intelligence and machine learning help analyse a person's genomic information to determine personalized treatment plans and clinical care. In pharmacology, oncology, infectious diseases, and more, genomic medicine is marking a great impact. Such information helps the medical community better understand how diseases occur and better way to treat the condition or possibly eradicate it.

3D Printing helps Doctors Replicate Patient-Specific Organs
Just like other industries, 3D printing technology enables prototyping, customization, research, and manufacturing for healthcare. Surgeons can replicate patient-specific organs using the advancements of 3D printing. It helps them prepare for procedures. Several medical devices and surgical tools can also be 3D printed. The technology makes it economic and effective to develop comfortable prosthetic limbs for patients and print tissues and organs for transplant.

Digital Twins Determine Possibility for Successful Outcomes
In healthcare, digital twin is a near real-time replica of life-long data record of an individual. It can help doctors in determining the possibilities for a successful outcome of a procedure. It also assists them in making better therapy decisions, and manage chronic diseases. Overall, the technology can help improve patient experience through effective, patient-centric care.

5G can Support Organization in Transmission of Files
As the healthcare centers are extending their reach in remote or under-served areas through telemedicine, 5G technology will potentially increase the quality and speed of the network and prove to be a necessity for positive outcomes. The technology can better support healthcare organizations in transmission of large imaging files so specialists can review and advice on care. It also enhances doctor's ability to deliver treatments through AR, VR and mixed reality while enabling remote and reliable monitoring of patients.

AI Neural Network can Improve Healthcare Biometrics
Scientists are capable of analyzing the atypical risk factors that were too complicated to quantify, using AI neural networks. It helps develop the industry in various ways such as by enabling retinal scans, examining and recording skin colour changes, and many more. Its proficiency in finding patterns will enable the unlocking of new diagnostic methods and discover unknown risk factors.

Module -2
Applications of emerging technology

Applications of AI

1. Artificial Intelligence in Healthcare
Health is wealth, and the rate at which humans are compromising on it is really shocking.
With AI, natural language is a boon. It helps to respond to the questions that are asked for. It enables workflow assistants who screen the patients, getting preliminary information. This in turn helps the doctors to free up their schedules and also reduce the time and cost by streamlining processes. AI-powered technology helps pathologists in analyzing samples of tissue and help in accurate diagnosis. Thus, these are the following advantages of using AI in healthcare:
1. It helps to support decision making and research.
2. Help to integrate activities in medical, software and cognitive sciences.
3. Help to offer a content-rich discipline for the future scientific medical communities.

2. Artificial Intelligence in Business
A business relies on real-time reporting, accuracy, and processing of large volumes of quantitative data to make crucial decisions. The adaptive intelligence, chatbots and automation helps to smoothen out the business process. Let's take an example of the Help Desk. AI is used in online help centers. If you've visited a website, you must have seen that the chat window pops up. You can then ask questions there directly and they revert to your problem or query in no time.

3. Artificial Intelligence in Education
It must be very tedious for a teacher to evaluate homework and tests for large lecture courses. A significant amount of time is consumed to interact with students, to prepare for class, or work on professional development. But, with AI in education, this will not be the case anymore. Though it can never replace human work, it is pretty close to it. So, with the automated grading system checking multiple-choice questions, fill-in-the-blank testing, grading of students can be done in no time.

4. Artificial Intelligence in Autonomous Vehicles
Long-range radar, cameras, and LIDAR, a lot of advancement has been made in the autonomous vehicle segment. These technologies are used in different capacities and each of them collects different pieces of information. The information is of no use unless it is processed and any form of insights can't be derived. This is where artificial intelligence is used and where it can be compared to the human brain. Some of its usage in autonomous vehicles are:
• Directing the car to the fuel station or recharge station when it is running low on fuel.
• Adjust the trip's directions based on known traffic conditions to find the quickest route.
• Incorporate speech recognition for advanced communication with passengers.
• Natural language interfaces and virtual assistance technologies.

5. Artificial Intelligence in Social Media
Instagram, Snapchat, Facebook, Twitter, the world today is changing and everyone is using these social media apps to stay connected with the virtual world. But, are you aware of the fact that a majority of your decisions are being influenced by artificial intelligence?
Starting from notifications, to upgradations, everything is managed by AI. It considers all the past web searches, behaviours, interactions, and much more. So, while you visit these websites, your data is being stored and analyzed and thus you are served with a personalized experience.

6. Artificial Intelligence for a Better World
Many people say that technology is snatching away their jobs and with the machine, there is no need for humans. But, do you know that it is these machines that are making the world a better place to live in.

7. Artificial Intelligence in Tourism
Competition in the travel and tourism industry is very high. You must have seen that prices keep on fluctuating and change often.

You might have also booked a flight ticket in advance or have waited just before the departure date to find cheaper tickets. Everyone does that, but the struggle is minimized with AI.

With predictive analytics driven by artificial intelligence, the price can be predicted. The application is able to predict price patterns and alert travellers when to buy the tickets. So, the cheapest rate can be known before you book the flights to your destination.

The price trend is analyzed on the basis of the recorded data on each route. So, you get notifications of when to book your flight. Book it at the right time and at the right price and say thanks to artificial intelligence.

2. DATABASE MANAGEMENT FOR DATA SCIENCE, BIG DATA ANALYTICS

Instagram, the social networking app for sharing photos and videos, launched in 2010. Today, it boasts 800 million monthly active users and is owned by Facebook. There are 70 million photos uploaded to Instagram every day. People interact with each of those posts by showing their love with a heart, commenting and using hashtags. What all of this activity does is create an enormous amount of data. Once analyzed, by humans as well as increasingly through artificial intelligence algorithms, it can provide incredible business intel and insights. Through the support of tags and trending information, the users can find photos and posts on particular topics or activities, events, and also for exploring experiences, trending restaurants, and places around the globe.
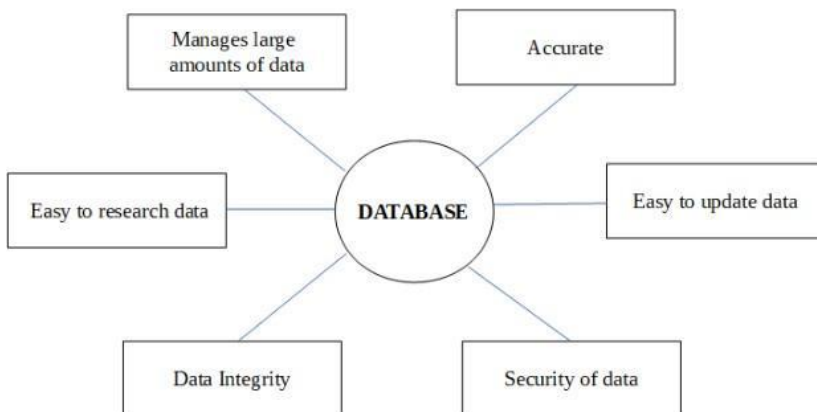
Introduction to Data

Data are individual facts, statistics, or items of information, often numeric, that are collected through observation. In a more technical sense, data are a set of values of qualitative or quantitative variables about one or more persons or objects, while a datum is a single value of a single variable.

Definition of Database

A database is defined as a structured set of data held in a computer's memory or on the cloud that is accessible in various ways.

Database Management Systems (DBMS) refer to the technology solution used to optimize and manage the storage and retrieval of data from databases.

Advantages of data base management:

 Overview of Big Data Analytics

Private companies and research institutions capture terabytes of data about their users' interactions, business, social media, and also sensors from devices such as mobile phones and automobiles. The challenge of this era is to make sense of this sea of data.This is where big data analytics comes into picture. Big data analytics uses efficient analytic techniques to discover hidden patterns, correlations, and other insights from big data. It brings significant cost advantages, enhances the performance of decision making, and creates new products to meet customers' needs. This method has various applications in plants, bioinformatics, healthcare, etc.

What is Big Data Analytics?
Big data analytics is the use of advanced analytic techniques against very large, diverse data sets that include structured, semi-structured and unstructured data, from different sources, and in different sizes from terabytes to zettabytes.

1. Data Collection - Data collection plays the most important role in the Big Data cycle. The Internet provides almost unlimited sources of data for a variety of topics. The importance of this area depends on the type of business, but traditional industries can acquire a diverse source of external data and combine those with their transactional data. For example, let's assume we would like to build a system that recommends restaurants. The first step would be to gather data, in this case, reviews of restaurants from different websites and store them in a database.

2. Data Cleansing - Data cleaning is the process of fixing or removing incorrect, corrupted, incorrectly formatted, duplicate, or incomplete data within a dataset. When combining multiple data sources, there are many opportunities for data to be duplicated or mislabeled.

3. Data Exploration - Data exploration is the first step of data analysis used to explore and visualize data to uncover insights from the start or identify areas or patterns to dig into more. Using interactive dashboards and point-and-click data exploration, users can better understand the bigger picture and get to insights faster.

4. Data Visualization - Big data visualization is the process of displaying data in charts, graphs, maps, and other visual forms. It is used to help people easily understand and interpret their data at a glance, and to clearly show trends and patterns that arise from this data.

Applications of Big Data:
1. **Healthcare:** Big data analytics have improved healthcare by providing personalized medicine and prescriptive analytics. Researchers are mining the data to see what treatments are more effective for particular conditions, identify patterns related to drug side effects, and gains other important information that can help patients and reduce costs. It's possible to predict disease that will escalate in specific areas. Based on predictions, it's easier to strategize diagnostics and plan for stocking serums and vaccines.

2. **Media & Entertainment:** Various companies in the media and entertainment industry are facing new business models, for the way they – create, market and distribute their content. Big Data applications benefits media and entertainment industry by: • Predicting what the audience wants
• Scheduling optimization
• Increasing acquisition and retention
• Ad targeting
• Content monetization and new product development

Spotify, an on-demand music service, uses Hadoop Big Data analytics, to collect data from its millions of users worldwide and then uses the analyzed data to give informed music recommendations to individual users.Amazon Prime, which is driven to provide a great customer experience by offering video, music, and Kindle books in a one-stop-shop, also heavily utilizes Big Data.

3. **Traffic Optimization:** Big Data helps in aggregating real-time traffic data gathered from road sensors, GPS devices and video cameras. The potential traffic problems in dense areas can be prevented by adjusting public transportation routes in real time.

4. **Real-time Analytics to Optimize Flight Route:** With each unsold seat of the aircraft, there is a loss of revenue. Route analysis is done to determine aircraft occupancy and route profitability. By analyzing customers' travel behavior, airlines can optimize flight routes to provide services to maximum customers.

5. **E-commerce Recommendation:** By tracking customer spending habit, shopping behavior, Big retails store provide a recommendation to the customer. E-commerce site like Amazon, Walmart, Flipkart does product recommendation. They track what product a customer is searching, based on that data they recommend that type of product to that customer. As an example, suppose any customer searched bed cover on Amazon. So, Amazon got data that customer may be interested to buy bed cover. Next time when that customer will go to any google page, advertisement of various bed covers will be seen. Thus, advertisement of the right product to the right customer can be sent. YouTube also shows recommend video based on user's previous liked, watched video type. Based on the content of a video, the user is watching, relevant advertisement is shown during video running. As an example suppose someone watching a tutorial video of Big data, then advertisement of some other big data course will be shown during that video.

6. **Big data applications in agriculture**: Traditional tools are being replaced by sensor-equipped machines that can collect data from their environments to control their behavior – such as thermostats for temperature regulation or algorithms for implementing crop protection strategies. Technology, combined with external big data sources like weather data, market data, or standards with other farms, is contributing to the rapid development of smart farming.

3. Internet of Things (IoT) and Industrial Internet of Things (IIoT)

An Overview of IoT(Internet of Things):
IoT is a buzzword today. Everyone uses IoT, but we are unaware that we are actually making use of this technology. So, since IoT is such an integral part of our lives, it makes sense to get more knowledge of this emerging technology.
Using our mobiles, we are adjusting the lighting in the house, switching on/off gadgets, monitoring the CCTV footage, opening/closing doors and gates and performing a lot of daily tasks. This is IoT. In this part, you will learn the core concepts of Internet of Things (IoT), discover the skills that are required for IoT and understand how IoT system works.

What is IoT?
IoT is an evolution of mobile, home and embedded applications interconnected to each other. Using the internet and data analytics, billions of devices connected to each other create an intelligent system of systems. When these connected devices use cloud computing, analyse huge amounts of data and provide services, they can change the way in which we live our lives and conduct our businesses.
The Internet of Things (IoT) describes physical objects (or groups of such objects), that are embedded with sensors, processing ability, software, and other technologies, and that connect and exchange data with other devices and systems over the Internet or other communications networks.

1. Sensors

Examples of IoT in Banking
For organizations in retail banking, faster payments, improved operability (to support the move to open banking) and more responsive mobile services are the main points of focus for innovation. IoT offers retail banks an opportunity to gather more information on customers, offer more personalized experiences and improve efficiencies. Here, we look at some novel examples of IoT in retail banking.
Wearables: Many banks now provide applications for popular wearables like Apple Watch and FitPay, which is already working with the Bank of America. Some banks have even launched their own devices, with Barclays unveiling bPay wearable contactless payment solutions and other wearable bands.
Connected Cars: Connected cars not only have the potential to improve customer relationships, but also boost revenues. But smarter vehicles represent an opportunity for banks, too: for example, Idea Bank runs a fleet of cars, each customized with an integrated security deposit box and an ATM, which can visit the customer, rather than vice versa. The bank's data suggests that the average deposit at one of its mobile, car-based ATMs is three times higher than at the branch.

Banking at home: With IoT, it is now possible to pay their bills through Amazon's Alexa, Google Home, integrating its API with the smart speaker to enable users to carry out balance queries and payments through voice commands.

IoT Architecture:
The four stages of IoT Architecture are –
1. Sensors and actuators – Sensing layer for Data Gathering

2. Internet gateways and Data Acquisition Systems – Network layer for Data Transmission

3. Edge IT - Data Analytics, pre-processing

4. Data center and cloud – Apps & services

What is Industrial Internet of Things (IIoT)?
Industrial IoT, or the **Industrial Internet of Things (IIoT)**, is a vital element of Industry 4.0. IIoT harnesses the power of smart machines and real-time analysis to make better use of the data that industrial machines have been churning out for years. The principal driver of IIoT is smart machines, for two reasons. The first is that smart machines capture and analyze data in real-time, which humans cannot. The second is that smart machines communicate their findings in a manner that is simple and fast, enabling faster and more accurate business decisions.

Some examples of IIoT can be
1. As simple as a connected rat trap which relays information about catching a rat to a mobile phone,

2. Slightly complex like a soil sensor which relays data about humidity and nutrient content to a system,

3. Complex system like smart parking and traffic management

4. A very complex set-up like a fully automated automobile assembly line relaying data in real- time to human supervisors.

IoT Applications:

1. IoT Applications in Agriculture
For indoor planting, IoT makes monitoring and management of micro-climate conditions a reality, which in turn increases production.
For outside planting, devices using IoT technology can sense soil moisture and nutrients, in conjunction with weather data, better control smart irrigation and fertilizer systems.
If the sprinkler systems dispense water only when needed, for example, this prevents wasting a precious resource.

2. IoT Applications in Consumer Use
For the private citizen, IoT devices in the form of wearables and smart homes make life easier. Wearables cover accessories such as Fitbit, smartphones, Apple watches, health monitors, to name a few. These devices improve entertainment, network connectivity, health, and fitness.
Smart homes take care of things like activating environmental controls so that your house is at peak comfort when you come home. Dinner that requires either an oven can be started remotely, so the food is ready when you arrive. Security is made more accessible as well, with the consumer having the ability to control appliances and lights remotely, as well as activating a smart lock to allow the appropriate people to enter the house even if they don't have a key.

3. IoT Applications in Healthcare
First and foremost, wearable IoT devices let hospitals monitor their patients' health at home, thereby reducing hospital stays while still providing up to the minute real-time information that could save lives. In hospitals, smart beds keep the staff informed as to the availability, thereby cutting wait time for free space. Putting IoT sensors on critical equipment means fewer breakdowns and increased reliability, which can mean the difference between life and death.

4. IoT Applications in Insurance

Even the insurance industry can benefit from the IoT revolution. Insurance companies can offer their policyholders discounts for IoT wearables such as Fitbit. By employing fitness tracking, the insurer can offer customized policies and encourage healthier habits.

5. IoT Applications in Manufacturing

The world of manufacturing and industrial automation uses IoT in a big way. RFID and GPS technology can help a manufacturer track a product from its start on the factory floor to its placement in the destination store, the whole supply chain from start to finish.

Sensors attached to factory equipment can help identify bottlenecks in the production line, thereby reducing lost time and waste. Other sensors mounted on those same machines can also track the performance of the machine, predicting when the unit will require maintenance, thereby preventing costly breakdowns.

6. IoT Applications in Retail

IoT technology has a lot to offer the world of retail. Online and in-store shopping sales figures can control warehouse automation and robotics through information gathered from IoT sensors.

IoT helps retailers target customers based on past purchases. Equipped with the information provided through IoT, a retailer could craft a personalized promotion for their loyal customers. Much of these promotions can be conducted through the customers' smartphones, especially if they have an app for the appropriate store.

7. IoT Applications in Transportation

The GPS is another example of IoT. It is being utilized to help transportation companies plot faster and more efficient routes for trucks hauling freight, thereby speeding up delivery times.

There's already significant progress made in navigation, once again referring to a phone or car's GPS. But city planners can also use that data to help determine traffic patterns, parking space demand, and road construction and maintenance.

Maybe, an app can be developed that prevents the vehicle from starting if the driver is drunk.

8. IoT Applications in Utilities/Energy

IoT sensors can be employed to monitor environmental conditions such as humidity, temperature, and lighting. The information provided by IoT sensors can aid in the creation of algorithms that regulate energy usage and make the appropriate adjustment.

With IoT-driven environmental control, businesses and private residences can experience significant energy savings.

On a larger scale, data gathered by the Internet of Things can be used to help run municipal power grids more efficiently, analyzing factors such as usage. Also, the sensors can help pinpoint outages faster, thereby increasing the response time of repair crews and decreasing blackout times.

4. CLOUD COMPUTING

Introduction:

Assume that you are an executive at a very big corporation. Your particular responsibilities include making sure that all of your employees have the right hardware and software they need to do their jobs. To buy computers for everyone is not enough. You also have to purchase software as well as software licenses and then provide all required software to your employees as they require. Whenever you hire a new employee, you need to buy more software or make sure your current software license allows another user. It is so stressful that you have to spend lots of money.

The term cloud refers to a network or the internet. It is a technology that uses remote servers on the internet to store, manage, and access data online rather than local drives. The data can be anything such as files, images, documents, audio, video, and more.

There are the following operations that we can do using cloud computing:

• Developing new applications and services

- Storage, back up, and recovery of data
- Hosting blogs and websites
- Delivery of software on demand
- Analysis of data
- Streaming videos and audios

Why Cloud Computing?

IT companies, follow the traditional methods to provide the IT infrastructure. That means for any IT company, we need a Server Room with basic needs like a database server, mail server, networking, firewalls, routers, modem, switches, QPS (Query Per Second means how much queries or load will be handled by the server), configurable system, high net speed, and the maintenance engineers. To establish such IT infrastructure, we need to spend lots of money. To overcome all these problems, Cloud Computing comes into existence.

Advantages of Cloud Computing

Cloud computing is a trending technology. Almost every company has switched their services on cloud to raise the company growth. Following are some important advantages of Cloud Computing-

1. Back-up and restore data

Once the data is stored in cloud, it is easier to get back-up and restore that data using the cloud.

2. Improved collaboration

Cloud applications improve collaboration by allowing groups of people to quickly and easily share information in the cloud via shared storage.

3. Excellent accessibility

Cloud allows us to quickly and easily store and access information anytime, anywhere in the whole world, using an internet connection.

4. Low maintenance cost

Cloud computing reduces both hardware and software maintenance costs for organizations.

5. Mobility

Cloud computing allows us to easily access all cloud data via any device.

6. Services in the pay-per-use model

Cloud computing offers Application Programming Interfaces (APIs) to the users for access services on the cloud and pays the charges as per the usage of service.

7. Unlimited storage capacity

Cloud offers a huge amount of storing capacity for storing important data such as documents, images, audio, video, etc. in one place.

8. Data security

Cloud offers many advanced features related to security and ensures that data is securely stored and handled.

Types of Cloud:
Public Cloud

Public cloud is open to all to store and access information via the Internet using the pay-per-usage method. In public cloud, computing resources are managed and operated by the Cloud Service Provider (CSP). Example: Amazon elastic compute cloud (EC2), IBM SmartCloud Enterprise, Microsoft, Google App Engine, Windows Azure Services Platform.

Private Cloud
Private cloud is also known as an internal cloud or corporate cloud. It is used by organizations to build and manage their own data centers internally or by the third party. It can be deployed using Opensource tools such as Openstack and Eucalyptus.

Hybrid Cloud:
Hybrid Cloud is a combination of the public cloud and the private cloud. We can say: Hybrid Cloud = Public Cloud + Private Cloud. Hybrid cloud is partially secure because the services which are running on the public cloud can be accessed by anyone, while the services which are running on a private cloud can be accessed only by the organization's users. Example: Google Application Suite (Gmail, Google Apps, and Google Drive), Office 365 (MS Office on the Web and One Drive), Amazon Web Services.

Community Cloud
Community cloud allows systems and services to be accessible by a group of several organizations to share the information between the organization and a specific community. It is owned, managed, and operated by one or more organizations in the community, a third party, or a combination of them. Example: Health Care community cloud.

Applications of cloud computing:
Art Applications
Cloud computing offers various art applications for quickly and easily design attractive cards, booklets, and images. Applications: Vistaprint, Moo, Adobe Creative Cloud.
Business Applications
Business applications are based on cloud service providers. Today, every organization requires the cloud business application to grow their business. It also ensures that business applications are 24*7 available to users. Applications: MailChimp, SalesForce, Chatter, QuickBooks
Data Storage and Backup Applications
Cloud computing allows us to store information (data, files, images, audios, and videos) on the cloud and access this information using an internet connection. As the cloud provider is responsible for providing security, so they offer various backup recovery application for retrieving the lost data.
Applications: Google G Suite, Box.com, Adobe Scanner
Education Applications
Cloud computing in the education sector becomes very popular. It offers various online distance learning platforms and student information portals to the students. The advantage of using cloud in the field of education is that it offers strong virtual classroom environments, Ease of accessibility, secure data storage, scalability, greater reach for the students, and minimal hardware requirements for the applications.
Applications: Google Apps for Education, Chromebooks for Education
Entertainment Applications
Entertainment industries use a multi-cloud strategy to interact with the target audience. Cloud computing offers various entertainment applications such as online games and video conferencing.
Applications: Online games, Video conferencing apps
Management Applications
Cloud computing offers various cloud management tools which help admins to manage all types of cloud activities, such as resource deployment, data integration, and disaster recovery. These management tools also provide administrative control over the platforms, applications, and infrastructure.
Applications: EverNote, Toggl
Social Applications
Social cloud applications allow a large number of users to connect with each other using social networking applications.
Applications: Facebook, Twitter, WhatsApp

CYBER SECURITY AND TYPES OF CYBER ATTACK

An Overview of Cyber Security:
With internet bandwidth becoming cheaper, and the usage of connected, smart gadgets increasing exponentially, protecting ourselves online and keeping all data safe and secure has become a priority. We are relying heavily on data, connected systems and online ecosystems to live our daily lives. It has become ubiquitous, and we cannot imagine living without connectivity and gadgets. Security threats like denial of service, hacking into systems, data theft, identity theft are something that we all have to safeguard against.
Cyber security is important because it protects all categories of data from theft and damage. This includes sensitive data, personally identifiable information (PII), protected health information (PHI), personal information, intellectual property, data, and governmental and industry information systems.
This part helps us to understand what Cyber security means, and how it can be implemented

What is Cyber security?
Cyber security is the application of technologies, processes and controls to protect systems, networks, programs, devices and data from cyber attacks.
It aims to reduce the risk of cyber attacks and protect against the unauthorised exploitation of systems, networks and technologies.

• electricity grid
• water purification
• traffic lights
• shopping centers
• hospitals

5 types of Cyber Security

1. Critical infrastructure security:
Critical infrastructure security consists of the cyber-physical systems that modern societies rely on.
Common examples of critical infrastructure:
Having the infrastructure of an electricity grid on the internet makes it vulnerable to cyber-attacks. Organizations with responsibility for any critical infrastructures should perform due diligence to understand the vulnerabilities and protect their business against them. The security and resilience of this critical infrastructure is vital to our society's safety and well-being.
Organizations that are not responsible for critical infrastructure, but still rely on it for a portion of their business, should develop a contingency plan by evaluating how an attack on critical infrastructure they depend on might affect them.

2. Application security:
You should choose application security as one of the several must-have security measures adopted to protect your systems. Application security uses software and hardware methods to tackle external threats that can arise in the development stage of an application.

• antivirus programs
• firewalls
• encryption programs
• extra logins
• new passwords
• application security o antivirus programs
      o antispyware software
      o encryption
      o firewalls

     o Monitored internet access

Applications are much more accessible over networks, causing the adoption of security measures during the development phase to be an imperative phase of the project.

Types of application security:

These help to ensure that unauthorized access is prevented. Companies can also detect sensitive data assets and protect them through specific application security processes attached to these data sets.

3. Network security:

As cyber security is concerned with outside threats, network security guards against unauthorized intrusion of your internal networks due to malicious intent.

Network security ensures that internal networks are secure by protecting the infrastructure and inhibiting access to it.

To help better manage network security monitoring, security teams are now using machine learning to flag abnormal traffic and alert to threats in real time. Network administrators continue to implement policies and procedures to prevent unauthorized access, modification and exploitation of the network.

Common examples of network security implementation:

4. Cloud security:

Improved cyber security is one of the main reasons why the cloud is taking over.

Cloud security is a software-based security tool that protects and monitors the data in your cloud resources. Cloud providers are constantly creating and implementing new security tools to help enterprise users better secure their data.

Cloud computing security is similar to traditional on-premise data centers, only without the time and costs of maintaining huge data facilities, and the risk of security breaches is minimal.

5 Internet of things (IoT) security

IoT refers to a wide variety of critical and non-critical cyber physical systems, like appliances, sensors, televisions, wifi routers, printers, and security cameras.

According to Bain & Company's prediction…

• Deny access to the critical components of the network

• Obtain information by retrieving data from the hard drive

• Disrupt the system or even rendering it inoperable

Cyber Attacks

A cyber attack is when an individual or an organization deliberately and maliciously attempts to breach the information system of another individual or organization. While there is usually an economic goal, some recent attacks show destruction of data as a goal.

Malicious actors often look for ransom, or other kinds of economic gain, but attacks can be perpetrated with an array of motives, including political activism purposes.

Types of cyber attacks:

1. Malware

The term "malware" encompasses various types of attacks including spyware, viruses, and worms.

Malware uses a vulnerability to breach a network when a user clicks a "planted" dangerous link or email attachment, which is used to install malicious software inside the system.

Malware and malicious files inside a computer system can:

     o   Deny access to the critical components of the network
     o   Obtain information by retrieving data from the hard drive
     o   Disrupt the system or even rendering it inoperable

2. Phishing

Phishing attacks are extremely common and involve sending mass amounts of fraudulent emails to unsuspecting users, disguised as coming from a reliable source. The fraudulent emails often have the appearance of being legit, but link the recipient to a malicious file or script designed to grant attackers access to your device to control it or gather recon, install malicious scripts/files, or to extract data such as user information, financial info, and more.

Phishing attacks can also take place via social networks and other online communities, via direct messages from other users with a hidden intent. Phishers often leverage social engineering and other public information sources to collect info about your work, interests, and activities—giving attackers an edge in convincing you they're not who they say.

3. Man-in-the-Middle (MitM) Attacks

Occurs when an attacker intercepts a two-party transaction, inserting themselves in the middle. From there, cyber attackers can steal and manipulate data by interrupting traffic.

This type of attack usually exploits security vulnerabilities in a network, such as an unsecured public WiFi, to insert themselves between a visitor's device and the network. The problem with this kind of attack is that it is very difficult to detect, as the victim thinks the information is going to a legitimate destination. Phishing or malware attacks are often leveraged to carry out a MitM attack.

4. Denial-of-Service (DOS) Attack

DOS attacks work by flooding systems, servers, and/or networks with traffic to overload resources and bandwidth. This result is rendering the system unable to process and fulfill legitimate requests. In addition to denial-of-service (DoS) attacks, there are also distributed denial-of-service (DDoS) attacks.

5. SQL Injections

This occurs when an attacker inserts malicious code into a server using server query language (SQL) forcing the server to deliver protected information. This type of attack usually involves submitting malicious code into an unprotected website comment or search box. Secure coding practices such as using prepared statements with parameterized queries is an effective way to prevent SQL injections.

6. Zero-day Exploit

A Zero-day Exploit refers to exploiting a network vulnerability when it is new and recently announced — before a patch is released and/or implemented. Zero-day attackers jump at the disclosed vulnerability in the small window of time where no solution/preventative measures exist. Thus, preventing zero-day attacks requires constant monitoring, proactive detection, and agile threat management practices.

7. Password Attack

Passwords are the most widespread method of authenticating access to a secure information system, making them an attractive target for cyber attackers. By accessing a person's password, an attacker can gain entry to confidential or critical data and systems, including the ability to maniuplate and control said data/systems.

8. Cross-site Scripting

A cross-site scripting attack sends malicious scripts into content from reliable websites. The malicious code joins the dynamic content that is sent to the victim's browser. Usually, this malicious code consists of Javascript code executed by the victim's browser, but can include Flash, HTML and XSS.

9. Rootkits

Rootkits are installed inside legitimate software, where they can gain remote control and administration-level access over a system. The attacker then uses the rootkit to steal passwords, keys, credentials, and retrieve critical data.

Since rootkits hide in legitimate software, once you allow the program to make changes in your OS, the rootkit installs itself in the system (host, computer, server, etc.) and remains dormant until the attacker

activates it or it's triggered through a persistence mechanism. Rootkits are commonly spread through email attachments and downloads from insecure websites.

10. Internet of Things (IoT) Attacks
While internet connectivity across almost every imaginable device creates convenience and ease for individuals, it also presents a growing—almost unlimited—number of access points for attackers to exploit and wreak havoc. The interconnectedness of things makes it possible for attackers to breach an entry point and use it as a gate to exploit other devices in the network.

Tips to avoid Cyber Attacks:
1. Train employees in cyber security principles
2. Install, use and regularly update antivirus and anti-spyware software on every computer
3. Use a firewall for Internet connection
4. Download and install software for operating systems and applications as they become available
5. Make backup copies of important business data and information
6. Control physical access to your computers and network components
7. Secure the Wi-Fi network
8. Require individual user accounts for each employee
9. Limit employee access to data and information, and limit authority to install software
10. Regularly change passwords

Different Areas of Cyber Security
1. Critical Infrastructure Security
This type of cybersecurity ensures that the digital infrastructure of our vital public systems remains preserved and protected from any form of malignant misuse such as keeping cyberattacks away from our hospitals, traffic lights, electricity grid, etc.
2. Application Security
Nowadays, when you have an app for nearly anything, it's of vital importance to keep the space secure. Application security does just that by building in all the safety measures, such as encryption, firewalls, or anti-virus systems.
3. Network Security
Network security is an area of expertise primarily concerned with keeping the network integrity preserved. In practice, this means performing due diligence to ensure that the highest security standards and protocols protect networked data and systems.
4. Cloud Security
Even though cloud computing is usually considered the least secured space to store your data, experts suggest that clouds are safer than traditional IT infrastructures. There are nearly half as many attacks in the on-premise environments than in those serviced by a provider. Generally, these providers are the biggest generators of cloud security tools that keep the space safe.
5. Internet of Things (IoT) Security
The Internet of Things security is concerned with securing all the devices connected to the internet. From security cameras to the smallest home appliances, everything's networked. Consequently, nearly everything can and should be clear of vulnerabilities and protected from potential cyber intrusions.

Module -3
Building essential skills beyond the technology

Communication skills:

Communication: communication means transferring thoughts, information emotion and ideas through gesture, voice symbols, signs and expressions from one person to another.

Process of communication:
Communication is an on going process that mainly pnvloves three components namely sender, message, and recipient.

- **Sender:** the sender or contact generates the message and transmits it to the recipient. He is the source and the first contact.

- **Message:** it is an idea, knowledge opinion, truth, feeling, etc. produced by the sender and intended for reference.

- **Encoding:** the message produced by the sender is encrypted in a symbolic way such as words, pictures touches, etc before transfer.

- **The media:** this is how the coded message is conveyed. The message can be conveyed orally or in writing.

- **Recording :** it is a process of modifying the signals sent by the sender . after recording the message is received by the recipient.

- **Recipient:** you are last person in the chain and the message you sent was sent. If the recipient receives the message and understand it correctly.

- **Answer :** once the recipient confirms to the sender that you received the message and understood it, the communication process is complete.

Barriers of communication:
- Physical barriers
- Perceptual barriers
- Emotional barriers
- Cultural barriers
- Language barriers
- Gender barriers
- Interpersonal barriers

Communication skills:
Good communication is about understanding instructions, acquiring new skills, making requests, asking questions and relaying information with ease.
Good communication skills are perhaps the most basic skills that you can posses as an employee, yet they remain one of the most sought- after by employers.

Importance of communication skills in the work place:
Communication skills are essential no matter what job you work in or your level of seniority. When there is a breakdown in communication, often efficiency, morale and objectives can all suffer. In today's competitive jobs market, communication skills in the business world are highly sought after, with

recruiters looking for candidates who can communicate information, negotiate and confidently deal with customers.
Listening carefully, speaking clearly and putting others at ease are very valuable attributes to possess.

Communication skills :
Emotional intelligence: is the ability to understand and manage your emotions so as to communicate effectively, avoid stress, overcome challenges and empathy with others.

Cohesion and clarity: good communication is much more than saying the right thing;it is about communicating messages clearly and concisely.

Friendliness: in any type of communication, make sure that you set the right tone. A friendly tone will encourage others to communicate.

Confidence: in all interactions, confidence (but not over confidence) is crucial.

Empathy: within busy work environment, everyone will have their own ideas about how things should be done. Even if you have disagreement with your collegues or partners, their point of view should be considered and respected.

Respect: Empathy leads into the next communication skills , respect.

Listening: good communication is all about listening effectively. Take the time to listen to what the other person is saying and practice active listening.

Open- mindness:try to enter into communications without having an agenda. Strong communication requires an open mind and commitment to understanding other peoples point of view.

Tone of voice: the tone of your voice can set the whole mood of the conversation. If you start the discussion in an aggressive pr unhelpful manner the recipient will be more inclined will be more inclined to respond in a similar way

Asking good questions : good questions can help conversation flow and improve the outcome.

Creative problem solving skills:
Thinking critically and creatively will help you not only with academic work, but also in everyday work and activities.
Being creative is often essential to problem solving, both in and out work place. Creative problem solving will prove you have the ability to approach as issue from every angle, rather than a simple linear, logicalapproach.

Creativity in problem solving:
- Creativity in leadership
- Encouraging creativity
- Creativity and innovation

Examples of problem solving in the workplace:
- Define the problem
- Generate the solutions
- Evaluate the solutions
- Implement the solutions
- Assess the solution

Critical thinking:

Critical thinking is self- directed, self-disciplined, self –corrected. In other words, it is a thought process that involves the evaluation, assessment and reinterpretation of your own others ideas and prossess.critical thinking requires effort and dedication, but pays dividend for the time invested.

Following are some steps to apply in order to think critically

- Creating your own solution to an unexpected problem.
- Using pros and cons to decide
- Making assumptions about a person
- Unthinkingly applying a bias

Collaboration skills:

Collaboration skills, also called collaborative skills, are the skills you use when working with others to produce or create something or achieve a common goal.

Types of collaboration skills:

- Communication skills
- Emotional intelligence
- Respect for diversity